magnus Group

JOINT EVENT ON

OIL, GAS AND PETROLEUM ENGINEERING & CATALYSIS, CHEMICAL ENGINEERING AND TECHNOLOGY

26-28 OCT, 2023

BOSTON, MASSACHUSETTS, USA

Venue:
Hilton Boston/Woburn 2 Forbes Road,
Woburn, Massachusetts, 01801, USA

BOOK OF ABSTRACTS

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26-28 OCT

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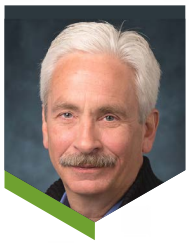
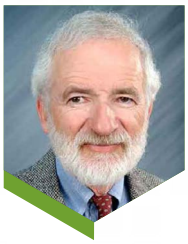


Richard Coffin
Texas A&M University - Corpus Christi, United States

Haibo Ge
Texas Tech University, United States



Arthur J Nozik
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Asia Climate Change Education Center, South Korea

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Mohamed A Morsy
King Fahd University of Petroleum & Minerals, Saudi Arabia

Mohamed Salim Al-Fazari
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Akita University, Japan

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Xiliang Liu
China University of Petroleum Beijing, China

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University of Sharjah, UAE

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Prairie View A&M University, United States

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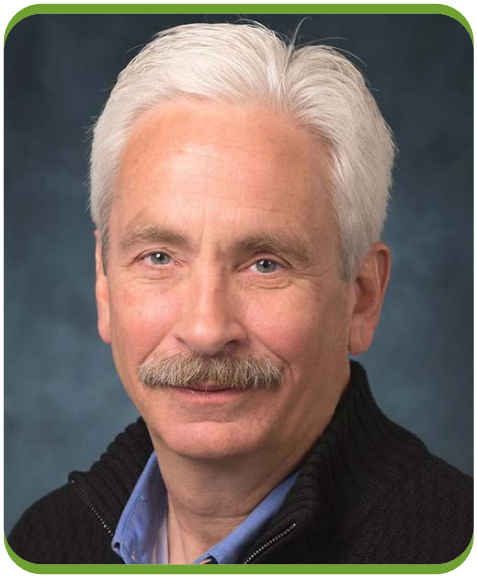
Universite de Sherbrooke, Canada

Youlia Kamei Saito
Federal University of Vicosa, Brazil

Yuli Marcela Henao-Hoyos
Universidad Nacional de Colombia, Colombia

Thank You All...

Welcome Message



Respected congress visitors, I appreciate provision of welcome notes to this meeting with a statement that we are in a strong need of an efficient energy that minimizes gas emissions to the atmosphere. Our engineering new technology provides the capability to refine crude or used oil with minimum release of gas to the atmosphere and transform crude oil into specific high energy clean compounds, at a substantial cost savings. With significant financial advantages operation gains include:

1) Portable fuel production for military, municipal, and industrial fuel strategic operations

2) In line oil processing during ship and tanker loading or off-loading

3) Marine ship operations with capability for on board fuel refining operations

4) From well to transport inline oil refining

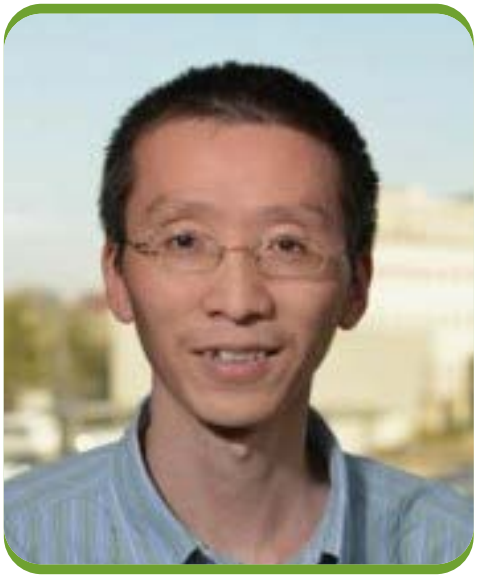
5) Lowered CO_2, nitrogen and sulfur emissions during oil refining at a significantly lowered cost and

6) Simultaneous removal of sulfur and nitrogen.

Prof. Dr. Richard B. Coffin

Texas A&M University – Corpus Christi

Welcome Message



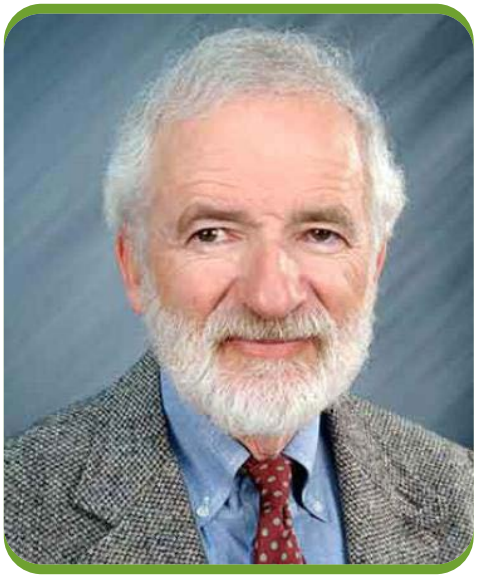
Dear congress visitors, it is my great pleasure and honor to welcome you on board. Chemical Synthesis and Catalysts Synthesis have witnessed great progress over the past few decades and have been continuously revolutionizing the ways we think about the formation and cleavage of chemical bonds. Indeed, Chemical Synthesis and Catalysts Synthesis have been playing a vital role in pharmaceutical, agricultural, and material research and production over many decades. Future studies and developments in these fields will enrich our toolbox of synthetic methods. Some exciting and recent progress in these fields will be communicated in this session in the hope of stimulating research interest among the wider scientific community.

Haibo Ge

Prof. Dr. Haibo Ge

Texas Tech University, United States

Welcome Message



Dear Attendees,

Welcome to the **17th Edition of the International Conference on Catalysis, Chemical Engineering and Technology"** (Catalysis 2023). It is a great pleasure, honor, and opportunity for me to welcome you to this conference since this meeting occurs at a very important point in time in our planet's history due to the critical need of humanity to immediately address and ameliorate the looming global disaster that will be caused by severe climate change—we are running out of time! Catalysis by new materials and innovative chemical engineering to produce cost effective liquid and gaseous fuels from renewable energy sources (solar, wind, geothermal and wave ocean energy, and biological and artificial photosynthesis), is absolutely at the center of this global challenge. This is because globally, liquid and gaseous fuel consumption represents about ¾ of the total energy consumed annually, but the greatest progress to date in renewable energy science and technology has been in electricity from solar photovoltaics and wind energy, which is only ¼ of the energy consumed. Great and rapid progress in the science and engineering of fuels and related chemical products from renewable energy sources is obviously needed to solve the climate change problem. Please have a very successful meeting at the 17th Catalysis 2023 Conference.

Arthur J Nozik

University of Colorado, United States

Welcome Message

Dear Congress Visitors,

It is my honor and great pleasure to write a few welcome notes to you. Through centuries people were fascinated with the possibilities of synthesis of new materials with extraordinary properties. New materials are practically needed in all domains of life. Design and synthesis of new materials is one of the most important and interesting part of material sciences. Particularly a synthesis of new active and selective catalysts is a very important challenge. Our main aim concentrates on the new methods of the synthesis of single-site hierarchical porous zeolite catalysts with acid-base and redox properties. Such zeolite catalysts with active sites formed by incorporation of heteroelements in their framework are perspective as catalysts of protection of environment and biofeedstock conversion into valuable chemicals.

Professor Dr. Stanislaw Dzwigaj
Sorbonne University—CNRS, France

Welcome Message

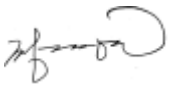
Dear Congress Visitors

Contemporary society is known as a risky society in terms of environmental problem such as pollution, decrease in biodiversity, climate change, and ozone depletion, etc. These are the evidences that the original quality and mechanism of nature are polluted and/or destructed.

Lots of activities are being launched to respond to the environmental problems by government, scholar, environmental NGO, citizen, and even mass media, etc. Their activities as a means responding to environmental problems may be classified into three categories. They are nature-based, technology-based, and social system-based means.

In such a context, the significance of the Catalysis 2023 lies in two dimensions. One is the value of the design and synthesis as a new material science. This value is extended to a technology-based approach as an important means responding to contemporary risky society.

At least in the sense of these two values, I cordially invite all the world famous/leading and outstanding researchers, academic people and industrialists from all over the world to attend Catalysis 2023.



Prof. Dai-Yeun Jeong

Director of Asia Climate Education Center, South Korea

Emeritus Professor at Jeju National Unversity, South Korea

Welcome Message

Dear Congress Delegates,

It is my honor to welcome you to this year's International Conference on Oil, Gas, and Petroleum Engineering. It is essential for the O&G industry to turn on in the implementation of new technological solutions, such as process Modelling and Simulation (M&S) with the use of immersive technologies at all stages of the process lifecycle. M&S of complicated processes in O&G field contributes indeed in better understanding, studying and analyzing procedures in the entire value chain of O&G industry. Afterwards, process engineering can successfully verify, validate, test and optimize the whole operation process. Seize the opportunity to attend such studies and presentations at IOGP Conference.

Assoc. Prof. Dr. Nikolaos C. Kokkinos

Department of Chemistry, International Hellenic University, Greece

Welcome Message

Dear Distinguished Scholars, Engineers, and Colleagues!

It is my great honour and pleasure as a Committee Member to invite you to join with a contribution to the **17th Edition of International Conference on Catalysis, Chemical Engineering and Technology"** (Catalysis 2023), which is scheduled in Hybrid Format during October 26-28, 2023 at Boston, Massachusetts, USA.

The conference will focus on the theme "Assembling Trivial Keys in Catalysis and Chemical Engineering. This event will have keynote sessions, oral and poster sessions, and our ever-popular 'Workshop' events, providing something for everyone focusing on latest advancements.

Keynote Speeches will be given by Distinguished Scholars and Experts from academic institutions and industry, and oral presentation by delegates and poster presentations by young junior participants. This worldwide congress is established for early-career scientists, researchers, academicians, chemists, policymakers, professors, students, and industrial researchers who are interested in the fundamentals of catalysis and chemical engineering and how they might impact various fields of science. This conference will provide excellent opportunity to meet distinguished scholars and experts and to exchange new ideas and application experiences, to establish research relations and collaborations for future research and projects. The conference has a wide variety of Catalysis and Chemical Engineering from Chemical Kinetics and Polymer Science to Environmental Catalysis and Green Chemistry. International scientific activities are big scientific platforms for the scientists, colleagues, young academicians, and participants from all over the world, to interact and communicate with each other.

I believe that 17th Edition of International Conference on Catalysis, Chemical Engineering will provide this opportunity for delegates from different cultures and countries.

Also, this conference will be performed successfully, in favour of the qualified scholars, colleagues and experts and with their valuable and informative presentations. The conference will be very beneficial for young delegates by encouraging them and improving their confidence of presenting research in an international platform.

I am pleased to invite prospective scholars, academicians, engineers, and other scientists to submit their original contributions to this important conference, where you are sure to have a meaningful experience with scholars and experts from different cultures and different countries from all around the World.

Dr. Osman Adiguzel

Firat University, Elazig, Turkey

Welcome Message

This conference will provide the new steps in the novel biofuel and bioenergy studies, the advanced studies in the fuel chemistry will be usefull to all participants and the advanced studies containing the oil gas and gas recoveries will provide an economical world.

Delıa Teresa Sponza

Dokuz Eylül University, Turkey

Welcome Message

Dear congress visitors, it is an honor and pleasure to write a few lines on welcome notes for Catalysis 2023. On behalf of the whole organizing committee, I warmly welcome all the delegates attending this congress meeting and thank them all for their active participation. Research in the field of Catalysis under Materials Chemistry has witnessed an exponential growth throughout the globe and the potential of its manifestation has been observed by 17th Edition of International Conference on Catalysis, Chemical Engineering and Technology on October 26-28, 2023 at Boston, Massachusetts, USA in Hybrid Event by gathering renowned scientists under one roof. The overall goal of the congress is to exchange breakthrough ideas in the field of Nanocatalysis to promote top level research by focusing on the recent trends as well as future prospects. We look forward to an excellent meeting with internationally renowned scientists and hope that the congress visitors are highly benefitted by their experiences and frontier research work in Advance areas of Catalysis, Chemical Engineering and Materials Chemistry.

Prof. Tokeer Ahmad

Department of Chemistry, Jamia Millia Islamia, New Delhi, India.

ABOUT
MAGNUS GROUP

Magnus Group (MG) is initiated to meet a need and to pursue collective goals of the scientific community specifically focusing in the field of Sciences, Engineering and technology to endorse exchanging of the ideas & knowledge which facilitate the collaboration between the scientists, academicians and researchers of same field or interdisciplinary research. Magnus Group is proficient in organizing conferences, meetings, seminars and workshops with the ingenious and peerless speakers throughout the world providing you and your organization with broad range of networking opportunities to globalize your research and create your own identity. Our conferences and workshops can be well titled as 'ocean of knowledge' where you can sail your boat and pick the pearls, leading the way for innovative research and strategies empowering the strength by overwhelming the complications associated with in the respective fields.

Participation from 90 different countries and 1090 different Universities have contributed to the success of our conferences. Our first International Conference was organized on Oncology and Radiology (ICOR) in Dubai, UAE. Our conferences usually run for 2-3 days completely covering Keynote & Oral sessions along with workshops and poster presentations. Our organization runs promptly with dedicated and proficient employees' managing different conferences throughout the world, without compromising service and quality.

magnus Group

26-28 OCT

DAY 01

KEYNOTE FORUM

JOINT EVENT ON

OIL, GAS AND PETROLEUM ENGINEERING & CATALYSIS, CHEMICAL ENGINEERING AND TECHNOLOGY

Application of metal single-site zeolite catalysts in catalysis

The metal ions well dispersed at zeolite framework are considered to be active sites of catalytic processes. Therefore, the incorporation of these metals into zeolites as isolated tetrahedral sites appears to be the important task. We have earlier shown that the incorporation of transition metal ions into vacant T-atom sites of framework zeolite is strongly favored when, in the first step, zeolite is dealuminated by treatment with nitric acid solution and then, in the second step, the incorporation of transition metal ions results in the reaction between the cationic metal species of the precursor solution and the SiO-H groups of vacant T-atom sites created by dealumination of zeolite. During my keynote talk the design of single-site zeolite catalysts with transition metal will be described and characterized by different physical techniques both at the macroscopic (XRD, BET, TPR, TEM) and molecular level (FT-IR, NMR, DR UV-Vis, XPS, EPR, XAFS). The application of metal single-site zeolite catalysts in environmental catalysis will be discussed. This two-step postsynthesis method applied in this work allowed obtaining metal single-site zeolite catalysts active in different catalytic processes such as oxidative dehydrogenation of propane into propene, selective catalytic reduction of NOx to N2, production of 1,3-butadiene or hydrogen from renewable sources, including ethanol obtained from biomass. Their catalytic activity strongly depended on the speciation and amount of metal incorporated into zeolite structure as well as their acidity.

Audience Take Away Notes

- The audience will be able to understand as control of preparation of catalyst systems
- They will see that catalytic activity depend on dispersion of metal in the framework of zeolite
- The researchers will be able, after my talk, do their own catalyst preparation using similar method

Stanislaw Dzwigaj

Sorbonne Universite, UMR 7197, Laboratoire de Reactivite de Surface, France

Biography

Professor Stanislaw Dzwigaj received his PhD degree in 1982 in Jerzy Haber Institute of Catalysis and Surface Chemistry, Krakow (Poland). After two years of postdoctoral stay at the Laboratoire de Reactivite de Surface Universite P. et M. Curie (Paris) he obtained in 1990 a position of contracted researcher in the same Laboratory devoted to surface reactivity in relation to catalysis phenomena. Then, in 2008 he obtained permanent position in CNRS as a researcher. On February 19, 2014 for outstanding scientific achievements he received the title of professor. His published work includes more than 170 papers published in reputable international journals.

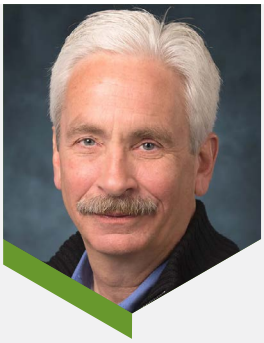
Harmonic frequency cascade: Oil refining with focus on sulfur

Harmonic Frequency Cascade (HFC) with counter rotating interfaces is developed for fuel refining technology. This initial effort for proof of concept is sulfur extraction from hydrocarbons. Focus for this technology development is application of HFC introduction of fuel cavitation resulting in oxygen free radical formation. We present new technology for oil refining that:

1. Provides lower costs in the production of fuel
2. Reduces atmospheric emissions of nitrogen, sulfur and carbon compounds
3. Can be applied to removal of sulfur from fuels
4. Produces specific fuel designs, and
5. Is capable of transport to remote locations for industrial and military operations

The HFC system consists of a cylindrical housing containing two, counter rotating, separately driven, multistage cylinders. This will provide multiple interfaces that will produce the required fluid shear. Multiple small diameter inlets at the top and bottom of the main cylinder direct fluid into the chamber while a flow capacity matched lesser number of larger outlets are located mid device. The drivers are small HP electrical motors that will be flange mounted and spline coupled to the main device at the top and bottom for a vertical stance. Flow and pressure are provided by a separate charge pump designed for light density liquids and for energy efficiency. The main device and intake manifold will be mounted on a framework of square tubing and angle iron that have dimensions of about 3 feet square and six feet in height. The controls consist of appropriate, explosion proof actuators and sensors to allow for precise operation of the unit in hazardous and or extreme conditions. Piping and other support vessels meet industry standards and codes and are mounted to provide the smallest footprint possible. We provide thorough evaluation of the fuel production with specific compound analysis and carbon analysis to provide operation efficiency assessment.

With a comparison of compounds before and after treatment the product shows higher hydrocarbon compounds (CH compounds), a lower percentage of oxygenated Organic nitrogen compounds (CHNO), and a low percentage of Sulfur-containing compounds (CHOS, CHNS). There is clear removal of S and N from the oil.



Richard B Coffin[1]*, Mark Law[2], Hussain Abdulla[1], Kevin Stickney[3]

[1]Texas A&M University Corpus Christi, Corpus Christi, TX, United States

[2]Coactus VP Development, Houston, Texas, United States

[3]Carbontrase llc Co-Founder, Corpus Christi, TX, United States

Biography

Dr. Coffin is geochemist with a focus on evaluation of geochemical field data and seismic profiles related to; gas hydrate and oil exploration, carbon sequestration, environmental restoration and climate change. Experience includes lead and co-lead field and laboratory development and operations on all continents with colleagues from over 15 countries since 1989 from basic science to industrial focuses. Currently, he serves as Full Professor and Chair of the Department of Physical and Environmental Sciences at Texas A&M University Corpus Christi. Previously, USA. Dr. Coffin earned a doctoral degree in oceanography from the University of Delaware, Lewes, Delaware, USA.

Audience Take Away Notes

- This presentation is an introduction to state of the art oil refining capability
- This technology provides potential for remote oil refining; including shipboard, during oil offloading from a ship, and in remote locations
- This new approach to oil refining expands knowledge in the classroom in terms of industrial efficiency as well as cost effective operations and reduced CO_2 emissions
- There is potential to omit CO_2 emissions during oil refining

BOOK OF ABSTRACTS

magnus Group

26-28 OCT

DAY 01

SPEAKERS

JOINT EVENT ON

OIL, GAS AND PETROLEUM ENGINEERING & CATALYSIS, CHEMICAL ENGINEERING AND TECHNOLOGY

Shawn Reeves*, Subha Kalyaanamoorthy
Department of Chemistry, University of Waterloo, Waterloo, Ontario, Canada

Engineering stable, expressible, functional industrial enzymes with protein sequence likelihood models

Protein sequence likelihood models are a rapidly emerging class of deep learning algorithms which learn the likelihood of each potential amino acid to occur in a given structural, evolutionary, or sequence context. Recently, these models have demonstrated impressive performance in predicting the relative fitness of variants assessed in Deep Mutational Scanning (DMS) experiments without any task-specific training (i.e. in a zero-shot setting). A limited number of DMS experiments have assessed fitness in terms of stability-related properties, but previous sequence likelihood models have performed well in these cases. We conduct a comprehensive analysis to assess the capacity of newly published models to generalize to direct experimental measurements of thermostability across variants of hundreds of heterogeneous proteins. We explore performance relative to state-of-the-art models trained on stability data, assess situations in which likelihood is at odds with stability, and examine the complementarity of likelihood models conditioned on different contexts. Further, we suggest that since zero-shot likelihood-based predictions of thermostability indeed correlate with experimental measurements, protein likelihood models may be used to generate new sequences which simultaneously possess desirable yet often conflicting properties in protein engineering pipelines: Improved function, expressibility, and stability. We show how structural and evolutionary likelihood models can be combined to perform ultra-high-throughput variant screening in silico, and how traditional biophysical simulations can further enhance stability of leading candidates. Carbon dioxide-sequestering carbonic anhydrase and plastic-degrading PETase are used for case studies in efficiently selecting stabilized variants with retained folding and function for in vitro analysis.

Audience Take Away Notes

- The audience will be able to use the described methods to rescue designed enzyme catalysts with lost function, folding, or stability
- The techniques described will allow rapid prioritization of candidates for accelerating popular in vitro enzyme design strategies such as directed evolution
- Compared to traditional methods of in silico design, including molecular dynamics and biophysical simulations, the computational burden is reduced by 3-8 orders of magnitude
- Sequence likelihood models give thermostability information complementary to biophysical models, with higher accuracy and generality than previous-generation statistical potentials
- The incredible speed of prediction for candidates with arbitrarily many mutations allows for an unprecedented search of the sequence fitness landscape

Biography

Shawn Reeves studied both Biochemistry and Nanotechnology Engineering at the University of Waterloo, where he graduated with Dean's Honours for the former in 2022. During his undergraduate, he worked in 3 different co-op positions in industry, publishing 2 papers related to chemical space exploration and deep learning methods for predicting molecular properties. He joined the research group of Dr. Subha Kalyaanamoorthy as an M.Sc. student and quickly transferred to the Ph.D. program, where he currently studies in silico enzyme engineering approaches.

Shutang Chen*, Gugang Chen

Honda Research Institute USA Inc./70 Rio Robles, San Jose, CA, 95134,
United States

Fcc/2h and Fcc/4h copper nanodisks for carbon dioxide reduction

The nanosized fcc/hcp (Face Centered Cubic/Hexagonal Close-Packed) noble metal heterostructures have demonstrated excellent catalytic performance towards hydrogen evolution reaction and CO_2 reduction reaction. Among all the monometallic catalysts, copper has drawn great attention because of its unique ability to convert CO_2 into hydrocarbon products with an appreciable selectivity. However, the wet-chemistry synthesis of fcc/hcp Cu nanostructure still remains a great challenge. Herein, we reported a high temperature solution reduction method to synthesize fcc/hcp Cu nanodisks with a thickness of 26.5 ± 2.3 nm and diameter of 85.6 ± 3.7 nm. The Cu nanodisks exhibited high selectivity towards CO_2 reduction reaction and high faradaic efficiency for methane (60.4%) production at -1.25 V vs Reversible Hydrogen Electrode (RHE). Transmission electron microscopy (TEM) revealed copious atomic interfaces of fcc/2H and fcc/4H heterostructures on the side surface of the nanodisks (2H/4H: hexagonal close-packed crystal structures with stacking sequence of “AB” and “ABCB”, respectively). Density functional theory calculations suggested that the fcc/2H and fcc/4H heterostructures possess lower ΔG*CHO compared to the pure fcc structure, indicating a lower kinetic barrier for CO_2 reduction reaction.

Biography

Dr. Shutang Chen studied Chemistry at the Lanzhou University, China and graduated as BS in 2002 and MS in 2005. He received his PhD degree (hysical chemistry) in 2010 at the Beijing Institute of Technology, China. After seven years postdoctoral fellowship at Ajou University in the Republic of Korea (2010-2011), University of Arkansas (2011-2013) and University of Connecticut (2014-2017) in USA, he joined in Honda Research Institute USA Inc. in 2017. He has published more than 60 research articles in SCI journals and 15 patents.

Ahmed Bahgat Radwan
Qatar University, Qatar

Tailoring Cu-hydroxyapatite catalysts for hydrogenation of levulinic acid to γ-valerolactone: Impact of copper loading, reaction temperature, and catalyst durability

Synthesis of γ-valerolactone (GVL) from Levulinic Acid (LA) holds significant importance as a sustainable route for the conversion of biomass-derived feedstocks into valuable chemicals. In this study, Cu-Hydroxyapatite (Cu-HAp) catalysts were investigated for the vapor-phase hydrogenation of LA to GVL. The Cu nanoparticles were supported on the HAp surface to enhance catalytic activity and selectivity. The influence of copper loading, reaction temperature, and catalyst stability was examined. The results revealed that Cu-HAp catalysts exhibited good catalytic performance, with an optimal copper loading of around 5 wt% for maximum LA conversion (60%) and GVL selectivity (90%) for 9 h time on stream at 265°C. This work facilitating the development of efficient and stable catalyst systems for biomass-derived chemical transformations.

Keywords: Biomass Valorization, Vapour-Phase, Hydrogenation, Γ-Valerolactone, Sustainable Approach.

Biography

Ahmed Bahgat Radwan obtained his PhD degrees in inorganic chemistry from Ain Shams University. Since 2014, he has been working as a senior researcher in the Centre for Advanced Materials at Qatar University. His research interests focus on material science and physical chemistry. He published over 45 research articles related to corrosion, catalysis with a total citation of 1200 according to google scholar.

Ahmed Almogbel*, Fahad Alkasmoul

Future Energy Technology Institute, King Abdulaziz City of Science and Technology, P.O.Box 6086 Riyadh 11442, Saudi Arabia

Enhancing energy efficiency in buildings through functional nano-coatings for window glazing: A study on the thermal behavior of glass in Saudi Arabia

Understanding and predicting the thermal behaviors of a building's interior requires knowledge of the amount of heat flow. Improving the performance of a building's window system is necessary for achieving greater energy efficiency. Glazing materials in windows allow visible solar radiation to enter the building, providing adequate illumination levels. However, the infrared part of solar radiation that enters through the glazing can cause an increase in interior temperature. Therefore, glazing is a crucial component in designing and analyzing energy demands, heating and cooling loads, and thermal comfort in a building. This study focuses on developing functional nano-coatings for window glazing in Saudi Arabia. The thermal behavior of glass was investigated, and different materials with optimized film properties of thickness and doping level of Antimony Tin Oxides (ATO) were prepared. The glass U-factor, Solar Heat Gain Coefficient (SHGC), and net heat transfer through the window were calculated. The results showed that the thermal insulation of the glass was significantly affected by the coating thickness and doping level. The simulated net heat transfer through the window decreased linearly with an increase in both coating thickness and ATO concentration. Additionally, the overall transmittance in the visible region and reflectance in the infrared and ultraviolet regions decreased with an increase in the weight content of Antimony doped Tin Oxides ATO, as well as an increase in coating thickness.

Audience Take Away Notes

- The focus of the study is on developing functional nano-coatings for window glazing specifically in Saudi Arabia. By investigating the thermal behavior of glass and preparing different materials with optimized film properties, such as thickness and doping level of Antimony Tin Oxides (ATO)
- The knowledge gained from this study will empower professionals in architecture, engineering, building design to make informed decisions, meet energy efficiency standards, enhance thermal comfort, and create sustainable and cost-effective buildings. It provides valuable insights and data to optimize window systems and improve the overall energy performance of buildings, benefiting both the professionals and their clients
- This study offers practical solutions and data-driven guidance to designers, simplifying material selection, enhancing design optimization, improving energy performance assessment, and streamlining decision-making processes. By leveraging the study's findings, designers can work more efficiently, confident in their choices to achieve energy-efficient and thermally comfortable building designs

Biography

Dr. Ahmed M Almogbel has over twenty years of teaching, research, management and training in different areas of Mechanical engineering, including power, materials, design and manufacturing. He has 15 technical papers to his credit and supervised 7 graduation projects in various areas of heat transfer, fluid mechanics, air conditioning manufacturing and science of materials. He is specialized in Air Conditioning Systems, Human Thermal Comfort inside the Building Envelope and Thermal Insulations. He has already conducted several applied researches in Solar Air-conditioning sys-

tem, Desiccant-Evaporative Cooling technology, Energy Performance optimization for Hot and Dry Air Conditioning Systems, and Solar Adsorption Air Conditioning System.

Gitika Rani Saha[1]*, C Subramaniam[2], Alan Chaffee[3], Shilpa Korde[4]

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Tunable anchoring of metal nanoparticles on hard carbon supports for kinetically superior and selective hydrogenation of olefins

The multiphasic nature of the catalysts, reactants and products continues to be a major obstacle in realizing enhanced kinetics without compromising on the selectivity and durability of heterogeneous chemical catalysts. Conventional understanding has focused on improving the accessible surface area and overcoming the diffusional restrictions with simultaneous nanoengineering of the catalytic surface in order to overcome these challenges. Herein, we demonstrate an orthogonal, counter-intuitive approach of burying the catalyst below hard-carbon framework with high pore volume to achieve superior catalytic activity (conversion ≃ 99%) and selectivity (≃ 99%) towards mono-hydrogenation of styrene to ethylbenzene, at ambient pressure and 100°C temperature. Porosity engineered nanostructured Hard-Carbon Framework (NCF) exhibits short range graphitic ordering and long-range disorder to synergistically combine accessibility in surface area (936 m^2/g, average pore diameter < 1 nm) with pore volume (0.44 cm^3/g). Nanostructured Platinum (Pt) catalysts (mean diameter ~ 3 nm) embedded within the NCF framework (PIN) exhibits 95% higher turnover frequency as compared to the state-of-art Pt/C catalyst. This is attributed to the ability of the open-ended framework to act as a reservoir for hydrogen and thus ensure sustained pseudo-first order kinetics for hydrogenation. Such engineered heterogeneous catalysts are reusable and can be subscribed with green matrices of chemical conversions established through the near ideal values of E-factor, Process Mass Intensity (PMI) and Carbon Efficiency (CE).

Audience Take Away Notes

- In this study, we demonstrated a unique design strategy for developing robust and sustainable catalysts for industrial applications. Utilizing a hard carbon material (NCF) as catalyst support, we developed various Pt- loaded nanocatalysts through tunable anchoring that combine mutually exclusive properties of high catalytic kinetics with high yield and selectivity. Such hard carbon-supported catalysts remarkably outperform the state-of-art catalysts for sustainable heterogeneous catalysis, attributing to “superior kinetics at ambient conditions” along with their “near-ideal green matrices.” Thus, the NCF-supported catalyst system can be considered as a potential candidate for industrial catalysis

Biography

Gitika is currently pursuing her PhD at IITB-Monash Research Academy, India and working in the field of Nanomaterials under the guidance of Prof. C. Subramaniam from IIT- Bombay and Prof. Alan Chaffee from Monash University, in industrial collaboration with BASF, India. She completed her Bachelor’s and Master’s degrees with specialization in Chemical Engineering. Following her Master’s, she worked as an Energy Manager at a building material company and looked after the efficient monitoring, process control and optimization of energy utilization in cement and ceramic plants. She has special interests in sustainable catalysis, energy optimization and unit operation. Apart from research, she also loves music, traveling and being part of various philanthropic activities.

Omar Abed[1]*, Idoia Hita[1], Hend Moahmed[1], Natalia Morlanes[2], Pedro Castano[1]

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The effect of co-feeding H_2 and CO_2 on ethylene oligomerization to produce fuel-range hydrocarbons

The climate change crisis has triggered various efforts to mitigate greenhouse gas emissions and reduce carbon footprints. One of the most promising approaches is to capture carbon dioxide and transform it into higher-value chemicals. Ethylene, a major building block in the chemical industry, is a key intermediate molecule in CO_2 transformation reactions. However, ethylene production from CO_2 is often accompanied by unreacted carbon dioxide and hydrogen streams.

Inspired by our previous work, 1 we have developed a cascade zeolite-based catalyst system for producing fuel-range hydrocarbons from ethylene in the presence of H_2 and CO_2. Our objective is the longer-chain hydrocarbons, which can be used as fuels or feedstocks to produce other chemicals. We also investigated the effects of co-feeding carbon dioxide and hydrogen at different partial pressures, mimicking feeds from CO_2 transformation cells, on the overall performance of the catalyst system and product yields.

The results of this study were promising. The catalyst system demonstrated 70-90% ethylene conversion, with selectivity toward C_{9+} products ranging from 13-36% based on the tested feed conditions. These findings represent a step forward in the collaborative efforts toward developing sustainable technologies for mitigating greenhouse gas emissions and reducing carbon footprints.

Audience Take Away Notes

- The cascade zeolite-based system utilizes different catalyst properties to produce fuel-range hydrocarbons
- The system demonstrates its capability to be connected directly to a CO_2 transformation reactor without requiring extensive separations
- These findings can be further enhanced and optimized to improve the yields even more

Biography

Omar Abed received his bachelor's degree in chemical engineering from King Fand University of Science and Technology (KAUPM) in 2015. Between 2015-2017 He worked as an engineer in the SABIC corporate research and development center. In 2019 he obtained his master's degree from King Abdullah University of Science and Technology (KAUST) under the supervision of Professor Osman Bakr. Since 2019, he has been a PhD candidate working under Professor Pedro Castano in the KAUST Catalysis Center (KCC). His work mainly focuses on studying gas phase ethylene oligomerization over heterogeneous catalysts.

Vinayak Sharma[1], Umit Cali[2], Bhav Sardana[3], Murat Kuzlu[4], Dishant Banga[5]*, Manisa Pipattanasomporn[6]

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[2]Department of Electric Power Engineering, Norwegian University of Science and Technology, Trondheim, Norway
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[6]Smart Grid Research Unit, Chulalongkorn University, Bangkok, Thailand, Norway

Data-driven short-term natural gas demand forecasting with machine learning techniques

Natural gas demand forecasting is one of the most crucial steps in the proper planning and operation of natural gas supply systems. The demand and supply of natural gas must be balanced at all times. Large error in forecasts of natural gas demand can cost Local Distribution Companies (LDCs) millions of dollars. In this study, techniques for accurate forecasting of natural gas demand are examined. The models are tested and validated on real data from nPower forecasting competition 2018, which consists of historical natural gas consumption and the corresponding weather forecast at 6-h intervals. The methodology presents a holistic approach that includes data pre-processing, feature engineering, feature selection, model development, and post-processing. To capture the intra-day variability in natural gas demand a block-wise approach is used to develop the forecasting models. In this approach, a separate model is developed for each block of the day. Subsequently, four different forecasting models are developed using the block-wise technique, namely, a block-wise gradient boosting model using features from sensitivity analysis (GB), a block-wise gradient boosting model using features from PCA (GB-PCA), a block-wise ANN-CG model using features from sensitivity analysis (ANN-CG) and a block-wise ANN-CG model using features from PCA (ANN-CG-PCA). Three hybrid forecasts are also developed by combining the forecasts from the four individual models. The results show that the combined models outperform the individual models, with an improvement of around 15% in terms of Mean Absolute Percentage Error (MAPE).

Audience Take Away Notes

- Trends in Natural Gas Consumption
- Machine Learning prediction Models for Natural Gas usage prediction
- Challenges in predicting the use of natural gas

Biography

Dishant Banga received his Master's in Systems Engineering and Engineering Management with specialization in Data Analytics/ Data Science from the University of North Carolina, Charlotte in 2018. His interest includes applications of Machine Learning and Data Science to solve complex business problems. He has participated in various national and international level competitions and secured good rank by developing solutions for complex business problems. Currently, he is working as a Sr. Analyst at Bridgetree. His research interests include developing statistical and machine learning models and applications, artificial intelligence, renewable energy.

Vu Nguyen
University of Louisiana at Lafayette, United states

Investigation of nano-silica solution flow through cement cracks

Cement cracks are one of the most common failures in oil and gas wells. Cracks can reduce cement strength, resulting in a loss of zonal isolation and fluid leak. Placement of gels of Nanoparticles (NPs) in the cracks is considered as a promising solution to solve the problem. It is highly desirable to know if the flow behavior of the NPs solutions is predictable when they are squeezed into the cracks. Experimental tests were performed in this study to investigate the flow behavior of nano-silica solutions in ducts of cross-sections of rectangular shape. The linear relationship between flow rate and pressure gradient and the calculated Reynolds number values suggests laminar flow in the ducts. However, the Hagen–Poiseuille correlation for laminar flow does not describe the flow behavior of the nano-silica solution. The classic hydraulic model with hydraulic diameter describes the nano-silica flow behavior with an average error of 12.38%. The cause of discrepancies between the flow models and the measured data is not known. It can be attributed to the NPs–NPs frictions and NPs–wall frictions in the rough ducts that were not considered in the flow models.

Audience Take Away Notes

- The flow behavior
- The potential solutions for well remediation
- The reasonability for the method

Biography

Mr. Nguyen is a doctoral candidate at Petroleum Engineering Department at the University of Louisiana at Lafayette. He received his bachelor's degree at Ho Chi Minh City University of Technology, Viet Nam and Master's Degree at the University of Florida, USA. They were both in Chemical Engineering. His currently research focus on investigating the nano silica gel for oil and gas wells remediation. He has several published papers for the subject. Also, he is working on the Carbon Capture Sequestration topic with his colleagues from University Arab Emirates University (UAEU). The research group is working to find the solution how to transport the Carbon Dioxide and how to maintain the Carbon Dioxide in the supercritical condition at specific pressure and temperature to storage. Besides research, he like to work with student by teaching the classes. His favorite teaching classes are Reservoir Mechanic Laboratory, Oil Field Chemistry, Reservoir Simulation. His plan for future career is to become a professor.

Khwaja Naweed Seddiqi[1]*, Kazunori Abe[1], Jirui Hou[2]

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Decision-making technique for water shutoff using random forests and its application in high water cut reservoirs

Most of the oilfields are now experiencing intermediate to late stages of their oil production by waterflooding method. The water injection effects in creating channels between wells are serious and the oil recovery efficiency are decreasing. The usage of water plugging profile control is required to manage excessive water production from an oil reservoir. This research examines the well selection for profile control using the Fuzzy Evaluation Method (FEM) and its enhancement utilizing the Random Forest (RF) classification model. Using a machine learning RF technique, candidate wells for profile control operations were performed. The data source consists of 18 injection wells, with 70% of the well data used for training and the remaining 30% for model testing. The new factor weights are established when the model has been fitted, and choices are made. Thus, 4 out of 18 wells are selected for profile control using a new factor weight created by RF, while 7 out of 18 wells are selected using FEM. The profile control is then carried out using a polymer gel plugging method that was studied by laboratory experiments. The selected wells are profiled using both techniques in a numerical simulation model, and the effects of gel system plugging on daily oil output, water cut, and cumulative oil production are then contrasted. According to the study, compared to 7 wells that were selected using the FEM model, the reservoir performed better when 4 wells were selected using a novel weighting system created by RF. The decision-making abilities of the profile control wells were improved by the new weighting model.

Audience Take Away Notes

- The well selection for water shutoff process by fuzzy mathematic method
- Factor weight generated by Random Forests and it is usage for well selection for water shutoff
- Chemical agent polymer based starch gel introduction for water shutoff numerical simulation and experiments

Biography

Naweed Seddiqi studied Enhanced Oil Recovery at Tokai University, Japan and graduated as a MS in 2017. He then joined the research group of Prof. HOU at China University of Petroleum-Beijing, China and get his Ph.D. degree in 2022. Now he is working as a postdoc at Prof. Hikari Fujii lab, at Akita University, Akita Japan.

Youlia Kamei Saito
Federal University of Vicosa, United States

Silting process in dam reservoirs. Case study: Lake on the piumhi river in minas gerais - Brazil

Silting in bodies of water is a worldwide problem and, in reservoirs, it results in the reduction of their partial or total capacity. It is a natural process, but it has been intensified by the action of man through deforestation, land movements, inadequate agricultural techniques and the discharge of effluents. This work evaluates the silting process of the Furnas dam reservoir near the urban area of Capitolio in Minas Gerais, Brazil, using automated single-beam bathymetry techniques. An analysis of the charts showing the Digital Elevation Models and Elevation x Surface Area X Accumulated Volume for the surveys conducted in 2013 and 2019, in addition to physical analyzes of deposited sediments, physical-chemical analyses of water, analyzes of changes in use and occupation of the region of the contribution of the reservoir and the precipitation in the region, the author tried to find a correlation of these factors with the silting in the place. An analysis of silting in the reservoir was also carried out using the HEC-RAS software in the period between the surveys and later a future projection of this process was carried out. Areas to be dredging and preventive measures were suggested so that dredging works do not have to be carried out frequently.

Kazunori Abe*, Khwaja Naweed Seddiqi, Katsuaki Fujii, Hikari Fujii

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Improvement of the performance of low-salinity water flooding on oil recovery For sandstone reservoirs in Northern Afghanistan Kashkari oil field

Low-Salinity Water Flooding (LSWF) is an environmental-friendly Enhanced Oil Recovery (EOR) technique and operates similarly to conventional water flooding without synthetic chemical material. The main mechanism of oil recovery by LSWF is to increase the water wettability in oil reservoirs. In this study, we investigate the effect of the injection patterns on the performance of LSWF in sandstone reservoirs in the Kashkari oil field using a laboratory core flooding test and a numerical simulation. Kashkari oil field is an onshore located in the northern Afghanistan, and currently only the primary recovery method is applied. Therefore, it is important to confirm the effect of low-salinity water injection in the target reservoirs and define an effective injection pattern. Firstly, the core flooding test was conducted to observe the oil recovery effect under the conditions designed to mimic those of the target reservoirs. The effects of LSWF on oil recovery were observed using sandstone cores containing kaolinite in various injection patterns such as secondary recovery mode, tertiary recovery mode, and continuous injection of low-salinity water with different salinity concentrations. In addition, based on changes in ion concentration and pH in the effluent in the core flooding test, it was suggested that the dominant mechanism to improve oil recovery is Multiple Ion Exchange (MIE). Next, core-scale simulations of LSWF based on the MIE were performed and compared with the core flooding results. Finally, the LSWF model based on the MIE was applied to the Kashkari reservoir model to estimate the total amount of recoverable oil. As a result, an amount of 10.3 MMbbls, which is about 7.5% of the field, was produced.

Audience Take Away Notes

- The effect and mechanism of oil recovery by low-salinity water flooding for sandstone reservoirs using a laboratory core flooding test
- Core-scale numerical simulation of low-salinity water flooding based on multiple ion exchange and comparison with experimental results
- Prediction of oil production rate using the Kashkari reservoir model when changing the injection pattern of low-salinity water

Biography

Kazunori Abe studied material engineering at Akita Prefectural University, Japan and graduated as M.Sc. in 2010 and Ph.D. in 2013. He then joined the energy resources engineering laboratory of Prof. Hikari Fujii at Akita University, Japan as a postdoctoral fellow. Three years later, he obtained the position of an Assistant Professor at Akita University in 2016, where he now studies oil/gas recovery techniques.

Osamah M Al Ghamdi
Saudi Aramco, Saudi Arabia

Success story in enhancing the reliability of sea water injection used for oil production

The seawater plant and its associated piping networks suffers from the multiple causes of corrosion, and one of the most causes, is the Microbial Influenced Corrosion. As the control of corrosion requires deep study of the process/system, through a formal corrosion management program. Sitting robust program requires monitoring the process, collecting and analyzing data, develop action plan and then establish roles and responsibility to each involved individual and/or organization. The journey took long time to finally prove the effectiveness of the program. This paper summarizes a success journey in enhancing the plant reliability and availability through effective corrosion control. The corrosion control program is summarized under 5 pillars:

- Stakeholder Engagement
- Data Analysis
- Corrosion Management Program
- Processes and Procedures Enhancement
- Capital Investments

Stakeholder Engagement: Engaging all stakeholder, and in particular the organization's leadership, was a key factor behind this success journey. The higher-level management were involved in most of the technical challenges and as a result all support was obtained in a smoother way, since they are well aware about consequences of the corrosion related failures. Also, the other organizations that are involved with us in the process of the sea water were closely involved with us, through the corrosion management program that was formally concurred by them.

Data Analysis: Starting the real work of developing corrosion management program requires massive work in analyzing all data available, such as process design and actual parameters, design and actual specification of the sea water, costumer input and concerns, lab data, failure analysis, leaks history… etc. After spending enough time in analyzing the available data, the team agreed to enhance the analysis through:

- Installing Additional instruments (analyzers, monitors, transmitters, … etc.)
- Introduce additional sampling location
- Change the frequency of the sampling
- Review and adjust the sampling procedures

Afterward, the team developed a road map to enhance the data analysis. Data were analyzed and corrosion management program was adjusted accordingly as needed.

Corrosion Management Program: Developing the corrosion management is an important step in order to have governance in all efforts being done toward controlling the corrosion. It also insures sustaining the high performance and serves as a good reference for the organization. The corrosion management

program was developed by our corrosion engineers, and then reviewed and concurred by the central engineering entity in the corporate.

Processes and Procedure Enhancement: As majority of the corrosion management program items are assigned to operation and maintenance, and in order to ensure they are formally assigned, the corrosion engineers reviewed the current manuals and the formal reference documents in the organization and added items assigned to each unit in the department. These efforts resulted in a better alignment between the corrosion management program and the other operation documents and manuals.

Capital Investment: The corrosion management program, and based on the analysis done by the corrosion engineers, involves short term and long-term action plans to enhance the corrosion control. Action plan were basically considered as multiple projects with different size. The organization built valid and solid convincing case to the corporate Finance team were approval was obtained based on both technical and financial analysis.

Outcomes: As a result of implementing the corrosion management program, the organization successfully achieved the below outcomes:

- Number of water leaks was dropped by more than 70%
- Enhanced specifications of the processed sea water
- Enhanced the lab analysis in terms of sample locations, frequency, procedures, etc
- Higher equipment availability % for the corrosion related plant equipment such as hypochlorite generators/pumps Clear road map on the corrosion control presented to the department head, attended by all stake holder, to track the progress of the road map

Biography

Osamah works as an engineering supervisor in Saudi Aramco, in the department of the sea water injection. Osamah has 13 years of experience in oil and gas in multiple plants through different disciplines including, operation, maintenance, safety and engineering. He holds a bachelor degree in mechanical engineering and a master degree in engineering management.

BOOK OF ABSTRACTS

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Fengshi Guo*, Mingcan Cui, Yangmin Ren, Yongyue Zhou, Shiyu Sun, Jeehyeong Khim

School of Civil, Environmental, and Architectural Engineering, Korea University, 145 Anam-ro, Seongbuk-gu, Seoul, 02841, Republic of Korea

Prediction of permeable reactive barrier width for arsenic treatment in groundwater using machine learning techniques

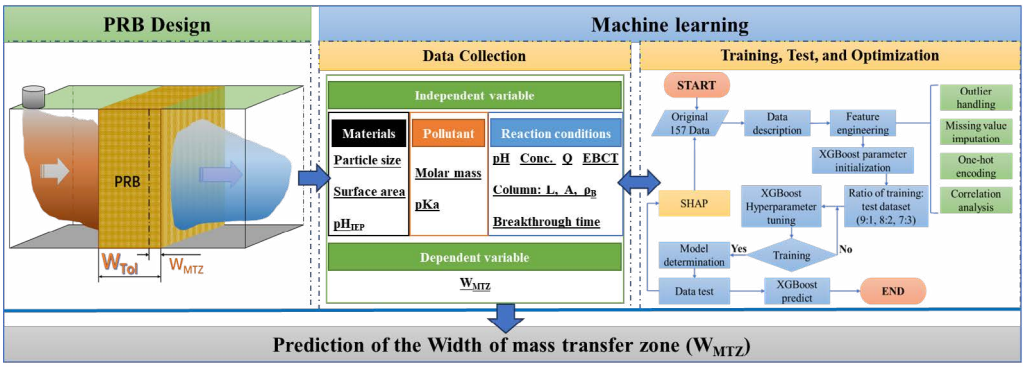
Permeable Reactive Barrier (PRB) is an effective in-situ technology for aquifer and groundwater remediation. The important factors in PRB design are the width and selection of the reactive material. In this study, the Beaded Coal Mine Drainage Sludge (BCMDS) was employed as the filling material for the PRB to adsorb arsenic pollutants in groundwater. The determination of PRB width using the conventional adsorption mechanism is determined by determining the delay coefficient through batch experiments and substituting it into Eq. 1, while the mass transfer zone is determined through the column experiment, and the final PRB width is determined by combining the equilibrium and mass transfer zone widths (WMTZ), i.e., Eq. 2.

$$W_{Tot}=(t_{life\times\mu\_Ground})/R \quad [1]$$

$$W_{Tot}=(W_{Equ}+W_{MTZ}) \quad [2]$$

Both experimental data and machine learning predictions were used for the design of the PRB width. The calculation of WMTZ was conducted through column experiments under various conditions: different pollutant initial concentrations (1.5, 5, and 8.1 mg/L), pH values (3, 5, 8, and 9.5), and flow rates (0.56, 0.85, and 1.13 ml/min). Breakthrough curves were generated based on the experimental results.

In this study, we try to predict the WMTZ of the PRB through machine learning and finally determine the PRB's width by considering the PRB's age. It is combined with XGBoost and SHapley Additive ExPlanations (SHAP) [4], which simultaneously consider the type of adsorbent material, pollutant, and environmental conditions, with 157 data collected from articles to predict WMTZ. Data preprocessing and model training improved the prediction accuracy. The experimentally derived WMTZ values were also used to validate the machine learning predictions, demonstrating the accuracy of the predictions and the feasibility of using machine learning.



Keywords: Groundwater Remediation, Permeable Reactive Barrier Thickness, Machine Learning, SHAP, Design.

Acknowledgment: This work was supported by the Korean Ministry of the Environment as a Subsurface Environment Management (SEM) project (No.2021002170003 and No. 202300231376).

Audience Take Away Notes

- Machine learning techniques can be applied in groundwater treatment, such as predicting adsorption experimental results and designing Permeable Reactive Barriers (PRBs)
- Machine learning, to some extent, saves both time and money in actual experiments and can predict outcomes that are challenging to achieve in the laboratory, which provides a practical solution that could simplify or make a designer's job more efficient
- This research that other faculty could use to expand their research with machine learning
- This research provides new information to assist in a design problem

Biography

Student Guo Fengshi studied environmental engineering at Hebei University of Technology in China and graduated as a bachelor in 2021. Then started to study civil, environmental, and architectural engineering at Korea University, and joined the research group of Prof. Jeehyeong Khim at the AOP lab.

Shiyu Sun*, Yanmin Ren, Yongyue Zhou, Fengshi Guo, Mingcan Cui, Jeehyeong Khim

Korea university, Seoul, Korea

Prediction of micro pollutants degradation kinetic constants by ultrasonic using XGBoost and SHAP models and verification through experiments

In recent years, the emissions of micro-pollutants have been continuously increasing, leading to the sustained significance of degrading micro-pollutants in aquatic systems. Among various degradation methods for micro-pollutants, the approach of ultrasonic degradation in aquatic environments has been garnering increasing attention. However, due to the wide variety of micro-pollutants, the complexity of their degradation pathways, and the diverse physicochemical properties of these pollutants, coupled with the influence of local conditions, determining local ultrasonic degradation methods has proven to be challenging. In order to enhance engineering efficiency and reduce trial-and-error costs, a straightforward and efficient method for predicting the performance of ultrasonic water treatment systems under various conditions is necessary. All training and testing data were collected from articles on ultrasonic purification of micro-pollutants between 1994 and 2022, proposes a prediction and feature analysis model for the ultrasonic degradation of micro-pollutant kinetic constants based on XGBoost. The relevant parameter variables include characteristics of ultrasound (frequency, power, power density, calorimetric power, and calorimetric power density), characteristics of pollutants (concentration, molar mass, Henry's constant, and logKow), and experimental conditions (pH, reaction volume, and temperature). Prior to the XGBoost modeling training, the raw data underwent preprocessing within the program. Utilizing the processed data as input for XGBoost, the model underwent iterative training to attain the optimal configuration. Various ratios (9:1, 8:2, 7:3, 6:4) of training and testing data were examined, with the 9:1 ratio yielding the highest accuracy and thus being chosen. SHAP values served to explain the model features, identifying the pivotal factors that influenced the kinetic constants. The model's prediction accuracy was further improved by clarifying the characteristics of the model through the SHAP value and re-dividing the scope of the critical factors affecting the kinetic constants. The results demonstrated that after iterative prediction, the model's MAPE, R2, MAE, MSE, and RMSE reached 0.056%, 0.932, 0.321, 0.221, and 0.470, respectively. Subsequently, six different pollutants were randomly selected for ultrasonic experiments to acquire kinetic constants. Following this, a set of six diverse pollutants was randomly selected for ultrasonic experiments to derive kinetic constants. Subsequently, a comparison between these experimental findings and the machine learning predictions, conducted under identical conditions, verified the accuracy of the model. The observed alignment between experimentally validated results and predicted outcomes underscored a notable level of accuracy. These ongoing endeavors will be channeled into further exploration of optimal reaction conditions for a specific reactor.

Audience Take Away Notes

- They will learn about the process of designing and optimizing reaction systems using the proposed XGBoost model. This knowledge will empower them to make informed decisions about the most effective parameters for degrading specific pollutants under different conditions
- This research offers a practical approach to designing efficient and effective ultrasonic degradation

experiments. Professionals in fields related to water treatment, environmental engineering, and pollutant remediation can utilize the findings to plan and conduct experiments that maximize the degradation of micro-pollutants, leading to better water quality management and improved environmental sustainability

- Yes, this research provides valuable insights into the use of advanced machine learning techniques like XGBoost for optimizing ultrasonic degradation processes. Other faculty members in the fields of chemical engineering, environmental sciences, and machine learning could use this research as a foundation for further exploration, experimentation, and teaching related topics
- Absolutely, this research presents a practical solution to the challenge of determining the optimal conditions for ultrasonic degradation of micro-pollutants. By using the XGBoost model to predict optimal parameters, designers and engineers can streamline their experimental designs, reducing trial and error and improving overall efficiency
- Yes, this research enhances the accuracy of experimental design for ultrasonic degradation by providing a data-driven approach. It offers insights into the intricate relationship between various parameters and their effects on micro-pollutant degradation. This understanding contributes to more precise and informed design decisions

Biography

Student Sun Shiyu pursued a Bachelor's degree in Materials Chemistry in China, graduating in 2019. Subsequently, she joined the AOP system Laboratory affiliated with the Department of Civil, Environmental, and Architectural Engineering at Korea University for advanced studies. She has since published a research article and actively participated in laboratory research projects. Currently, she is pursuing both a Master's and a Ph.D. degree at Korea University.

Dinesh I Prajapati

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Synthesis, characterization and application of nano sized barium chromate for photocatalytic degradation of an organic pollutant

In the present investigation, nano-sized barium chromate has been used as a photocatalyst for the degradation of an organic pollutant. The semiconductor was prepared by precipitation method and it was characterized by different analytical techniques like XRD, SEM-EDS and FT-IR. Barium Chromate absorbs major portion of visible light due to its yellow color and acts as an efficient photocatalyst. The effects of different operating parameters were studied to obtain optimum conditions for organic pollutant degradation. Physico-chemical parameters of the organic pollutant (before and after photocatalytic treatment) have also been studied to show the complete mineralization of organic pollutant molecules. A tentative mechanism for the photocatalytic degradation of organic pollutant has been proposed, where hydroxyl radical has been observed as an oxidizing species.

Keywords: Photocatalytic Degradation, Semiconductor, Barium Chromate.

Audience Take Away Notes

- Water pollution is one of the world's most burning issues of today. The different industries produced a huge amount of wastewater in developing countries. The release of organic pollutants (dyes) from different dying industries into the aquatic system creates a large amount of water pollution. The coloured and polluted waste waters containing dye pollutants create many environmental and health hazards. Different methods have been used for the removal of dyes from waste waters like chemical, physical and biological methods, but each method has its own advantages and disadvantages. Photocatalysis method may play an important role to solve this problem. It is also an eco-friendly and low cost method to remove dyes from wastewater.

Biography

Dr. Dinesh I Prajapati is an associate Professor in Chemistry at Department of Chemistry, M. G. Science Institute, Navrangpura, Ahmedabad, Gujarat, India. He has 25 years teaching experience in under graduate and post graduate level. He has published seven research papers in different peer reviewed journals.

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The solventfree mechano-chemical grinding of a bifunctional P25–graphene oxide adsorbent photocatalyst and its configuration as porousbeads

Titanium-dioxide based nanomaterials have been widely used in water-cleaning technology, with Degussa (P25) being the most promising photocatalyst under UV light. However, its effectiveness under visible light requires the combination of titanium dioxide with other photosensitizing nanomaterials. Most of the strategies aimed at achieving this are chemically non-facile, expensive, energy-intensive, and not suitable for large-scale production. This conference paper presents a solvent-free approach for preparing visible-light activated titanium-dioxide-based photocatalysts by mechanochemical grinding of Degussa P25 with graphene oxide. The preparation of graphene oxide by Hummer's method, the method and characterization of the photocatalyst TiO_2-GO, and its efficient performance for adsorption and photodegradation of various dye pollutants, including methylene blue, malachite green, Congo red, and methyl orange, are all described. The paper also highlights how the recyclability of TiO_2-GO can be improved through a porous-bead configuration using biomass waste chitosan hydrogel, which contributes to more sustainable photocatalyst designs.

Biography

Professor Malika Tamimi received her PhD degree in physical chemistry from the university Ibn Zohr of Agadir, Morocco in 2007, and since 2010 she began her academic career at the same university (Ibn Zohr Agadir, Morocco), Faculty of sciences, Department of chemistry, Laboratory of Physical Chemistry and environment. Research by her group is mainly focused on development of novel methods for synthesize and preparation the new catalysts, semiconductors.... for heterogeneous photo catalysis. Also, we are interested to Treatment of water pollution through advanced oxidation process techniques such as fenton reaction, electro-fenton, electrochemical method, and electro-degradation including the second.

Cristian Valdebenito[1], Jose Gaete[1], Claudio Osorio[1], Yuvaraja Dibdalli[1], Angel Norambuena[2], Gabriel Abarca[1], Cesar Morales Verdejo[1]*

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Evidence for formation of iron oxide nanoparticles into the mechanistic of the thermal decomposition of Ammonium Perchlorate using ferrocenyl compounds derived from 1,2,3-triazolyl ligand as burning rate catalysts

Rocket technology research is currently receiving the utmost attention due to its potential applications, mainly in the aerospace equipment industry. In this way, for the first time in human history, a commercially built spacecraft by Space-X operated by a crew of NASA astronauts has been launched from American soil to the International Space Station. Furthermore, the launch of this commercial space system designed for humans is an essential step on our path to expand human exploration to the Moon and Mars. A propellant rocket motor is the purest form of an energy conversion device in which matter (solid or liquid) is burned, producing hot gases.

Concerning the solid propellant rocket, the thermal decomposition of Ammonium Perchlorate (AP) has a close relationship with the propellants' combustion process. There are highly effective Burn-Rate (BR) catalysts for AP and excellent candidates for application in rocket motors with high thrust and acceleration power in comparison with Fe_2O_3, a commonly used BR catalyst.

Therefore, the impact on the thermal degradation of AP is often used to evaluate the combustion effect of a burning rate catalyst candidate on the combustion behaviour of composite solid propellants. This work aims to describe the catalytic effect of different ferrocenyl compounds derived from 1,2,3-triazolyl ligand as BR catalysts by Thermogravimetry (TGA) and Differential Scanning Calorimetry (DSC) techniques, which will significantly decrease the decomposition temperature of Ammonium Perchlorate, resulting in improved performance of the composite solid propellant, and increasing the energy release. The ballistic parameters of the examined propellants were determined by combustion in a laboratory rocket motor. The ballistic properties were evaluated in the pressure range 7–30 MPa. It was found that the linear burning rate was increased for propellants with ferrocene derivatives as BR Catalyst compared to propellant without the modifier. Comparatively lower pressure index (n) value was observed for composition containing ferrocene derivatives as BR catalyst than for propellant with iron oxide and HTPB-based propellant without the modifier.

All ferrocenyl compounds derived from 1,2,3-triazolyl ligand here reported were characterized by means of 1H and 13C NMR, elemental analysis, and mossbauer spectroscopy and X-ray diffraction.

Audience Take Away Notes

- Introduce students and young professionals to a multidisciplinary environment for the development of propulsion technologies. The production of solid propellants allows the design and implementation of probe rockets, essential for the development of aerospace technology
- Other faculty could use this research to expand their teaching related to different topics, such as thermal, mechanical, chemical, and thermochemical data of the propellants and reaction products, which are essential parameters that determine the flight performance of the rocket

- The present work consists of developing propellant-catalyst mixtures, with projection of scaling towards the propulsion of small-sized rockets, with sufficient impulse for the placement of microsatellites at the suborbital level. For this purpose, this work is oriented along three axes
    - **First axis:** The study of a series of synthetic propellant-catalyst mixtures, for the development of a suitable fuel for propulsion of suborbital rockets
    - **Second axis:** The development of an assembly to be used as a ballistic measurement test bench for small-scale nozzles, which allows obtaining physical and chemical measurements of the impulse generated by the combustion of propellant-catalyst mixtures
    - **Third axis:** The study of propulsion scalability in a suborbital rocket in the field
- Since the combustion performances, particularly the BR and pressure exponent, have always been the focus in the field of solid propellant and considering that the ferrocene derivatives have become an indispensable component in HTPB/AP composite solid propellants owing to their extraordinary effects in enhancing the BRs, especially because they bring down pressure indexes of the propellants, in this context, this contribution describes the catalytic activity of the ferrocenyl compounds derived from 1,2,3-triazolyl ligand on the BR and its effect on the pressure exponent of the composite solid propellant in comparison with ferric oxide, commonly used modifier
- In this way, the formulation of ferrocenyl compounds derived from 1,2,3-triazolyl ligand as burning rate catalysts, increasing the performance of the combustion rate, allowing access to rocket flight tests, in a multidisciplinary environment, allowing projects on meteorology, contamination of the troposphere and the stratosphere, agriculture, telecommunications, maritime and land monitoring, among others

Biography

Dr. Cesar Morales Verdejo studied Chemistry at Pontificia Universidad Catolica de Chile and graduated in 2006. He received his Ph.D. in Chemistry degree in 2010 at the same institution. After one-year postdoctoral fellowship supervised by Dr. Michael D. Hopkins at Argonne National Laboratory, Illinois, USA, he obtained the position of an Associate Professor at Universidad Bernardo O'Higgins, Chile. During his career, he has co-authored more than 40 peer-reviewed publications and has received funding as a PI and co-PI on grants from the Chilean Science Foundation (Fondecyt) and the US Army (RDECOM W911NF1810398).

S. M. Hossein Hejazi[1,5]*, Jana Dzibelová[1,2], Veronika Sedajova[1,3], David Panacek[1,3], Petr Jakubec[1], Zdenek Baďura[1,2], Ondrej Malina[1], Josef Kaslik[1], Jan Filip[1], Stepan Kment[1,5], Michal Otyepka[1,4], Radek Zboril[1,5]

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Enhanced photodecomposition of Ammonia using Ruthenium oxide-loaded 2D Hematene

Two-Dimensional (2D) non-van der Waals (n-vdW) materials, similar to graphene counterparts, offer exceptional properties and versatile uses. Among these, 2D iron oxides stand out for their magnetic, photocatalytic, and electrocatalytic potential. Here, we present the effective loading of hematene, a 2D iron oxide, with RuO_2 nanoparticles to act as an efficient co-catalyst for the photocatalytic decomposition of aqueous ammonia. Ammonia, vital for fertilizers, poses challenges due to its negative impacts. Conversely, its high hydrogen densities make it an attractive carrier for clean fuel production. This study focuses on converting NH_3 to H_2 (fuel) and N_2 (innocuous gas) using renewable energy sources. Our findings highlight the facile modification of n-vdW materials with ruthenium oxide nanoparticles, showcasing their potential for visible light-induced ammonia decomposition. Ruthenium oxide's mid-band gap positioning expedites charge separation. This work not only advances sustainable ammonia decomposition but also contributes to magnetic technologies, photocatalysis, and electrochemistry, bridging nanomaterials and renewable energy-driven processes for a greener future.

Audience Take Away Notes

- The audience will gain insight into the utilization of two-dimensional (2D) materials, specifically hematene loaded with ruthenium oxide, as an effective photocatalyst for the photodecomposition of ammonia using visible light irradiation. This knowledge will provide researchers, engineers, and professionals in the fields of materials science, renewable energy, and catalysis with a deeper understanding of a novel and environmentally friendly approach to harnessing solar energy for ammonia decomposition. They will learn about the synthesis, properties, and applications of this unique photocatalytic material, enabling them to explore its potential for sustainable energy conversion
- Professionals in fields related to energy, catalysis, and materials science will find valuable information that could enhance their work. The research offers an innovative approach to addressing the challenge of ammonia decomposition, an important process for both energy production and environmental sustainability. By utilizing hematene loaded with ruthenium oxide, researchers and engineers can potentially develop more efficient and eco-friendly technologies for producing hydrogen gas and nitrogen gas from ammonia, contributing to their work in renewable energy and green technology development

- This research holds potential for other faculty members to expand their investigations in areas such as photocatalysis, materials synthesis, and sustainable energy. It introduces a new approach to utilizing 2D materials for efficient ammonia photodecomposition, which could inspire further research projects or even curriculum development for teaching advanced topics in materials chemistry and renewable energy conversion
- The study presents a practical solution to the challenge of ammonia decomposition, offering a clean and renewable method for generating hydrogen fuel and harmless nitrogen gas. Designers and engineers working on energy conversion systems, such as fuel cells or hydrogen production technologies, could benefit from incorporating this photocatalytic approach into their designs. This research simplifies the process by providing an alternative to traditional methods that often involve energy-intensive processes or costly materials
- The research introduces a novel photocatalytic material, hematene loaded with ruthenium oxide that exhibits enhanced ammonia photodecomposition under visible light. Integrating this material into energy conversion systems could improve the accuracy and efficiency of hydrogen production. The study also contributes new information about the potential of 2D materials in photocatalysis, broadening the scope of design options for clean energy technologies
- **Economic Implications:** The research potentially paves the way for cost-effective and scalable production methods for photocatalytic materials, contributing to the commercial viability of clean energy technologies
- **Scientific Advancement:** The study expands the understanding of the capabilities of 2D materials and their application in catalysis and renewable energy, advancing the overall field of materials science and chemistry

Biography

Dr. Hossein Hejazi earned his 2017 doctoral degree from "Amirkabir University of Technology," Iran. He's a dedicated researcher in Photoelectrochemistry at Palacky University's Regional Centre of Advanced Technologies and Materials. His expertise lies in synthesizing and characterizing single-atom nanomaterial photocatalysts, enhancing water splitting, H2 evolution, and CO2 reduction. His work addresses crucial challenges in materials science, advancing renewable energy conversion and sustainable environmental technologies.

Mohammed Al Fazari[1]*, Hamed Al Subhi[1], Al Khalil Al Sarhani[2]

[1]Thermal Production Operation, Petroleum Development Oman, Muscat, Muscat, Oman

[2]Process Control & Optimisation, Petroleum Development Oman, Muscat, Muscat, Oman

Water treatment plant enhancement - maximize value for lower ghg

The Purpose of "A" Thermal Field Water Treatment Plant (WTP) is to remove hardness of Aquifer Pump-Off (APO) well water to make it suitable for steam generation. The process involves removal of suspended solids, traces of oil and dissolved minerals from water. The total water output from all phases is 18,350 m^3/d in which it is used for steam generation and local WTP consumptions e.g. brine tank, regeneration process, and backwash.

In 2017 & 2019, Solar Miraah Phase-1 & phase-2 has been commissioned with a daily average capacity of 1,980 tons of steam per day connected to Amal steam injection systems and considering that the soft water supply will be provided from the same existing WTP. As an outcome of this change, a shortage of 2,000 m^3/d of soft water had been identified resulted in an impact of Amal oil target KPI.

In 2020 a new CI has been identified within operation to debottleneck the existing WTP trains to increase its capacity and cater for total generators throughput and linked to forecasted steam demand with minimum modification.

The new scope execution was started, and total water production has been increased of around 3,000 m^3/d resulting in maintain the supply of soft water to steam generators and maintain the steam demand within forecast.

This project has been completed with minimum spend on capex (15,000 USD) for logic modifications in DCS system.

By doing this modification, it resulted in below benefits (confirmed):

1. GHG Reduction of 4,600 TCo_2e/yr due to reduction of blanketing gas in WTP soft water tank and avoidance of power consumptions for the additional water produced.
2. An oil secure of 390 m^3/d from Amal fields due to securing the required soft water for steam injection.
3. An oil gain of average of 30 m^3/d due to potential of project acceleration because of high availability of soft water.
4. A cost saving of more than 4.7 mln$ due to cancelation of other project to cater for water shortage.

Audience Take Away Notes

- Out of box solution developed within PDO resulted in high gain with less CAPEX
- They can get best of it for replication as applicable
- T research that other faculty could use to expand their research or teaching
- This been implemented in one of the facilities and shows the value
- It improves the accuracy of a design, or provide new information to assist in a design problem

Biography

Mohammed Al Fazari as a 11 years' experience in oil & Gas. Wide experience in process engineering covering concept, engineering, commissioning, and operation including Thermal Operation. 6 years' Experience in Gas Processing covering Gas conditioning units and stabilization process. 4 years experience in Thermal operation and design Graduated from Sultan Qaboos University (bachelor degree on chemical and process engineering) on 2011 and joined PDO as process engineer.

Mohammed Al Fazari*, Al Yaqadhan Al-Rashdi, Hilal Al-Ghefeili
Thermal Production Operation, Petroleum Development Oman, Muscat, Muscat, Oman

Flare reduction and utilization for lower GHG

Petroleum Development Oman LLC (PDO) is Oman's premier oil producer and operates several fields at "A". "A" East and "A" West are located on the eastern flank of the South Oman Salt Basin. As "A" Thermal fields contain heavy oil, PDO plans to significantly increase oil recovery by increasing the steam injection which is having high energy intensity. The objective of this paper is to demonstrate the improvement in flared gas reduction and utilization for other consumers resulted in reduction in Green House Gases (GHG) emissions. This work had been initiated after noticeable increase in associate gas flaring in AP flare system. High GOR wells has been surveyed and closed to control the flare resulted in oil deferment, however the flaring was still increasing. Many challenges faced including casing vent, PCV passing, increasing in steam injection (Aqua Thermolysis Process) and flare gas metering.

In this project, lean practice was used to define the opportunities including A SIPOC (Suppliers, Inputs, Process, Outputs, Customers) diagram, Process Mapping, Cause & Effect Diagram, Root causes analysis, and development of Visual Management Boards (VMB), Standard Operating Procedures (SOP) to sustain Improvements. Practical Problem Solving (PPS) approach was used and several countermeasures had been completed leading to reduce in Associate gas flaring by an average of 50%, equivalent to (~ 2 million USD/ annum).

This project had been completed with minimum spend on capex. By doing these modifications, it resulted in below benefits (confirmed):

- GHG Reduction of 30K TCo_2e/yr due to reduction of Flared gas in and utilization for Boiler Fuel Gas.
- An oil secure of 200 m^3/d due to maintaining the processing Gas in /out of the Facility.
- A cost saving of more than 2 mln$ / annum due to the utilization of gas for other process.

Audience Take Away Notes

- Out of box solution developed within PDO resulted in high gain with less CAPEX
- They can get best of it for replication as applicable
- This been implemented in one of the facility and shows the value

Biography

Mohammed Al Fazari as a 11 years' experience in oil & Gas. Wide experience in process engineering covering concept, engineering, commissioning, and operation including Thermal Operation. 6 years' Experience in Gas Processing covering Gas conditioning units and stabilization process. 4 years experience in Thermal operation and design Graduated from Sultan Qaboos University (bachelor degree on chemical and process engineering) on 2011 and joined PDO as process engineer

Mahdi Ashkanani
Kuwait Oil Company, Kuwait

Water injection for enhanced oil recovery

Water produced from oil and gas production is one of the most significant effluent stream due to its large volume and strategic importance. The amount of produced water, the constituents present in produced water usually vary significantly over the lifetime of a field. During early life of the field, water cut can be very low, but it gradually increase and becomes multiple times of oil production rate as the field matures.

In terms of composition, the changes are complex because they are a function of the geological formation, the oil and water chemistry, reservoir behavior and additives / chemicals injected for reservoir maintenance.

Properly treated produced water can be recycled and used for produced water re-injection and other applications, such as crop irrigation, wildlife and livestock consumption, aquaculture, agriculture, industrial processes, vehicle and equipment washing, power generation and fire suppression etc. These beneficial reuses decrease reliance on potable water / brackish water, which are highly valuable commodity in water-scarce regions of the world. Thus, for oil and gas production facilities located in water-scarce regions, re-injection of treated produced water for improved oil recovery has emerged as a viable option but its implementation has challenges related to injection water quality, injectivity and safety issues. In addition, strict environmental regulations require extensive treatment of produced water before safe disposal making reinjection of produced water even more viable alternative.

The specification of injection water quality is of prime importance and optimization of injection water quality vis-a-vis the cost of treatment is the key factor for reservoir health maintenance without sacrificing the injectivity loss or excessive increase of backpressure from the well.

Thus, the role of produce water treatment and injection facility is vital for sustaining well injectivity over field life while maintaining reservoir health for an effective Improved Oil Recovery program.

This paper provides an overview of the various challenges, opportunities and resolutions for utilizing produced water in Kuwait for Improved Oil Recovery. New novel technology for treating and re-injecting effluent water will be covered through this paper highlighting its operating window, advantages and limitations.

Biography

Mahdi Ashkanani is Senior Mechanical Engineer at Kuwait Oil Company. He Worked as Mechanical Engineer in maintenance team for the first 8 years at Kuwait Oil Company. At recent time, his position is Snr. Mechanical Engineer working in Operations Technical Services handling Oil & Gas projects in all Kuwait oil fields.

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DAY 02

KEYNOTE FORUM

JOINT EVENT ON

OIL, GAS AND PETROLEUM ENGINEERING & CATALYSIS, CHEMICAL ENGINEERING AND TECHNOLOGY

United Nations' strategy responding to climate change

The United Nations has begun to establish the strategies responding to climate change at a global level as a guideline for climate change policies to be launched by each country. This is because climate change is placed at the top among environmental problems in that its impact on nature and society is most serious at a global level.

The purpose of the United Nations' strategy is to restore the current status of climate change to the climate neutrality which is the original status of climate before the industrialization having been advanced in the 18th century.

In this context, this paper aims at introducing the key contents of the United Nations' strategies and at examining critically them. This paper will be composed of five parts as below.

Part 1: There are hot debates on climate change in academia. The examples include that what climate change is, climate change is a real reality or uncertain, and what causes of climate change are, etc. Part 1 will introduce some debates on climate change.

Part 2: The current status, future prospect and impact of climate change will be introduced because these are the factors determining the direction and content of climate change response strategies.

Part 3: As a main content of this paper, the United Nations' strategy responding to climate change will be introduced. This will be presented in three stages. They are Kyoto Protocol Period (1998 - 2012), Post Kyoto Protocol (2013 - 2014), and Paris Agreement (2015 - present).

Part 4: The major strategy having been and being promoted at each stage will be critically reviewed. The critical review will be done on the basis of the concept and implications of low carbon, carbon neutrality, and carbon-zero, all of which are the means to restore the current status of climate change to climate neutrality.

Part 5: Most strategies require a lot of conditions in their process being launched such as finance and advanced technologies, etc. In this context, this paper will examine what capacities should be built as the pre-requisites for implementing successfully the climate change strategy.

Audience Take Away Notes

- The hot issues being debated in relation to climate change
- The impact of climate change on nature and society
- The framework and contents of the United Nations' strategy responding to climate change with a critical point of view, a critical point of view on the United Nations' framework, and a new desirable framework

Dai Yeun Jeong

Asia Climate Change Education Center, Jeju City, Jeju Special Self-Governing Province, South Korea

Emeritus Prof. at Jeju National University, Jeju City, Jeju Special Self-Governing Province, South Korea

Biography

Dr. Dai Yeun Jeong is presently the Director of Asia Climate Change Education Center and an Emeritus Professor of Environmental Sociology at Jeju National University (South Korea). He received BA and MA Degree in Sociology from Korea University, and PhD in Environmental Sociology from University of Queensland (Australia). He was a Professor of environmental sociology at Jeju National University (South Korea) from 1981 to 2012. His past major professional activities include a Teaching Professor at University of Sheffield in UK, the President of Asia-Pacific Sociological Association, a Delegate of South Korean Government to UNFCCC and OECD Environmental Meeting, etc. He has published 13 books including Environmental Sociology, and has conducted 95 environment-related research projects funded by domestic and international organizations.

- The limitations inherent in the United Nations' framework and contents of the strategy responding to climate change, and how to overcome them
- The capacities to be built for implementing successfully the strategy of climate change

The contribution of process modeling and simulation in oil and gas industry

The Oil and Gas (O&G) industry has confronted with many difficulties in recent years, such as the extreme price variability in short periods, the instability of global supply and demand, and the increasing competition in the energy sector with numerous alternatives forms of energy. It is essential for the O&G industry to discover ways to conduct business for achieving high levels of productivity at low cost, while at the same time remaining profitable and competitive. To achieve the aforementioned aim, it is important to turn on in the implementation of new technological solutions, such as process modelling and simulation with the use of immersive technologies at all stages of the industry. The immersive technologies, and particularly VR, in the oil and gas industry improved the accessibility of information, enhanced personnel and team training, reduced maintenance time and contributed in operational awareness and preparedness during emergencies. In the current study, an innovative methodology was proposed for training and assessment of oil and gas professionals as well as chemical industry staff in a virtual reality high tech environment.

Audience Take Away Notes

- Modeling and simulation in petroleum engineering
- Process verification, validation and testing
- Applying immersive technologies in O&G professional training
- Control room operations in O&G industry

Nikolaos C Kokkinos

Department of Chemistry, School of Science, International Hellenic University, Kavala, Greece

Biography

Dr. Nikolaos C. Kokkinos is Associate Professor at the Department of Chemistry of the International Hellenic University (IHU), Greece. He is the Director of Petroleum Institute and the Program Director of MSc in Oil and Gas Technology at IHU. Moreover, Dr. Kokkinos is the Research Director of Hephaestus Advanced Laboratory and he is in charge of Process Simulation in Petroleum and Natural Gas Engineering Laboratory at IHU. Dr. Kokkinos has more than 100 peer-reviewed publications in international scientific journals and conference proceedings. His research interests among others include process modelling and simulation and applied catalysis of complex substances.

Mechanical behavior of sandstone reservoir rocks accessed through absorption of water under low pressure test

The study of the mechanical behavior of reservoir rocks is traditionally supported by destructive compression tests carried out on representative specimens. The stress–strain curves and the values of the major parameters that characterize the pre-peak behavior—compressive strength, elastic modulus and strain at failure are very important. The physical properties of the sandstones, e.g., absorption of water under low pressure, greatly influences their compressive behavior, as shown by the experimental results. Higher values of the coefficient of absorption of water under low pressure of sandstone were clearly followed by smaller compressive strength and elastic modulus values and higher values of strain at failure. An analytical model was derived to obtain the description of the mechanical behavior of sandstones under compression. The evaluation of the performance of this analytical model was based on the comparison between the analytical stress–strain curves and the experimental stress–strain curves. The behavior under compression could be predicted when the absorption of water under low pressure was known because a good agreement was obtained between the analytical and experimental data of the pre-peak stress–strain curves. The water absorption under low pressure is a true NDT and a time-saving test for samples with higher porosity values, and it allows the prediction of the mechanical behavior of the sandstone reservoir rocks towards failure. This method can be applied in the oil and gas industry, since the rocks of the best oil and gas reservoirs have higher values of porosity, and these small periods of testing can be an important laboratory time-saving procedure during the well construction activity. In the early stages of exploration, the proposed methodology can also be applied on rock samples showing a wide range of water absorption values, collected on outcrops used as analogs of near-surface or deep formations of oil and gas reservoirs.

Marco Antonio Ludovico Marques

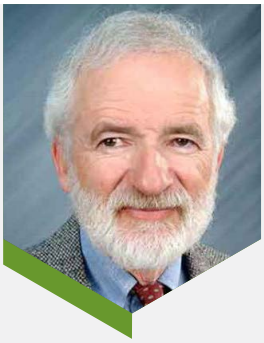
Barreiro School of Technology, Polytechnic Institute of Setúbal/ Coordinator of Petroleum and Gas Courses, Barreiro, Setúbal, Portugal

Biography

Marco Ludovico Marques is a Geological Engineer, MSc in Soil Mechanics and Ph.D. in Geotechnical Engineering (Rock Mechanics) at the Universidade Nova de Lisboa in 2008. He is an As. Prof. at Barreiro School of Technology of Polytechnic Institute of Setúbal since 2010, Head of Department of Structures and Geotechnics since 2014 till 2021 and is also Coordinator of Petroleum and Gas Technologies courses (E&P) since 2014. He teaches at Higher Education Institutions since 2005 and has been responsible for twenty subjects (different curricula units). Editorial board member of seven scientific journals and Reviewer of another twenty-seven journal. He is an expert assessor for R&D and Innovation project applications. His research interests and practice are Geotechnics, Petroleum, and Gas Engineering, CCUS, Transition scenario of Energy, Fuels and Gas underground storage & engineering, Stone conservation

Advanced concepts for ultra-high conversion efficiency of solar photons into photovoltaics and solar fuels based on quantization effects in nanostructures and molecular singlet fission

In order to utilize solar power for the production of solar electricity and solar fuels on a global scale, it will be necessary to develop solar photon conversion systems that have an appropriate combination of high efficiency (delivered watts/m^2) and low capital cost ($/$m^2$). One potential, long-term approach to attain high conversion efficiencies above (by a factor of 2) the well-known Shockley-Queisser thermodynamic limit of 33% is to utilize the unique properties of Quantum Dot/Rod (QD/QR) nanostructures and Singlet Fission (SF) in molecular chromophores, to control the relaxation dynamics of photogenerated hot carriers and excited states in photoexcited molecules to produce either enhanced photocurrent through efficient photogenerated electron-hole pair (ie, exciton) multiplication or enhanced photopotential through hot electron transport and transfer processes. To achieve these desirable effects it is necessary to understand and control the dynamics of SF and hot electron and hole cooling, charge transport, and interfacial charge transfer of the photogenerated carriers. These fundamental dynamics in various bulk and quantized nanoscale semiconductors and SF molecules have been studied for many years using various spectroscopies with fs tons time resolution. The prediction that the generation of more than one electron-hole pair (which exist as excitons in size-quantized nanostructures and photoexcited molecules) per absorbed photon would be an efficient process in QDs, QRs and SF molecules, has been confirmed over the past years in different classes of materials, molecules, and in their device architectures. Very efficient and ultrafast Multiple Exciton Generation (MEG), also called Carrier Multiplication (CM), and SF from absorbed single higher energy photons has been reported in many quantized semiconductors and molecules and associated solar photon conversion devices for solar electricity and solar fuels (e.g. H_2) production. Selected aspects of this work will be summarized and recent advances will be discussed, including the very remarkable and extremely large beneficial theoretical effects obtain when combining MEG with solar concentration. The analogous MEG effect in SF molecules and its use in molecular-based solar cells will also be discussed.



Arthur J Nozik

Department of Chemistry and Renewable & Sustainable Energy Institute (RASEI), University of Colorado, Boulder, CO 80309 and National Renewable Energy Laboratory (NREL) Golden, CO 80401

Biography

Dr. Nozik has established a leading position in the interdisciplinary fields of photoelectrochemistry, semiconductor-molecule interfaces, quantum size effects and electron relaxation dynamics in semiconductor quantum wells, quantum dots, quantum wires, and nanostructures, and applications of this science to solar photon conversion technologies. He has published over 270 peer reviewed papers, proceedings, and book chapters in these fields and in the related fields of photocatalysis, heterogeneous catalysis, the optical, magnetic and electrical properties of solids, and Mossbauer spectroscopy, and has presented > 380 invited talks. He has led a large group of scientists engaged in basic and applied research on the direct photoconversion of light into chemicals, fuels and electricity, and on the optical and electronic properties and applications of nanostructures. Dr. Nozik has been awarded 11 U.S. patents and has received many honors and awards

Distal functionalization via transition metal catalysis

The ubiquitous presence of sp^3 C–H bonds in natural feedstock makes them inexpensive, easily accessible, and attractive synthons for the preparation of common and/or complex molecular frameworks in biologically active natural products, pharmaceutics, agrochemicals, and materials. However, the inertness of these bonds due to the high bond dissociation energies and low polarity difference between the carbon and hydrogen atoms makes them challenging reaction partners. Moreover, the desired site-selectivity is often an issue in reactions with multiple analogous sp^3 C–H bonds. To overcome these problems, transition metal-catalyzed C–H functionalization has been developed with the assistance of various well-designed directing groups which can coordinate to a metal center to deliver it on a targeted C–H bond through an appropriate spatial arrangement, enabling C–H activation via the formation of a cyclometalated species. However, the requirement of often additional steps for the construction of the directing groups and their subsequent removal after the desired operation severely hampers the efficacy and compatibility of the reactions. A promising solution would be the utilization of a transient ligand which can bind to the substrate and coordinate to the metal center in a reversible fashion. In this way, the directing group is installed, sp^3 C–H functionalization occurs, and the directing group is then removed in situ without affecting the substrate function after the catalysis is finished. Overall, the whole process occurs in a single reaction pot. Herein, we are presenting our studies on transition metal-catalyzed transient directing group-enabled C–H functionalization reaction.

Audience Take Away Notes

- This study could potentially be used for others to build small molecules in an efficient way
- This study could potentially be used for others to carry out late-stage functionalization of natural products or drug molecules
- This research could also be used by others to expand their research

Haibo Ge

Department of Chemistry & Biochemistry, Texas Tech University, Lubbock, TX, United States of America

Biography

Haibo Ge received his PhD degree in Medicinal Chemistry from The University of Kansas in 2006, and then moved to The Scripps Research Institute for Postdoctoral Study. In 2009, he began his independent academic career at the Indiana University – Purdue University Indianapolis and relocated to Texas Tech University in 2020. Research by his group is mainly focused on the development of novel methods for carbon–carbon and carbon–heteroatom bond formation through transition metal catalyzed C–H functionalization.

BOOK OF ABSTRACTS

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DAY 02

SPEAKERS

JOINT EVENT ON

OIL, GAS AND PETROLEUM ENGINEERING & CATALYSIS, CHEMICAL ENGINEERING AND TECHNOLOGY

Mohamed A Morsy[1,2]*, Muhammad Kamran[1], Tarek A Kandiel[1,2]

[1]Department of Chemistry, King Fahd University of Petroleum and Minerals (KFUPM), Dhahran, Saudi Arabia

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An innovative magnetic resonance spectroscopic method for catalysts' activities

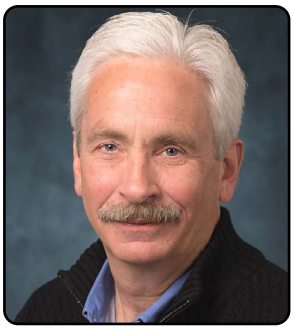
The photocatalytic activity of TiO_2 nanoparticles in aqueous solutions is commonly evaluated by monitoring the rate of Methylene Blue (MB) bleaching and phenols degradation, but both substrates suffer from many drawbacks, e.g. the high capacity of dark adsorption, self-degradation, and photosensitization. Besides, filtration is always required to separate the particulate photocatalyst before the analysis. Herein, we investigated the potential use of Electron Paramagnetic Resonance (EPR) and 4-hydroxy-2,2,6,6- Tetramethylpiperidine-N-Oxyl (TEMPOL) to directly monitor the photocatalytic activity of different types of TiO_2 suspensions without the need for filtration. TEMPOL does not absorb UV-A and visible light, and thus the photosensitization problem associated with the MB-dyes and phenolic compounds is readily overcome. The dark adsorption results indicated that the adsorption of TEMPOL on TiO_2 is negligible. Unlike MB dye, the TEMPOL can be directly used without spending a long-time establishing adsorption equilibrium before the photocatalytic test. The mechanisms of TEMPOL deactivation, in the presence and absence of oxygen (electron acceptors) as well as in the presence of methanol (•OH radicals' scavenger) have been discussed. Moreover, the photocatalytic deactivation products have been analysed using EPR data simulation, 1H-NMR, and 13C-NMR spectroscopies. Finally, TEMPOL deactivation over different types of TiO_2 photocatalysts evincing that the proposed method has a potential for direct monitoring of the activities of photocatalyst suspensions.

Audience Take Away Notes

- By monitoring TEMPOL-EPR signal decay, the rate of the photocatalytic reaction can be instantly examined without the need for the filtration of the photocatalyst particles
- A direct semi-automated EPR-photocatalytic setup could be developed to examine the photocatalytic activity of different catalysts' suspensions relative to Degussa P25-TiO_2 photocatalyst as a reference
- In addition to the kinetic exploration of the reactive oxygen species (ROS's), the EPR could be used to detect a trapped ROS, such as •OH radicals, using 5,5-dimethyl-1-pyrroline N-oxide (DMPO) as a conventional spin trapping agent
- The unavailability of the EPR machine in some labs (e.g. SpinScan X of Linev Systems, of a price comparable to a UV-Vis spectrometer) might limit the widespread use of this method

Biography

Dr. Morsy studied Chemistry at Alexandria University, Egypt, and graduated with an MS in 1987. He joined the research group of Prof. Jimmy Hwang (his Ph.D. from UCLA) at KFUPM, Saudi Arabia, and received his Ph.D. degree in 1993. As a first honor of his class, Dr. Morsy obtained the position of Assistant Professor at KFUPM in the same year and continued his never-ending efforts at KFUPM up to a Physical Chemistry Professor position. His research interest in the mechanistic chemistry of chemicals, photo, and electrochemical oxidation reaction systems, which were characterized mostly by EPR, graduated more than 30 Ph.D./M.S. students, and produced 7 US patents and more than 100 journal publications.



Richard Coffin[1]*, Ph.D., Ingo Pecher[1], Ph.D., Maria Vasilyeva[2], Ph.D.

Department of Environmental Engineering, Engineering Faculty, Dokuz Eylul University, İzmir Turkey

Data required for thorough assessment of oil/gas loading or CO_2 storage monitoring

Through world, coastal oceans there have been extensive surveys with the application of seismic data to predict deep sediment gas hydrate loading. Over the past 10 years comparisons of seismic data and geochemistry show there is a need to combine these data for a more thorough understanding of the deep sediment gas hydrate loading. Initial observations in predicting hydrate presence with integration of seismic and geochemistry data off the mid Chilean margin suggested gas hydrate loading could be greater at a location where seismic data showed moderate gas blanking. On the Atwater Valley in the Gulf of Mexico geochemical assessment showed a region with a strong vertical rise in the BSR to be a site where gas hydrate are likely not stable as a result of salt diapir intrusions creating gas hydrate instability and higher vertical methane advection. Here we present a series of data along the eastern coast of New Zealand that include seismic profiles, geochemistry, controlled source electromagnetics, and heat flow to assess gas hydrate loading. This comparison of locations shows remarkable inconsistencies in the data sets applied to gas hydrate predictions.

Further assessment is provided with a comparison across a focus area off the coast of New Zealand that shows strong variations through comparisons of geophysical and geochemical data. The Porangahau Ridge in the Hikurangi Margin where geochemical profiles focusing anaerobic methane oxidation display moderate vertical gas migration in a region that strong seismic reflection, active heat flow, and controlled source electromagnetic data suggest deep gas hydrate loading and active fluid and gas advection. Mahia Peninsula, located further south from the Porangahau Ridge show strong similarity in geochemical and seismic data for assessment vertical methane fluxes in two different transects. However, porewater geochemical data from these transects compared to a location where seismic data indicates no gas hydrate loading are similar. Chatham Rise, a region where published seismic data was believed to contain gas hydrate loading was found to have a total absence of vertical methane migration. In this location, radiocarbon data of shallow sediment carbonate and organic carbon suggest a potential for carbon dioxide migration.

Finally, this approach applied to oil and gas assessment does provide a thorough capability to evaluate offshore deep sediment CO_2 storage. This presentation will include current planning of through monitoring the fate of stored CO_2 with the same data based used to assess the oil and gas loading.

Audience Take Away Notes

- Understanding sediment oil and gas loading requires integration of geochemistry and geophysics
- Our approach provides more thorough evaluation of different ecosystems for oil and gas mining or CO_2 storage
- This approach provides new ideas for planning offshore fieldwork and needs to be integrated in teaching as well as planning

Biography

Richard B. Coffin is an isotope geochemist working offshore on a broad range of sediment topics. Oceanographic research has been conducted through positions at the US EPA Gulf Breeze-Florida, Naval Research Laboratory Washington DC and currently, Texas A&M University Corpus Christi where he works as a Full Professor and Chair for the Department of Physical and Environmental Sciences. Oceanographic research has been conducted off 5 continents and in 4 oceans. Results of this research is presented in over 180 published papers.

Nouh Al Naabi*, Dhiyab Mahrezi
Thermal C&A Specialist, Petroleum Development Oman, Muscat, Muscat, Oman

Operation and production critical valves digitalization “emergency showdown valves digitalization journey in oil south fields in oman for safer and higher ultimate production”

In a steam-flooded field in Oman, Emergency Showdown Valves (ESDs) are used in all facilities (station, off-plot, and steam generators) as safeguarding. ESDs are safety critical element that play strong role as safety barrier to ensure safe facility in production and HSE, also to avoid process safety incidents.

The journey started to digitalize these critical valves and link it to current interfaces where production operators, discipline engineers can view them. Different platforms were used for this project such as Nibras (in-house tool developed by PDO for smart operation).

In additions and with compliances to existing procedures and specification, this system helps the frontline operators and engineers to check the ESDs status and healthiness before initiating facility start-up in quick overview.

Different methods used to mature this project and execute it with all system interfaces. An accelerated lean approach known as LEAN project was followed. it is a structured framework to understand the causes of a sudden behavior change in a defined step within a process. The analysis included outlining the “SIPOC”, i.e., defining the Suppliers, Inputs, Process, Outputs, Customers of this matter, a detailed process mapping, fishbone analysis, the 5-whys, etc. The LEAN project findings were piloted on a selected valves from different process where configured and to give life report to DCS.

Also, this project involved execution of interfaces platforms to update and view the data live with zero reported issues. These interfaces ease the work from maintenance team to run all critical valves checks (e.g., update detect configuration of the valves traveling time and compare it with the design limit as per the performance standards) and log them into the dashboard for view.

NIBRAS dashboard was created to show live valves status for frontline operators and discipline engineers. This dashboard shows the list of the critical valves with all their details such as valves tag, Size, function location, valve status and the open/close timing.

This system also includes other functions such as a calculation block to calculate the traveling time to open and close and log it electronically in the dashboard. The calculation block in DCS detects the process signal and feedback between the DCS and valves.

As an outcome of this project, several observations were observed and overcome for sustainable solution. Examples of these observations:

- Impact of Power-dip that can impact the calculation blook.
- Impact of incorrect valves feedback.

These observations and many others had been solved using this system and confirmed operationally that the frontline operators received high accurate valves status and traveling time during all operation modes.

As a sustainability solution and for continuous improvement, a weekly check for dashboard is mandated by the instrument maintenance focal point and compare the ESDs function test with the dashboard feedback. Also, monthly update is initiated on these critical valves as Visual Management Board (VMB).

Audience Take Away Notes

- Out of box solution developed within PDO resulted in high gain with less CAPEX
- They can get best of it for replication as applicable
- This research that other faculty could use to expand their research or teaching
- As this been implemented in one of the facility and shows the value
- It improve the accuracy of a design, or provide new information to assist in a design problem

Biography

8 years' experience in oil & Gas. Wide experience in Control and Automation Engineering covering concept, engineering, commissioning, and operation including Thermal Operation. 5 years' Experience in Thermal Process covering operation of steam generators (OTSGs, HRSGs) & looking after production & steam system optimization. In addition, he obtained a certification in lean approach methodologies and running lean projects. Approved HSE assessor and technical competency assessment. He obtained several recognitions with company for developing sustainable system for critical valves digitalization. Graduated from Sultan Qaboos University (bachelor's degree in electrical engineering) in 2014.

Dhiyab Al Mahrezi[1]*, Mohammed Al Fazari[2]

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[2]Thermal Production Operation, Petroleum Development Oman, Muscat, Muscat, Oman

Aquifer Pump Off (APO) meter improvement for higher ultimate recovery: An applications of lean approach methodology in a south oil field in Oman

In a steam-flooded field in Oman, APO wells are drilled to reduce the influx of cold aquifer water into the reservoir and lower its pressure. The water is softened and used as Boiler feed water.

In 2021, APO meters reported a major deviation in meter reading from their design limit due to unknown deposit; resulting in an increase in Corrective Maintenance jobs, oil regrets in missing offtake target and pressure drop for steam-chest development.

To diagnose the root cause of the meter faulty reading and reduce its deviation from the observed (12%) to design limit of (5%); an accelerated lean approach known as Practical Problem Solving (PPS) was followed. This is a structured framework to understand the causes of a sudden behavior change in a defined step within a process. The analysis included outlining the “SIPOC”, i.e. defining the Suppliers, Inputs, Process, Outputs, Customers of this matter, a Detailed Process Mapping, fishbone analysis, the 5-whys, etc. The PPS findings were piloted on a selected well where Innovative technologies were used to verify the meters.

As part of the PPS countermeasures, several analyses have been taken to define the source of the deposits in the flowmeter internal surfaces:

- Sulphate-Reduced Bacteria analysis (SRB): Found zero. No sign of bacteria in the water.
- Oil In Water analysis (OIW): Found zero. No schmoo generation.
- Solubility test of solid sample: Found no traces of oil.
- Corrosion Rate Hydro-core Analysis: Found corrosion rate at 0.8 mm/year

With the absence of Schmoo formation, It was confirmed the reservoir formation was the source of the Sulphide. The iron was inspected in corrosion products. Thus, the Iron Sulphide formation led to the Prob blocking. Several solutions were taken:

Short-term solution: Corrective maintenance crew deployed for frequent cleaning leading to a deviation reduction of 7% and using a portable clamp on meter to further verify the meter reading.

Long term solution: Facility Improvement Proposal (FIP) put in place to upgrade the material selection and avoid the Iron Sulphide deposition in water. Replace any defected magnetic flowmeter by a permanent clamp on meter.

To sustain the PPS results and findings: Visual Management Board (VMB) and Standard Operating Procedure (SOP) lean tools, were put in place for proactive follow-up and attendance.

Achieving more reliable APO meter reading resulted in more accurate flow allocation, hence better reservoir management. The PPS lean approach enabled the analysis to be effective and concise within a timely manner utilizing in-house resources. This is in line with field's reservoir & facility management (WRFM) strategy.

Audience Take Away Notes

- Out of box solution developed within PDO resulted in high gain with less CAPEX
- They can get best of it for replication as applicable
- This research that other faculty could use to expand their research or teaching
- This issue can be avoided if it is considered during design
- It improve the accuracy of a design, or provide new information to assist in a design problem
- List all other benefits
    - Invistigate the possiple reasons that may cause the problem instead of replacing the instrument with similar material
    - Select the best instrument for different processes

Biography

Dhiyab Al Mahrezi as a 7.5 years' experience in oil & Gas. Wide experience in Control and Automation with Electrical Engineering background covering instrument, SCADA, and operation including Thermal Operation. 2 years' Experience in SCADA and Production Measurement. 3 years experience in C&A maintenance and operation. Graduated from Sultan Qaboos University (bachelor degree on Electrical and computer Engineering) on 2015 and joined PDO as C&A Operation.

Hamza Medjadji[1], Nassima Salhi[1,2]*, Maroua Benlembarek[2], Ali Boulahouache[1,2], Mohamed Trari[3]

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[3]Laboratoire de Stockage et valorization de l'energie renouvelable, Faculte de Chimie, USTHB, BP32, El-Alia, 16111 Bab Ezzouar, Alger, Algerie

$CoFe_2O_4/LaAlO_3$ heterojunction for efficient photocatalytic hydrogen evolution

Due to its undeniable importance, hydrogen is receiving increasing attention as a clean energy carrier for transportation and stationary energy applications. Over the past few decades, photocatalytic hydrogen production has emerged as a promising approach and has attracted much interest. One of the most promising approaches to avoid charge recombination and extend the light response range of a single photocatalyst is the construction of a heterojunction system. In the present work, the reactivity of the $CoFe_2O_4/LaAlO_3$ heterojunction system was studied by testing the photocatalytic activity under visible light irradiation. The heterojunction material was prepared via a simple mechanical mixing strategy and characterized using various techniques including: TGA analysis, X-ray diffraction, FTIR spectroscopy, UV-visible microscopy and scanning electron microscopy. The spinel $CoFe_2O_4$ spinel and perovskite $LaAlO_3$ materials were previously prepared via nitrate route and sol gel methods respectively.

Photocatalytic tests were carried out in a Pyrex reactor with temperature controlled at 50 ± 1°C by a circulating water bath (Polystat-Fisher). A solution of 100 mg of $CoFe_2O_4/LaAlO_3$ dispersed in 100 mL of electrolyte solution (0.033 M Na_2SO_4) was prepared by magnetic stirring to avoid vortex phenomenon. The solution was then subjected to N_2 gas bubbles under continuous stirring. For illumination, three LED lamps were used as light source. The volume of H_2 generated during the reaction was measured using a water manometer.

The material showed a higher photocatalytic H_2 production of 82.6 µmol min-1 under visible light irradiation without any co-catalyst in Na_2SO_3 solution.

The excellent activity is attributed to the Z-charge transfer pathway between $CoFe_2O_4$ and $LaAlO_3$, which effectively limits charge recombination and maintains a higher redox capacity of electrons and holes.

Audience Take Away Notes

- New research findings, best practices and strategies related to hydrogen production via green process and the principles of photocatalytic process
- The potential of this approach to reduce greenhouse gas emissions and contribute to a more sustainable energy future
- The advantages and limitations of using photocatalysis for hydrogen production compared to other methods such as electrolysis and steam methane reformation (industrial process)
- The efficiency of the photocatalytic process, the purity of the hydrogen produced and the possibility of using this process for commercial purposes
- To offer the attendees valuable information, insights that they could use to enhance their own knowledge, teaching and skills

Biography

Dr. Nassima SALHI has thirty years of experience teaching and research. She received her Ph.D. (2006) degree at the University of Sciences and Technology Houari Boumedienne (USTHB) (Algeria). She has 30 years of experience both in teaching and research in the chemistry area. She starts her research at the natural gas conversion laboratory and then joined the LCPMM laboratory at Blida 1 University in 2019. Her research interests are focused on homogenous and heterogenous catalysis, materials, nanoparticles organic synthesis, organometallic catalysis, natural gas conversion, green hydrogen production, photocatalysis for hydrogen production and spectroscopic analysis methods.

Mostafa Ahmed Sobhy
American University in Cairo, Egypt

A review on clay reactivity with brine and its impact on fluid flow through porous media

This study examines the effect of various common and main parameters on the reactivity between clay and brine, focusing on fine migration, fine flocculation, swelling, and wettability alteration. This study examines the reactivity between clay and brine and its implications, with a specific focus on highlighting the key parameters that influence this reaction. While the investigation aims to provide an overview of the main parameters affecting clay/brine reactivity, it acknowledges that not all aspects of the reaction for each parameter will be fully covered.

Considered parameters include salt concentration, salt type, acidity/alkalinity, clay type, clay concentration, temperature, flow rate and oil presence. The impact of these parameters on clay fine migration is investigated, as is their influence on fluid flow through porous media.

In addition, the effect of salt concentration, salt type, acidity/alkalinity, clay type, temperature, and pressure on clay swelling is analyzed, as well as the resulting effects on fluid flow.

Furthermore, effects of salt concentration, salt type, acidity/alkalinity, oil type, clay type, clay concentration, pressure and temperature on the wettability alteration are investigated, as well as the implications on fluid flow. This research offers a brief comprehension of the effects on fluid flow in porous media, which is crucial to the oil and gas industry, regarding the complex interactions between clay, brine, under various conditions.

Audience Take Away Notes

- The audience should be able to choose the appropriate brine composition used in waterflooding operations of clay bearing formations to avoid potential formation damage and increase the oil recovery
- The audience should be able to understand the effect of clay/brine reactivity on fine migration and its impact on fluid flow through porous media and on oil recovery
- The audience should be able to analyze the effect of clay/brine reactivity on clay swelling and its impact on fluid flow through porous media
- The audience should be able to investigate the effect of clay/brine reactivity on wettability alteration and its impact on fluid flow through porous media
- The audience should be able to understand the contribution of different parameters on the clay/brine reaction rate and the resultant of that reaction
- This will help reservoir engineers in developing a better design for the brine being used in waterflooding operations of clay bearing formations by understanding the mechanism of reaction between the brine and clay and its impact on fluid flow through media and eventually oil recovery
- It will allow the reservoir engineers to avoid potential formation damages that could be triggered by choosing a poor design of the brine composition used in waterflooding operations
- It highlights the benefit of mixed-wet fine migration showing that it could be beneficial from the standpoint of increasing the ultimate oil recovery

- Yes, this research will help other faculties to expand their research and teaching. There are many research groups that are interested in the topic of waterflooding with different brine salinities such as LowSal. Hence, this research will be very beneficial in understanding how the salinity of different brines affects the clay stability and fluid flow through porous media along with other parameters included in the research
- This research also could be used as an excellent material in any reservoir engineering course at any university
- It provides a practical solution for producing from reservoirs with clay bearing zones using waterflooding as a secondary recovery technique. As it gives the designer the option to choose the proper brine composition in waterflooding operations depending on the amount and type of clay in the formation
- This research allows the designer to avoid the common pitfalls and misunderstandings associated with clay/brine reactivity
- It allows the designer to maximize the gain from the waterflooding operation by adjusting the parameters that favors the results that he is seeking from the operation
- It will help to improve the accuracy of water flooding projects significantly
- This research is the first one to combine all the aspects of brine and clay reactivity on fluid flow through porous media as in the past the clay brine reactivity was mainly viewed from the point of formation damage due to swelling
- That isn't the only case, and it has come to our knowledge that fine migration of mixed-wet clays could be beneficial in increase the ultimate oil recovery
- **List all other benefits**
    - This research could be used as a general guideline and a review for clay/brine reactivity and the impact of several parameters on that reaction
    - This research is very good in describing the basic and simple physics that is responsible for such reactions which gives the engineer the fundamentals behind certain phenomena
    - This research opens the door for future quantification of the combined effect of fine migration, clay swelling and wettability alteration on fluid flow through porous media and ultimate oil recovered

Biography

Eng. Mostafa Sobhy studied Petroleum Exploration and Production Engineering at Suez University, Arab Republic of Egypt, and graduated with a BS in 2018. He then joined The American University in Cairo, Arab Republic of Egypt, as a Teaching Assistant in Petroleum Engineering Department in 2018. After a while he became Production Technologist at Qarun Petroleum Company, Arab Republic of Egypt, in 2020. In the same year, he started pursuing his MS in Petroleum Engineering at The American University in Cairo. Eng. Mostafa started his current position as a Drilling Engineer in 2022 at The North Bahariya Petroleum Company, Arab Republic of Egypt.

Saad Alarjani
Gas Producing Department, Aramco/ Hofuf, Eastern Province, Saudi Arabia

Self-Regulating corrosion inhibitors for gas wells: A technological breakthrough

This abstract presents a technological breakthrough in the form of self-regulating corrosion inhibitors for gas wells. These inhibitors utilize advanced chemical and material engineering techniques to combat corrosion, aiming to improve operational efficiency and extend equipment lifespan. The main objective is to address corrosion challenges in gas wells and provide a sustainable solution. The self-regulating inhibitors incorporate real-time monitoring and adjustment capabilities, adapting to changing conditions. Highlights include their ability to optimize corrosion protection in varying temperatures, pressures, and corrosive environments. This adaptability improves efficiency, reduces chemical waste, and enhances equipment protection. Implemented using advanced materials, chemical engineering, and monitoring technologies, the inhibitors offer scalability and versatility for seamless integration into gas well operations. Additionally, the technology tackles critical industry concerns, including reducing downtime, optimizing costs, and minimizing environmental impact. By effectively managing corrosion, it provides long-term economic and environmental benefits. To conclude, the introduction of self-regulating corrosion inhibitors revolutionizes corrosion control in gas wells. Through adaptive mechanisms and real-time monitoring, this innovation enhances performance, extends lifespan, and improves operational efficiency.

Audience Take Away Notes

- Explore the new technology for automated chemical injection
- Audience will be able to understand how this new technology will enhance operational efficiency
- The Interpretation of binding energies in photocatalytic systems

Biography

Saad Alarjani is an innovative problem-solver and decision-maker with strong interpersonal and communications skills. He is a mechanical engineer, who graduated with an honorary degree from King Faisal University. Besides his industrial experience, Saad was involved in academic activities such as research and tutoring experience in the thermo fluids area in ABET Accredited institution. Moreover, he got certified as a Maintenance and Reliability Professional by ANSI and SMRP. He joined Saudi Aramco back in 2021 as an operations engineer, mainly in the gas-producing field. As an operations engineer, his main responsibility is to provide the required engineering support to ensure the day-to-day activities are performed effectively, efficiently, and safely.

Bismark Tsatsu Kofi Agbezudor
Quality Assurance Department, Duraplast Limited, Accra-Ghana
Projects, DAS Biogas & Construction Limited, Kumasi, Ghana

Waste, a resource rather than unwanted and unusable commodity

Waste is not Waste, but a resource at the wrong place. Renewable energy sources have become an essential commodity since the beginning of modern human civilization. Renewable energy sources such as biomass or biogas have been used mostly in heating and cooking to support traditional means of energy sources all across the world. Ghana's energy sources are mainly dominated by hydro generation and thermal generation fuelled by crude oil, natural gas and diesel. According to the Energy Commission of Ghana, as at 2021 Ghana has a total installed capacity of 5,134 Megawatts (MW) of electric power. Thermal generation accounts for 66% of energy need in Ghana, whiles hydro energy accounts for 33% of the Ghana's energy mix. Total electricity access rate in Ghana stands at 86.63% as at end of 2021 according to Ghana's Energy Commission. Obviously, the burden on the environment (air pollution) and economic impact of these means of energy generation calls for alternative means of energy generation for Ghana and Africa at large. Biogas energy is one of the most sustainable and environmentally acceptable alternative means of renewable energy sources Ghana and the rest of Africa can take advantage of. Biogas generated through onsite sewage treatment plants which uses natural means to turn faecal matter or food waste into energy and clear- odourless recycled water for reuse (landscaping, washing of vehicles, flushing of toilet or further treated for drinking purposes). Our Biogas Sewage treatment plants (Biogas STP's) are gravity-based systems that uses natural processes to treat sewage underground without chemicals, electricity, or mechanical parts. The system however requires minimal maintenance through little human interventions. The biogas STP is developed to ensure reduced carbon emissions, conserves water, saves cost of maintenance and operation and requires only small space for installation. The Biogas STP systems are ideal for apartment buildings, schools, private homes, hospitals, hotels, estate, public toilet, offices, factories etc. There are enormous potentials in biogas energy sources in Ghana to help reduce the country's dependency on wood fuel and fossil fuels which has the ability to reduce the country's overall greenhouse gas emissions thereby directly leading to combat climate change. Ghana is expected to possess the technical ability to develop at least 278,000 biogas plants to generate biogas energy sources. However, only about 100 biogas plants has so far been developed according to anecdotal sources. It is our hope and strategic objective that Duraplast Limited in collaboration with DAS Biogas STP technology helps breach this gap by accelerating the provision of easy to reach and affordable biogas technology to the remaining 13% of Ghanaians without any source of generated traditional power.

Audience Take Away Notes

- Ability of audience to understand and appreciate prospects of the biogas technology development and business opportunities it presents to would be investors
- My presentation will also assist participants to see new perspectives of developing and harnessing biogas technologies in developing counties
- Other researchers can build on this research and conduct more detailed research biogas technology in Africa
- My presentation shall comprise of pictural displace of actual systems developed for various categories of users

- My presentation shall also comprise of precise system specifications that will assist in determining design accuracy
- Presentation shall also throw more light on the African story and our quest to breach the energy gap

Biography

Bismark Tsatsu K. Agbezudor studied Health Services Administration at the University of Ghana, Legon- Ghana and graduated as MBA holder in 2016. He joined Duraplast Limited in 2015 as the systems manager in charge of quality and also the Management representative responsible for maintaining operational quality system processes. He is currently the head of the Quality Assurance Department. He was later made to oversee the company's research and development outfit to coordinate design and development activities. In 2019 he was directed by management to oversee the development of sewage treatment systems such as DST systems and Biogas systems. He has worked extensively and was part of one of the founding members of the Biogas Association of Ghana (BAG). He is currently coordinating with an indigenous designer/developer to replicate traditional brick biogas systems into Bio Digester plastic tank systems.

Arial S Thomas, Yingchun Li*

Department of Chemistry, Prairie View A&M University, Prairie View, Texas, United States

Photocatalysis for organic transformations under visible light

Green chemistry is attracting more attention and effort than ever before because it can provide sustainability of environments and energy from noncarbon-based fuels. Semiconductor photocatalysis has been under extensive study since the 1970s for many applications, especially in the reduction of carbon dioxide to fuel and the production of hydrogen gas by water splitting. The working principle of a photocatalyst is that irradiation of light onto a catalyst will excite an electron from the valence band to the conducting band and leave a hole (h+) and an extra electron (e-) in the corresponding band. The 'hole' will act as an oxidant and get itself refilled by getting an electron from a reductant; the 'extra electron' will act as a reductant and combine with an oxidant. The mechanistic principle can also be applied to organic redox reactions. Here is presented green chemistry in the reduction of azo and nitro groups in organic compounds based on photocatalysis. The semiconductor photocatalyst used in the reactions is graphitic carbon nitride (g-C_3N_4), which was prepared by pyrolysis of melamine at different temperatures. The reductions were carried out in an aqueous solution under visible light. Our experimental results revealed that the rate of reduction of azo compounds to amine is greatly enhanced. The photocatalytic activity of g-C_3N_4 in this reduction exhibited great dependence on the temperature at which the catalyst is prepared. The application of g-C_3N_4 as photocatalysts to nitro group reductions has also been explored. The experimental details and results will be presented. A plausible mechanism will be provided.

Biography

Yingchun Li graduated as a Ph.D. majoring in chemistry from the University of Houston in the year 2000. He has shown expertise in traditional organic synthesis, enzyme inhibitor design and activity assessment, resolution of racemic mixture with enzymes. He is currently an assistant professor in the Department of Chemistry in Prairie View A&M University with research focused on mechanism-based development of photocatalysts for application to organic reactions.

Y Hurtado[1]*, E Lins de Barro[2], J M Lavoie[1]

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[2]Universidade Federal do Rio Grande do Norte, Natal, Rio Grande do Norte, Brasil

Biofuels Production Using Iron Foam as Structured Catalyst in Fischer-Tropsch Synthesis

Biomass to liquid process is a promising alternative to meet the growing demand for liquid fuels in a sustainable way, with this in mind the present study focuses on the fabrication, characterization, and performance of a structured iron catalyst to produce hydrocarbons through Fischer-Tropsch Synthesis (FTS). The catalyst was engineered to tackle some of the draw backs conventional supported catalyst, such as low catalyst utilization and poor activity and stability.

The experimental investigation involved the manufacturing of iron-based catalysts using the sponge replication method (powder metallurgy). The resulting structured catalyst reach a one-pass conversion of 85 % with 10 % selectivity to CH_4. The performance of the structured iron catalyst was assessed in a fixed-bed reactor under industrially relevant conditions. Notably, this result was reach with syngas ratio typical of gasification on lignocellulosic biomass where the catalyst exhibited superior catalytic activity and selectivity toward desired hydrocarbon products including light olefins and long-chain paraffins, compare to a precipitate catalyst for which conversion was 18%.

The results obtained indicate that the developed structured iron catalyst holds considerable potential for efficient and sustainable hydrocarbon production via Fischer-Tropsch synthesis. The catalyst's excellent performance, coupled with its improved stability and selectivity, offers promising prospects for its application in commercial-scale hydrocarbon synthesis processes.

Audience Take Away Notes

- **Catalyst Design and Development:** The study provides insights into the fabrication and characterization of a structured iron catalyst for biomass-to-liquid conversion. The audience can learn about the sponge replication method and its application in catalyst manufacturing. This knowledge can be utilized to design and develop similar structured catalysts tailored for specific reactions and feedstocks Think about the properties of the materials used in powder metallurgy not only in the context of mechanical characteristics, but also in terms of their chemical functionality and catalytic activity
- **Improved Catalyst Performance:** The research highlights the superior performance of the structured iron catalyst compared to conventional precipitate catalysts. The audience can understand the factors that contribute to enhanced catalytic activity, stability, and selectivity. This understanding can guide the development of more efficient catalysts for Fischer-Tropsch synthesis or other related processes. Find alternatives route to use and active phase (iron) that in conventional form (powder catalysts) has lower activity so it performs in a way that is comparable to is counter par
- **Sustainable Hydrocarbon Production:** The study emphasizes the potential of biomass-to-liquid conversion as a sustainable approach to meet the growing demand for liquid fuels. By learning about the successful application of the structured iron catalyst, the audience can explore and promote the use of biomass feedstocks, such as lignocellulosic biomass, in hydrocarbon synthesis. This knowledge can contribute to the development of environmentally friendly and renewable fuel production methods

- **Industrial Applications:** The performance evaluation of the catalyst was conducted under industrially relevant conditions. Therefore, the audience can extrapolate the findings and consider the practical implementation of the structured iron catalyst in commercial-scale hydrocarbon synthesis processes. The improved efficiency, stability, and selectivity demonstrated by the catalyst offer valuable insights for optimizing industrial processes and increasing productivity. The development and implementation of a structure catalyst aides the design of of a compact reactor unit to make syngas-to-liquids economically feasible at small scales
- **Catalyst Development and Optimization:** Researchers and catalyst designers can apply the knowledge gained from this study to develop and optimize catalysts for biomass-to-liquid conversion
- **Process Improvement and Efficiency:** Engineers and professionals working in industrial settings can utilize the insights from this study to improve the efficiency of their hydrocarbon synthesis processes. The information on the structured iron catalyst can guide them in modifying existing processes or implementing new catalyst systems to enhance productivity and reduce costs
- **Sustainability and Renewable Energy Focus:** Given the growing demand for sustainable and renewable energy solutions, professionals in the energy sector can leverage the study's emphasis on biomass-to-liquid conversion. By adopting the knowledge gained, they can contribute to the development of environmentally friendly fuel production methods, thereby aligning their job roles with the goals of sustainability and reducing carbon emissions
- **Research Expansion:** Other faculty members working in the field of catalysis, biomass conversion, or Fischer-Tropsch synthesis can build upon the findings of this research. They can use the knowledge and insights gained from the study to explore related research questions or investigate different aspects of catalyst design, performance evaluation, or process optimization. The study's methodology, experimental setup, and characterization techniques can serve as a reference for their own research endeavors
- **Teaching Material:** Faculty members can incorporate the findings of this research into their teaching material, particularly in courses related to catalysis, sustainable energy, or renewable fuels. The study provides a practical example of catalyst development, performance evaluation, and process optimization, which can be valuable for students to understand the real-world applications of these concepts. The research findings can be used as case studies, discussion topics, or examples in lectures, enhancing the learning experience for students
- **Collaborative Opportunities:** This research presents opportunities for collaboration among faculty members from different disciplines. For instance, faculty members specializing in materials science, chemical engineering, or environmental science can collaborate with those involved in biomass feedstock research or process engineering to explore interdisciplinary solutions. The study's results can act as a starting point for collaborative projects, where faculty members can combine their expertise and extend the research in new directions

Biography

Yira Hurtado is a chemical engineer graduate from the Faculty of Mines of Colombia National University. In 2017, she was awarded a grand in the COLCIENCIAS young researchers program. In 2018 she obtained a scholarship to carry out her master's studies in chemical engineering at the same university, and she graduated with a meritorious thesis in 2020. Her research experience is related to the synthesis, characterization, and utilization of nanoparticles for applications in the oil and gas industry with an emphasis on enhance oil recovery techniques. This time her focus is to produce liquid fuels from biomass.

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Valorization of the plant extracts in the synthesis of magnetic nanocatalysts

Background: This study describes the synthesis of an innovative nanomaterial composed of cobalt ferrite functionalized in niobium pentoxide $CoFe_2O_4@Nb_2O_5$ synthesized by green synthesis using tangerine peel extract. The material values the combination of a magnetic material (which allows easy recovery after application) with niobium pentoxide (whose metal is abundant in Brazilian territory).

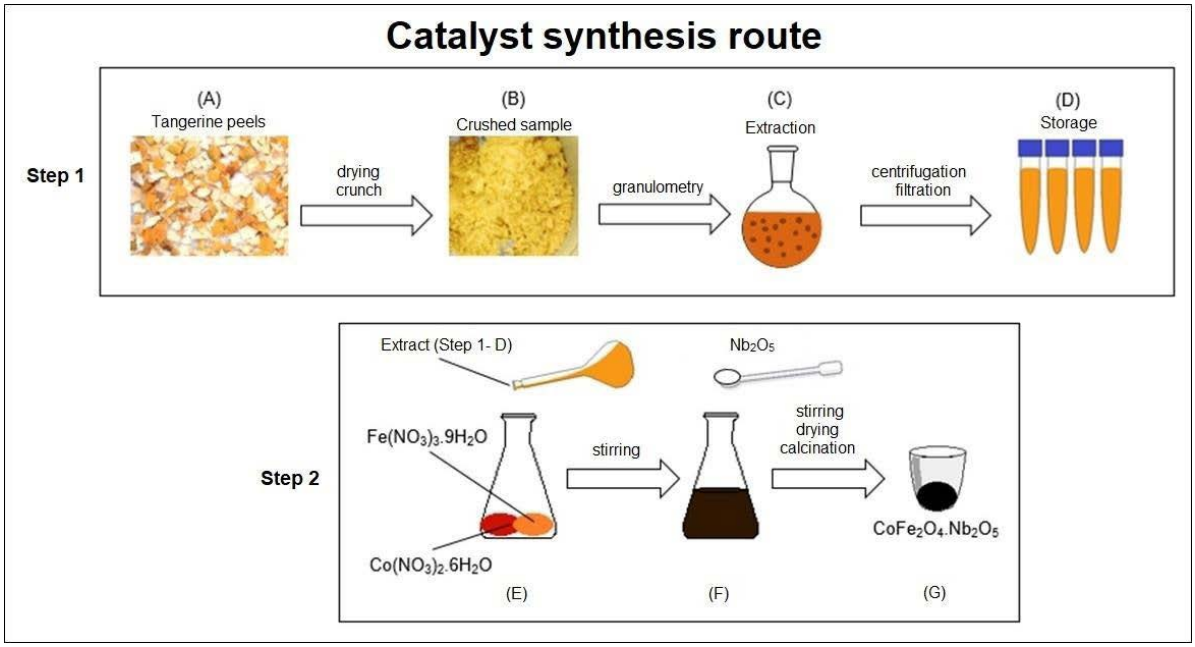
Methods: The first step to obtaining the catalyst is drying the tangerine peels in drying oven at 80°C for 18 h. Sequentially, the tangerine peels were crushed in an analytical mill and sieved. To obtain the tangerine peels extract the following methodology was optimized, using an analytical balance, 4.0 g of crushed tangerine peels were placed in a round-bottom flask with 100 mL of distilled water, which was placed under magnetic stirring at room temperature for 3 h. After, the temperature was increased to 60 °C for 1 h, the dispersion further centrifuged at 4000 rpm for 5 minutes, to separate the tangerine peels from the supernatant. Finally, the obtained extract solution was stored in a freezer until use, completing the first step, Figure 1.

On the second step, the cobalt ferrite functionalized catalysts in niobium pentoxide ($CoFe_2O_4@Nb_2O_5$) have been synthesized. The salts Fe^{3+} (11.4 mmol) and Co^{2+} (5.7 mmol) were weighted in a Erlenmeyer. After were added 25 mL of tangerine peels extract, the resultant solution showing immediately black color. The Erlenmeyer was stirred in the shaker at 200 rpm, 25°C for 15 minutes. So, niobium pentoxide was weighted and added in the Erlenmeyer and the mixture was stirred more 15 minutes under the same conditions. In sequence, the mixture was transferred to a porcelain crucible, which stayed in a drying oven for 4.5 hours at 100°C, until forming a gel. Finally, the porcelain crucible with the gel was placed in a calcination furnace with a heating ramp until 600°C. After calcination, the resulting material in the porcelain crucible is cobalt ferrite functionalized in niobium, CFNb ($CoFe_2O_4@Nb_2O_5$) Figure 1.

Contribution: Besides the magnetic properties, the type of synthesis created has several advantages over other types of synthesis already reported in literature. Among the advantages can be highlighted: Utilization of biomass, namely fruit peels; Extract production using only distilled water as a solvent and low temperatures; Incorporation of the niobium pentoxide support in the same stage of synthesis of cobalt ferrite; High support incorporation compared to other methods, without losing or decreasing the magnetic properties of cobalt ferrite; Added-value to a raw material abundant in Brazilian territory, Nb; Low cost synthesis, using common equipment of laboratory, and relatively low cost.

The nanomaterial in question is being optimized for the degradation of emerging pollutants (i.e. paracetamol, ibuprofen, salicylic acid), but preliminary tests indicated that the $CoFe_2O_4@Nb_5O_2$ nanocatalysts were efficient in the degradation of Paracetamol (up to 99% degradation), showing better results under conditions of pH 1.0, catalyst concentration 103 $mg.L^{-1}$, under irradiation of the 250 W mercury vapor lamp (greater than 28 mW /cm^2) at 240 minutes of the reaction.

Figure 1 - Route of $CoFe_2O_4$@Nb_5O_2 synthesis



Source: Own Authorship.

Audience Take Away Notes

- Other faculty could use this research to expand their research or teaching on synthesis of magnetic nanocatalysts
- This research offers a practical solution for recovering the nanocatalyst after use (with a magnet), allowing its reuse
- It is possible to obtain the material with few resources, allowing its reproducibility

Biography

Jessica studied Chemical Engineering at the Federal Technological University of Parana (UTFPR) and did a Double Degree at Polytechnic Institute of Braganca, Portugal, about Nanotechnology. She participated in the internship at the International Iberian Nanotechnology Laboratory (INL) and at the Institute of Experimental Physics (Slovak Academy of Science), perfecting some techniques with nanomaterials. She completed a Brazilian Masters at UTFPR, whose work resulted in the synthesis of an unprecedented nanomaterial which has intellectual protection through a patent. Currently, she is PhD student in Production Engineering, at UTFPR (Knowledge and Innovation Management), continuing to explore the versatility of the nanomaterial created.

Orlando Elguera Ysnaga

D.Sc. with Major in Analytical and Inorganic Chemistry- Universidade de São Paulo (Brazil)/ B.Sc. with Major in Chemical Engineering- Universidad Nacional de Ingenieria (Peru)

Review of research topics for scaling-up of sonochemical reactors (sono-reactors)

This study is aimed to review the topics of chemical engineering to take in consideration for the scaling-up of reactors, in order to perform processes based on the application of the sonochemistry at industrial level. Sonochemistry is an emergent technology, defined as chemistry made with ultrasound. The characteristic ultrasound frequencies are in the range of 1-10MHz, and in particular for sonochemistry in the sub-range 16-100 KHz. Chemical effects of ultrasound exist when there are changes in the pathways of reactions, yields and/or selectivities of the products due to the ultrasonic activation. At laboratory level, the sonochemistry has shown fantastic results, because it is based on the phenomenon of acoustic cavitation in liquids, thus, producing very high temperatures (some thousands of Kelvin degrees) and high pressures (some hundreds of atmospheres) during very short times (from tenths to hundreds of microseconds). Cavitation is the phenomenon with the most important effect for intensification of physical and chemical processing. Under these conditions, the yields of sonochemical reactions increase drastically, and their selectivities are improved, thus generating new mechanisms of reaction involving inorganic and organic syntheses. It is not easy to reproduce experimental results of quantification of sonochemical intensity, which is significant for the efficient scaling-up of sonochemical reactors (sono-reactors) for the progress of industrial applications of sonochemistry. This technology has application at industrial level for the treatment of waste-water and black-water. Sonochemistry can be considered as Green Chemistry, presenting the following advantages: low waste, low consumption of materials and energy with optimized use of non- renewable resources and use of renewable energies. Few studies were aimed about optimum design and scaling-up of sonochemical reactors. The implementation of sonochemistry at the industrial level will be feasible when the use of cavitational energy can be adequately controlled.

Audience Take Away Notes

- It is expected that this review can collaborate in the diffusion and development of this emergent technology, due to the advantages that possess:
  1. Enhancement of the yields of chemical reactions significantly
  2. Improvement of selectivities
  3. Generation of new reaction pathways
- This technology has applications at industrial level for the treatment of wastewater
- Sonochemistry can be considered as Green Chemistry

Biography

D.Sc./B.Sc. Orlando Elguera studied Chemical Engineering at the National University of Engineering (Lima-Peru) with Master's studies in Chemistry Sciences at the National University of Engineering (Lima-Peru), and with Doctorate of Science with Major in Analytical and Inorganic Chemistry at the University of São Paulo (São Paulo-Brazil). He performed as Analyst of the Laboratory of samples of Geochemical Exploration and Inorganic Compounds at SGS del Peru S.A.C (almost 5 years). He has experience in the following method of analysis: Atomic Absorption Spectrometry, Inductively Coupled Plasma Optical Emission- Mass Spectrometry and X-ray Fluorescence. He has published 9 research articles in journals.

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JOINT EVENT ON

OIL, GAS AND PETROLEUM ENGINEERING & CATALYSIS, CHEMICAL ENGINEERING AND TECHNOLOGY

Designing of nano-sized heterostructures for hydrogen production using overall water splitting

Multifunctional nanostructures find the possibility for their applications in water splitting processes for hydrogen generation as a renewable source of green energy. The studies of some multifunctional nanoparticles especially heterostructures by chemical synthesis reveal the formation of monophasic structures with fairly uniform distribution of nearly spherical particles, high specific surface area and visible optical band gap. Photocatalytic generation of hydrogen in water splitting process by using as-prepared doped and heterostructure nanoparticles has also been studied under the visible light irradiations which showed a significant H2 evolution reaction rate. The development of nanostructured catalysts has also been preferred to carry out the heterogeneous catalytic organic transformations because of greater number of surface-active sites for catalytic processes, high catalyst recovery rate, especially their environment friendly nature and their ease of synthesis. Herein, we also discuss some nanocatalysts for certain organic transformation reactions with enhanced activity as well as in water splitting reactions for hydrogen production.

Audience Take Away Notes

- Techniques to design heterostructured nanocatalysts
- What is water splitting and how experimentally used for Hydrogen production
- Chemistry of photocatalysis, electrocatalysis and photoelectrocatalysis
- What is the need of Hydrogen energy?
- Nanocatalysis for organic transformation

Tokeer Ahmad

Department of Chemistry, Jamia Millia Islamia, Jamia Nagar, New Delhi, India

Biography

Prof. Tokeer Ahmad graduated from IIT Roorkee and Ph.D. from IIT Delhi. Presently, he is full Professor at Department of Chemistry, Jamia Millia Islamia, New Delhi. Prof. Ahmad has supervised 10 PhD's, 77 postgraduates, 9 projects, published 139 research papers, one patent and two books with research citation of 4970, h-index of 43 and i10-index of 98. Prof. Ahmad is active reviewer of 120 journals, delivered 117 Invited talks and presented 126 conference papers. Prof. Ahmad has received DST-DFG award, SMC Bronze and ISCAS Medals, Inspired Teacher's President Award, Distinguished Scientist Award, Maulana Abul Kalam Azad Excellence Award of Education and elected as Member of National Academy of Sciences India. Prof. Ahmad has been figured in World Top 2% Scientists for consecutive three years in both coveted lists including career long by Stanford University, USA.

Failure mechanism of cement sheath interface integrity under severe alternating temperature

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The wellbore integrity is threatened by severe alternating temperature and pressure in ultra-deep wells, leading the failure of cement sheath, such as deformation, damage, leakage, and interface debonding, which seriously threatens wellbore safety and greatly reduces the safe service life of ultra-deep wells. Hence, based on typical well structure in some ultra-deep wells, the interface integrity testing of cement sheath under severe alternating temperature has been conducted by using self-developed full-scale "production casing-cement sheath-technical casing" system experiment device. The interface mechanical behavior for cement sheath has been investigated and the cycle numbers required for interface debonding and disappearing of interaction between casing and cement sheath (The shearing force, chemical bonding force, friction force, shearing strength and bonding strength is all equal to 0) under thermal cycling have been obtained. The decay mechanism for interface mechanical of cement sheath under severe alternating temperature have been clarified. The results show that the temperature and thermal cycling have significant negative effects on the cement sheath interface integrity, which poses a serious threat to wellbore integrity. The alternating temperature first destroys the chemical bonding between the casing and cement sheath interface, causing the decrease of chemical bonding force and shearing force before interface debonding. When the chemical bonding force decreases to 0, interface debonding occurs and micro-annulus generates. The micro-annulus will increase with the increase of alternating number after interface debonding, which cause the decrease of friction force and shearing force. The interface debonding for ordinary cement sheath occurs after 3rd alternating at 150℃, 1st alternating at 200℃, 1st alternating at 250℃, respectively, which is similarly for tough cement sheath after 6th alternating at 150℃, 1st alternating at 200℃, 1st alternating at 250℃, respectively. The interaction between casing and ordinary cement sheath completely disappears after 10th alternating at 150℃, 4th alternating at 200℃, 2nd alternating at 250℃, respectively, which is similarly for tough cement sheath after 16th alternating at 150℃, 7th alternating at 200℃, 3rd alternating at 250℃, respectively. The research results can provide a new method and concept for the optimization design of wellbore integrity and cement sheath integrity in deep wells and ultra-deep wells.

Audience Take Away Notes

- A method for the integrity testing of cement sheath interface under ultra-high temperature thermal cycling is proposed
- This could benefit to clarify the interface failure mechanism of cement sheath under severe alternating temperature
- This could contribute to broaden the cognition of the boundary for

Biography

Yuanhua Lin, the professor and doctoral supervisor, is the deputy director of CNPC Key Laboratory of Petroleum Pipe Engineering, the researcher of the State Key Laboratory of "Oil and Gas Reservoir Geology and Development Engineering", and the head of the Team leader of young scientific and technological innovation research in Sichuan Province. He mainly engages in research on oil and gas well construction engineering, oil well tubing mechanics and corrosion prevention, wellbore integrity management, and other related fields. He has published more than 120 research articles in SCI journals and obtained more than 60 national patents.

wellhead movement and enrich the wellbore integrity theory, and more benefit to investigate the control and prediction method of wellhead movement and wellbore integrity

- This could contribute to establish the indicator system for the evaluation of cement sheath integrity under severe alternating temperature and propose the recommended practices for maintaining the long-term integrity of cement sheath in ultra-deep wells
- The research results can provide a new method and concept for the optimization design of wellbore integrity and cement sheath integrity in deep wells and ultra-deep wells

Nanocatalysts used for biofuel production

The demand for renewable and alternative types of energy has taken a new dimension; the primary reason is traceable to the climate change effects that fossil-based fuels have in the earth atmosphere. Bioenergy is one of the many arrays of renewable forms of energy that have taken centre stage in replacing the conventional fossil-based energy sources. Biofuel is the liquid or gaseous fuel derived from biological processes such as agriculture (biomass) or anaerobic digestion (solid or liquid wastes) or a combination of both, rather than geological processes that are known with the traditional fossil-based counterparts. Biomass energy is readily available and environmentally friendly, because it does not lead to a net increase in carbon dioxide levels and produces low amounts of sulphur. An effective implementation of biomass in the current energy scheme would involve the development of new technologies for the large-scale production of biofuel. The two primary methods for converting biomass to biofuels are thermochemical and biochemical processes. Thermochemical biofuels are getting much more attention lately as these biofuels offer several technical and strategic advantages, such as highly developed industrial infrastructure and the biofuels can be produced from virtually all sorts of available biomass in a reasonable timeframe without significant modification in the overall process. At lower reaction temperatures, thermal processing of biomass with catalytic methods offers the possibility of selectively yielding a narrow range of products and reducing the energy requirements of the transformations. In terms of catalysts used, for biodiesel production, heterogeneous catalysts in comparison to homogeneous catalysts provide more effective separation steps for products and catalysts, eliminate quenching process, and offer conditions for the continuous production process. The objective of this review is to discuss the trends, recent advances in heterogeneous catalysts and expected contribution to knowledge, specifically in nanocatalysts for biofuel production, such as metal oxide catalysts (e.g. ZnO), metal supported by metal oxide catalysts (e.g. Au–ZnO), Alloy (e.g. Cu–Co), Metal oxide supported by metal oxide (e.g. KF–CaO–Fe_3O_4). The effects of the concentrations of the nanocomposites aforementioned, of time, of temperature and of pH on 1=butanol producton was InvestIgated.

Audience Take Away Notes

- The audience will be able to Understand what they learned
- Help to Share the Data
- Yes, this research that other faculty could use to expand their research or teaching
- Yes, this provide a practical solution to a problem that could simplify or make a designer's job more efficient
- Yes, it improve the accuracy of a design, or provide new information to assist in a design problem

Delia Teresa Sponza

Environmental Engineering Department, Engineering Faculty, Dokuz Eylul University, Izmir, Buca Kaynaklae Campus, Turkey

Biography

Prof. Dr. Delia Teresa Sponza is currently working as a professor at Dokuz Eylul University, Department of Environmental Engineering. Scientific study topics are; Environmental engineering microbiology, Environmental engineering ecology, Treatment of fluidized bed and activated sludge systems, Nutrient removal, Activated sludge microbiology, Environmental health, Industrial toxicity and toxicity studies, The effect of heavy metals on microorganisms, Treatment of toxic compounds by anaerobic / aerobic sequential processes, Anaerobic treatment of organic chemicals that cause industrial toxicity and wastewater containing them, Anaerobic treatability of wastewater containing dyes, Treatment of antibiotics with anaerobic and aerobic sequential systems, Anaerobic and aerobic treatment of domestic organic wastes with different industrial treatment sludges, Treatment of polyaromatic compounds with bio-surfactants in anaerobic and aerobic environments, Treatment of petrochemical, Textile and olive processing industry wastewater by sonication, Treatment of olive processing industry wastewater with nanoparticles and the toxicity of nanoparticles. She has many international publications.

Thermal and mechanical processes and reactions in reversible behavior of shape memory alloys

A series of alloy systems called shape memory alloys exhibit a peculiar property, called shape memory effect in the β-phase fields with chemical compositions. This phenomenon is result of thermal and mechanical treatments and reactions. These alloys have dual characteristics called thermoelasticity and superelasticity, governed by thermal and mechanical reactions, thermal and stress induced martensitic transformations, and performed thermally and mechanically. Thermal induced martensitic transformation occurs on cooling with cooperative movements of atoms by means of lattice invariant shears in <110 > -type directions on the {110} - type planes of austenite matrix, along with lattice twinning, and ordered parent phase structures turn into the twinned martensite structures. The twinned structures turn into the detwinned martensitic structures by means of stress induced martensitic transformation, by stressing material in the martensitic condition. Strain energy is stored in the material with deformation and released upon heating, by recovering the original shape in bulk level, and cycles between original and deformed shapes on heating and cooling, respectively. Superelasticity is also a result of stress induced martensitic transformation and performed in only mechanical manner in the parent austenite phase region. The materials are deformed just over austenite finish temperature, and shape recovery is performed simultaneously upon releasing the applied stress. The ordered parent phase structures turn into the detwinned structures by means of stress induced martensitic transformation, like the deformation step in shape memory. Superelasticity is performed in non-linear way, unlike normal elastic materials, loading and unloading paths in stress-strain diagram are different, and hysteresis loop reveals energy dissipation. Shape memory effect is performed thermally in a temperature interval depending on the forward and reverse transformation, on cooling and heating, respectively, and this behavior is called thermoelasticity. Copper based alloys exhibit this property in metastable β-phase region, which has bcc-based structures. Lattice invariant shears are not uniform in copper-based shape memory alloys, and the ordered parent phase structures martensitically undergo the non-conventional complex layered structures on further cooling. The long-period layered structures can be described by different unit cells as 3R, 9R or 18R depending on the stacking sequences on the close-packed planes of the ordered lattice. In the present contribution, x-ray diffraction and transmission electron microscopy studies were carried out on copper based CuZnAl and CuAlMn alloys. X-ray diffraction profiles and electron diffraction patterns reveal that both alloys exhibit super lattice reflections inherited from parent phase due to the displacive character of martensitic transformation. X-ray diffractograms taken in a long-time interval show that diffraction

Osman Adiguzel

Department of Physics, Firat University, Elazig, Turkey

Biography

Dr. Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from Dicle University, Diyarbakir-Turkey. He has studied at Surrey University, Guildford, UK, as a post-doctoral research scientist in 1986-1987, and studied on shape memory alloys. He worked as research assistant, 1975-80, at Dicle University and shifted to Firat University, Elazig, Turkey in 1980. He became professor in 1996, and he has been retired on November 28, 2019, due to the age limit of 67, following academic life of 45 years. He published over 80 papers in international and national journals; He joined over 120 conferences and symposia in international and national level as participant, invited speaker or keynote speaker with contributions of oral or poster. He served the program chair or conference chair/co-chair in some of these activities. In particular, he joined in last six years (2014 - 2019) over 60 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. Also, he joined over 70 online conferences in the same way in pandemic period of 2020-2021. He supervised 5 PhD- theses and 3 M. Sc- theses. Dr. Adiguzel served his

angles and intensities of diffraction peaks change with the aging time at room temperature. This result refers to a new transformation in diffusive manner.

Keywords: Shape Memory Effect, Martensitic Transformation, Thermoelasticity, Superelasticity, Lattice Twinning and Detwinning.

Audience Take Away Notes

- Shape memory effect is a multi-disciplinary phenomenon and shape memory alloys are used in many fields from biomedical to the building industry. Therefore, I will introduce the basic terms and definition about thermoelasticity and superelasticity and introduce the reached experimental results

directorate of Graduate School of Natural and Applied Sciences, Firat University, in 1999-2004. He received a certificate awarded to him and his experimental group in recognition of significant contribution of 2 patterns to the Powder Diffraction File – Release 2000. The ICDD (International Centre for Diffraction Data) also appreciates cooperation of his group and interest in Powder Diffraction File.

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OIL, GAS AND PETROLEUM ENGINEERING & CATALYSIS, CHEMICAL ENGINEERING AND TECHNOLOGY

Kil Yong Choi*, In Cheon Kim

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Air pollution and respiratory disease risks in residential areas near smelters in Korea: A retrospective cohort study using national health information database

Non-ferrous metal smelters produce 450,000 tons of output (3.1% of the world's output), with copper ranking as the 10th most impactful metal in terms of health. The latest data from smelters shows the overall average concentration of SO_2, NO_2, O_3, PM10, and PM2.5 in 2020 were 8.2 ppb, 7.5 ppb, 30.8 ppb, 21.3 μg/m^3, and 13.2 μg/ m^3, respectively. The maximum concentrations were 390 ppb, 50 ppb, 167 ppb, 148 μg/ m^3, and 107 μg/ m^3, respectively. The Art Corporation model was used to investigate the resident health follow-up management (cohort study) in the area, using SAS Enterprise Guide to determine the source of the diffuse pollution. The highest average concentration of carcinogenic PAHs (polynuclear aromatic hydrocarbons) in the air was found in Seokpo 4-ri (60.7 μg/ m^3), followed by Seokpo 1-ri (48.6 ng/ m^3) and Seokpo. Among the respiratory diseases, the following were correlated with the exposed area and the control area: Acute upper respiratory tract disease (J00-J06), other upper respiratory tract diseases (J32-J39), acute lower respiratory tract infection (excluding pneumonia) (J20-J22), chronic lower respiratory disease (persons) (excluding J40-J47, J45-J46), asthma (J45-J46), rhinitis (J30-J31), respiratory disease (J00-J99), and cough (R05). The concentration of environmental pollutants and inconveniences faced by residents due to noise and scattered dust caused by transportation vehicles needs to be considered. Therefore, a life questionnaire centered on residents and workers can help gather valuable insights.

Audience Take Away Notes

- It is expected that each research team will be able to utilize and apply it as good basic data to identify the specific methodology for the follow-up of air pollution and the occurrence of epidemiological diseases in Korea
- It is thought that Korea will be of great help in utilizing specific measures for environmental diseases in follow-up observation of industrial complexes exposed to air pollution
- A sample of a cohort study can confirm the characteristics of air pollution and chronic diseases.
- It is intended to prepare management plans for health influencing factors and air pollution through follow-up observation of a Korean cohort
- There is no global method for follow-up after obtaining informed consent through the IRB (Institutional Review Board). It is expected that it will be of great help to future epidemiological investigations of industrial complexes

Xiliang Liu[1,2]*, Hao Chen[1,2,4,5], Shuaiqiang Gao[1,2], ChenghaoXu[1,2], Yang Li[3], Haipeng Liu[1,2], Mingsheng Zuo[1,2], Yiqing Zhang[1,2], Zafarullah Abro[1,2], Mahaman Sidi Brahim[1,2], Lantewa Aliyu Lawan[1,2]

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[2]College of Safety and Ocean Engineering, China University of Petroleum (Beijing), Beijing, China
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The effect of different phase zones distribution on the characteristics of oil production during CO_2 flooding process

Both laboratory tests and pilot wells have demonstrated the significant potential of CO_2 as an EOR medium. Due to the weak pressure conduction and mass transfer of the CO_2-oil system, multiple zones between the injection well and production well are generated in the ultra-low permeability reservoirs. This work aims to explore the characteristics of multiple zones and mechanisms of CO_2-EOR, combining the experimental results, core-scale, and field-scale simulation. Long core displacement experiments were conducted under different miscibility pressures with production gas assayed using gas chromatography. When the core-scale simulation matched with the experimental results, the four CO_2 fronts, which were used to distinguish different zones, were defined based on pressure, interfacial tension, and CO_2 concentration along the long core. The distribution of five zones was upscaled to the field-scale model after the history matching of pilot wells. The final step was to evaluate the value of the miscible zone range, utilization factor of v injection, oil recovery, and CO_2 storage efficiency during the CO_2 injection process. Results show that the boundary between the original oil zone and the oil transition zone exists at the CO_2 component front, where the CO_2 concentration is zero. Additionally, the location of the v component front does not overlap with the contact interface of CO_2-crude oil, meaning that the dissolution effect of v in the oil transition zone results in the v component front moving farther. Besides, when the formation pressure is higher than the Minimum Miscibility Pressure (MMP), the distance between the CO_2 effective phase front and the CO_2 effective component front further expands as the pressure increases, enlarging the miscible zone range. The pressure accumulates around the injection well because of slow pressure conduction. When the average formation pressure reaches 1.1 MMP, the miscible zone range is enlarged by 2.7% higher than that of the near miscible flooding (0.92 MMP), leading to a higher rate of oil recovery by 8.6% and a utilization factor of CO_2 by 0.14t/t. An increment in pressure yields a slowing migration velocity of the CO_2 component front, therefore, the miscible flooding has a breakthrough time of 0.08 PV later, and the CO_2 storage efficiency of 1.4% higher than those of the near miscible flooding. It is for the first time that the range of five zones and the characteristics of four CO_2 fronts migration is assessed, furnishing an in-depth understanding of the complicated mechanisms and phase behavior in CO_2 EOR in the ultra-low permeability oil reservoir. This work contributes to providing significant information for designing an economic and environmental CO_2 flooding strategy and is significant in the improvement of oil recovery and the reduction of CO_2 emission.

Audience Take Away Notes

- This work contributes to providing significant information for designing an economic and environmental CO_2 flooding strategy and is significant in the improvement of oil recovery and the reduction of CO_2 emission
- This work explores the characteristics of multiple zones and mechanisms of CO_2-EOR

- It is for the first time that the range of five zones and the characteristics of four CO_2 fronts migration is assessed
- This work furnishes an in-depth understanding of the complicated mechanisms and phase behavior in CO_2 EOR in the ultra-low permeability oil reservoir
- This research could be used to expand other faculty research or teaching

Biography

Dr. Xiliang studied EOR at China university of petroleum Beijing in 2018. He joined the research group of Fellow of China academic of Engineering Yang Li at China university of petroleum Beijing. My research interests include CO_2-EOR and geological storage. As a researcher, I have published Chemical Engineering Journal, Applied Energy, Energy, Fuel, and Energy & Fuels. Besides, I have attended more than 10 projects entrusted by the National Natural Science Foundation of China, the National Key Basic Research Program, and oilfield enterprises and I have awarded 3 provincial level prizes.

Endalamaw Ewnu Kassa[1,2]*, Ade Kurniawan[2,3], Ya-Fen Wu[1,2], Sajal Biring[1,2]

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Optimal solvent selection to develop highly responsive and selective $MAPbI_3$-based ammonia gas sensors

Metal halide perovskite materials have emerged as promising candidates for the development of highly responsive ammonia gas sensors due to their sensitivity to low gas concentrations, with potential applications in safeguarding human health and environmental ecosystems. Typically, Dimethylformamide (DMF) has been the preferred solvent for preparing $MAPbI_3$ perovskite solutions in sensor fabrication. In this study, we explored the impact of an alternative solvent, Dimethylacetamide (DMaC), on sensor response by comparing it with DMF solvent. Our findings reveal that solvent selection significantly influences the ammonia gas sensor's response. When DMaC was used as the solvent for $MAPbI_3$ solution preparation, we observed a remarkable response of 237% and 22% response achieved with DMF solvent. This enhancement in sensor response can be attributed to DMaC's exceptional solubility power and low viscosity, facilitating the efficient preparation of $MAPbI_3$ solutions, resulting in improved gas-sensing capabilities. In conclusion, our study showed the critical role of solvent choice in optimizing perovskite-based ammonia gas sensors. DMaC with its unique characteristics, emerges as a selective solvent for $MAPbI_3$ solution preparation, offering the potential for significantly enhanced sensor response. This work paves the way for future advancements in gas-sensing technology, contributing to improved environmental protection and human safety.

Keywords: Ammonia Gas, Solvent, Response, Sensitivity, Sensors.

Biography

Mr. Endalamaw Ewnu Kassa is currently pursuing a master's degree in electronic engineering (MSc) at Ming Chi University of Technology (MCUT) in Taiwan, building on his prior educational background with a bachelor's degree in physics (BSc) from Wollo University in Ethiopia. In January 2022, he joined organic electronic research group at MCUT, Taiwan. He is keenly exploring the realms of perovskite-based gas sensor technology, Organic Photodetectors (OPD), and Light-Emitting Diodes (LED). From 2017 to 2021, he served as an assistant lecturer and assistant lab technician, accumulating valuable professional experience in academia.

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Role of additional nutrients and intermediate temperature on methane generation from anaerobic digestion of agricultural waste: Feasibility & fertilizer recovery

The rise in demand for organisms pulled in by anaerobic digestion could be due to the simultaneous digestion of many substrates. The impact of supplements on the co-digestion of growth substrates was investigated in this study. In three phases, 37°C, 40°C, and 50°C, an extra improvement plan that anticipates a critical occupancy in anaerobic digestion was used. As a result of the changes, biogas output climbed to 1.38 times that of the control at 37 °C. Furthermore, as a result of 40°C without additives, the excellent usage of this newly discovered mid-temperature considerably influenced an innovative philosophy (56 percent of VS end and 8.4 L-biogas). Biogas output surpassed 11.3 L with supplements during anaerobic co-digestion at 50°C, and mL-CH4/g-VS was 1.24 times that of the system without any extra improvement. The results reveal that at each temperature, the improved course of action promotes co-digestion. The most generally utilized temperature on the advanced scale was 37°C, which had the biggest influence on the utilization of improvements during the anaerobic process. Sludge was recovered at a rate of 0.09 m^3 sludge/m^3 substrate from the digester, while water was recovered at a rate of 0.86 m^3 sludge/m^3 substrate from the digester. The processed sludge may be utilized as compost, and the water can be used to water plants. The time it took to recoup the investment was found to be 3.77 years. As a result, it may be inferred that the current research might soon be recognized as a potential green solution for trash management across the world.

Biography

Dr. Md Nurul Islam Siddique studied Civil Engineering at the Khulna University of Engineering & Technology, Bangladesh, and graduated as MS in 2012 from University Malaysia Pahang. He then joined the research group of Prof. Zularisam at the Institute of University Malaysia Pahang. He received her Ph.D. degree in 2015 at the same institution. After that, he obtained the position of Assistant Professor at the University Malaysia Pahang. He has published more than 40 research articles in ISI journals.

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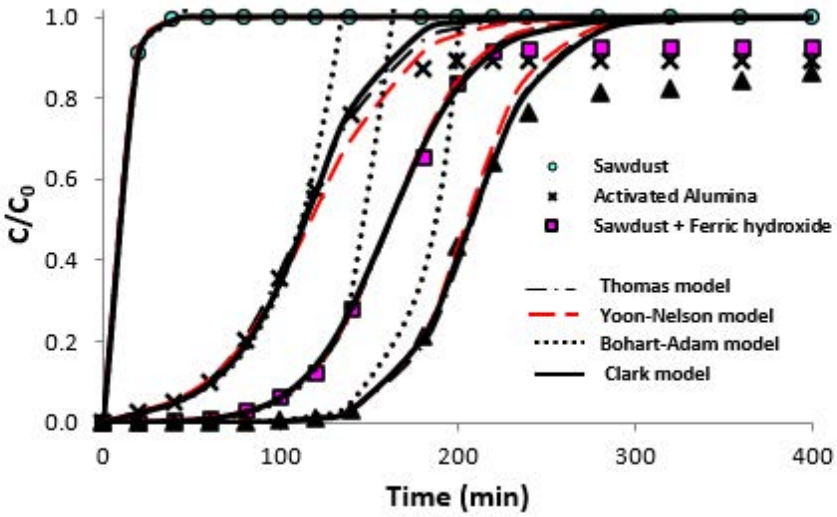
Fixed bed adsorption of arsenate [As (V)] and arsenite [As (III)] from groundwater using artocarpus hirsutus based adsorbent

Anjili tree (Artocarpus hirsutus) sawdust (44%) impregnated with ferric hydroxide (28%) and activated alumina (28%) to form an adsorbent SFAA contains micro, meso and macro pores with high BET surface area and good pore size distribution. The macro pores transport the liquid to the meso pores, these pores highly increases the surface area (61.10 m^2/g). The fixed bed experiments were carried out to study the effect of parameters such as flow rate, inlet concentration, particle size and bed height on breakthrough and adsorption capacity. As (III, V) inlet concentration 1 mg/L with 1 mL/min flow rate through 0.121 mm size SFAA particles and 12 cm bed height gives efficient As(III) & As(V) adsorption with good breakthrough. The breakthrough behavior was also effectively described by the Thomas and Clark model. Regeneration studies reveal that the SFAA can be suitable for industrial scale operations.

Keywords: Arsenic, Sawdust, Adsorption, Fixed Bed, Breakthrough.



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Photocatalysis: An eco-friendly technology

The pollution of water is increasing day by day with a rapid pace and it has reached an alarming situation in this century. Although, many methods are available for wastewater treatment but majority of them are not green chemical in nature. The scarcity of useable/potable water in becoming a burning problem all over the globe. Photocatalysis has emerged as a promising technique for wastewater treatment. It can degrade some stable organic pollutants also to less harmful or harmless smaller degradation products. However, the activity of a photocatalysis is restricted by little absorption in the visible range and fast electron–hole pair recombination. These limitations can be overcome by increasing the photocatalytic activity by some modifications such as sensitization, doping, Z-scheme, use of co-catalyst, composite formation, etc. The reduction of carbon dioxide and photosplitting of water to hydrogen can also be driven photocatalytically to solve the problems of global warming and generation of hydrogen as the fuel of future. All these will be discussed in the presentation.

Audience Take Away Notes

- Audience will learn about the concept of photocatalysis.
- This technique can be utilized for wastewater treatment.
- Efforts can be made to degrade various pollutants as well as to modify the photocatalyst for higher activity.

Biography

Prof. Suresh C. Ameta obtained his masters degree from university of Udaipur and was awarded gold medal-1970. He secured First position in M. Phil-1978 in Vikram University, Ujjain (M. P.). He also obtained Ph. D degree from this University in 1980. He has served as Professor & Head, Department of Chemistry, North Gujarat University, Patan (1994) and M. L. Sukhadia University, Udaipur (2002-2005) & Head, Department of Polymer Science (2005-2008). He also served as Dean, P.G. Studies for a period of four years (2004-2008). He has served as Dean, Faculty of Science, PAHER University, Udaipur for six years (2011-2017). Presently, he is working as Professor of Eminence (Distinguished Professor of Chemistry) in Pacific University, Udaipur.

Prof. Ameta has occupied the coveted position of President, Indian Chemical Society, Kotkata (2000-2001) and is now lifelong Advisor (2002-continue). He was awarded a number of prizes during his career like National prize twice for writing Chemistry books in Hindi (1976 & 1978), Scientist of the Year Award (2002), Prof. M. N. Desai Award (2004), Prof. G. V. Bakore Award (2007), prof. W. U. Malik Award (2008), national Teacher Award (2011), and above all, Life Time Achievement Awards by Indian Chemical Society, Kolkata (2011), Indian Council of Chemists, Agra (2015), by Association of Chemistry Teachers, Mumbai (2018), and also H. North Gujrat University, Patan (2022). He has successfully guided 110 students for Ph. D. Prof. Ameta has more than 450 research papers and 36 books to his credit. He has contributed Chapters in Books published by Trans-Tech, Switzerland: Nova Science, Taylor & Francis, and Apple Academic Press, USA. Three books on Green Chemistry, Microwave Assisted Organic Synthesis and Chemical Applications of Symmetry and Group Theory have been published by Apple Academic Press, USA. Two more books on Solar Energy Conversion & Storage and Photocatalysis; An Emerging Technology have been recently released by Taylor & Francis, USA and a book on Waste Water Treatments by AOPs by Elsevier. He has completed 5 Major Research Projects by DST, UGC, CSIR, and Ministry of Energy, Govt. of India. Prof. Ameta has delivered lectures and chaired sessions in National Conferences organized in almost every part of this country. He is also reviewer of number of international Journals. Prof. Ameta

has an experience of more than 50 years of Teaching and Research. Indian Chemical Society, Kolkata has published a Special issue of Journal of Indian Chemical Society in December 2008 to felicitate him on his 60th birthday and has instituted aa Award in his name as Prof. Suresh C. Ameta Award to be given to a senior chemist of repute from 2003 onwards. Recently he has delivered Key Note Addresses in International Conferences at Tokyo, Japan in May 2022 and Hangzhou, China in July 2022. Above all, he has pointed out some problems in h-index and proposed a complimentary index as Ameta or A-index for further improving h-index and for this, he granted copyright for this improvement by Registrar, Copyrights, Govt. of India.

Ashanendu Mandal
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Removal of phenol from wastewater using biological and industrial wastes as adsorbents

This research aims for adsorptive removal of phenol from wastewater by solid materials generated from biological wastes viz. guava tree bark, rice husk, neem leaves, activated carbon from coconut coir and industrial wastes viz. rice husk ash, red mud, clarified sludge from basic oxygen furnace, activated alumina. The adsorbents are characterized by SEM, XRD, FTIR and BET analyzers. The experiments of phenol removal are carried out with the variation of initial phenol concentration (5-500 mg/L), initial pH (2-12), adsorbent dose (0.10-20 gm/L), temperature (25-50°C) and contact time (30-600 min). The maximum removal obtained is 97.50%. The kinetics shows that the pseudo-second order model is best fitted for all adsorbents except red mud. The kinetic modelings show that the adsorption mechanism is supportive of film diffusion, intra-particle diffusion and chemisorption for all adsorbents. The isotherm analysis suggests that Freundlich isotherm model is best supportive for guava tree bark, rice husk, neem leaves, activated carbon, red mud and activated alumina, whereas Langmuir and D-R isotherm are best supportive for rice husk ash and clarified sludge respectively. The thermodynamics shows the spontaneity, randomness and endothermic/exothermic nature of the adsorption processes. The ANN modelling using two popular algorithms viz., Levenberg-Marquardt and Scaled Conjugate Gradient establishes that the experimental and predictive data are within allowable range. The scale-up designs are performed for their commercial applications. The regeneration and the safe disposal of used adsorbents are also studied for checking their wider industrial applicability

Biography

Ashanendu Mandal has graduated as B. Sc in Chemistry and B. Tech in Chemical Engineering from University of Calcutta. He has got his M. Tech Degree in Chemical Engineering from IIT, Kharagpur. He has acquired MBA degree in Finance from IGNOU, New Delhi and has undertaken an Advanced Management Program from IIM Calcutta. He has also acquired the Degree of Ph. D. (Tech) in Chemical Engineering from University of Calcutta. Dr. Mandal has worked in ONGC for more than 34 years and his experience includes commissioning, modifications, safety, operations, artificial lifts, pressure maintenance, EOR and planning in offshore and onshore oilfields. He has also vast experience in marketing of upstream and downstream petroleum products. Dr. Mandal has published technical papers in Chemical Weekly and research papers in international journals. He has visited more than 25 countries for attending training programs and for participating in international conferences as invited speaker or panelist. Dr. Mandal is a lifetime member of Indian Chemical Society and Indian Science Congress.

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Facile fabrication of SnO_2/g-C_3N_4 photocatalysts for the degradation of endocrine disruptors and pharmaceutical drugs in natural sunlight exposure

The present investigation primarily concentrates on the surface alteration of pure g-C_3N_4 by SnO_2 to expand the life span of excitons. The pure and SnO_2 loaded g-C_3N_4 photocatalysts in various compositions were synthesized and characterized by UV-vis diffuse reflectance spectroscopy, photoluminescence, FESEM, HRTEM and XPS. The absorption spectra of SnO_2 loaded g-C_3N_4 revealed the red shift in the band energy. The successive decrease in the PL spectra with the increase of loading authenticates the supporting role of SnO_2 in extending the life span of excitons. The charge retention ability was estimated by electrochemical measurements whereas the SPIES measurements coupled with Mott-Schottky analysis facilitated the fetching of the flat band potential as well as the semiconducting electrical nature of the materials. The as-synthesized SnO_2 loaded g-C_3N_4 photocatalysts displayed an enhanced activity as compared to pure g-C_3N_4 for the degradation and mineralization of BPA, tetracycline, diclofenac and oxacillin in natural sunlight exposure. The progress of BPA and drugs degradation was monitored by HPLS and UV-visible spectroscopy respectively. The Total Organic Carbon (TOC) and Ion Chromatography (IC) measurements helped in the estimation of the mineralization efficiency of impregnated materials. The contribution of both hydroxyl (OH•) and superoxide anion (O_2•-) radicals in the degradation/mineralization process. The maximum degradation was achieved over 3% SnO_2 loaded g-C_3N_4 in the order of diclofenac (97%) > chlortetracycline (95) > BPA (88%) > Oxacillin (80%). The information collected from the analytical tools correlated to propose the plausible mechanism of the degrading/mineralization process.

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The removal of refining hydrocracking's heavy polynuclear aromatic hydrocarbons: Challenges and solutions

Heavy Poly Nuclear Aromatic (HPNA) hydrocarbon compounds are one of the major poisoning and corrosive substances that severely impact refinery equipment and catalyst life cycle. It is mostly produced as a by-product of the hydrocracking process, where the lack of efficient hydrogen contacts during the reaction phase results in the polymerization of the hydrocarbon as undesired products. Overtime-on-stream, HPNA formations increases exponentially and that forces refineries around the globe to adapt purging or bleeding techniques to reduce the HPNA concentration within the hydrocracking unit, which drastically impacts reactor conversion efficiency and product yields costing > $ 10 million per year. Currently, such operational mitigation approaches are contributing to additional amount of CO_2 emission. In this work, we propose an alternative cost-efficient approach targeting reduction in carbon footprint, through the development of novel HPNA adsorption technology. The technology was designed for selective HPNA removal from Hydrocracker Bottom recycling stream having HPNA concentration of > 1000 PPM. Carbon based adsorbent was applied to demonstrate further selective performance for HPNA removal compared with commonly applied operational mitigation approaches to illustrate the main limitations in currently applied approaches. We found that carbon-based adsorbents capable for HPNA removal. We concluded that carbon-based materials economically attractive by outlining the ideal scenario of HPNA removal through carbon-based adsorption process.

Yarub Al Douri
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Incorporating nanotechnology into renewable energy

The nanotechnology could deliver world-altering changes in the ways we create, transmit, store, and use energy. The scientists are working to develop super-efficient batteries, low-resistance transmission lines, and cheaper solar cells. However, the likelihood and time frame of these developments is unknown for the moment. The next generation of solar cells is thin film solar cells—flexible sheets of solar panels—that are easier to produce and install, use less material, and are cheaper to manufacture. These sheets can be incorporated into a briefcase that charges your laptop, woven into wearable fabrics that charge your cell phone and iPod, or incorporated into windows that can supply power to high-rise buildings.

In different parts of the world, the people do not have access to safe drinking water. But the new nanofiber water filters can remove bacteria, viruses, heavy metals and organic materials from water. They are re relatively inexpensive and easy to use, so the nanofilter could be widely employed easily. Providing pure drinking water would help prevent disease in many parts of the world, but it would not resolve many basic inequalities.

The nanotechnology has unique properties. The electrical properties, durability, strength and activity of nanomaterials are enhanced and engineered to obtain desired features through nanotechnology. Nanotechnology focusses on solar, hydrogen and biomass energy. The nanostructured catalysts are used to increase the efficiency of fuel cells while porous nanomaterials are used for hydrogen storage. The quantum dots and carbon nanotubes increase the energy absorption properties of solar cells. The development of cost-effective renewable energy systems will contribute to the urgent energy goals of our world and reduce the destructive effect of human activities.

Biography

Prof. Dr. Yarub Al-Douri is from University of Sharjah. Al-Douri is a Fellow of European Academy of Sciences. He has initiated Nanotechnology Engineering MSc Program and Nano Computing Laboratory. He has received numerous accolades including winner of IAAM Scientist Award by International Association of Advanced Materials, Sweden 2022, World's Top 2% Scientists by Stanford University, USA 2022, 2021 & 2020, World's Top 2% Scientist Career-Long Citation Impact by Stanford University, USA 2020, OeAD Award, Austria 2020, Japan Society for the Promotion of Science (JSPS) Award 2019, Asian Universities Alliance (AUA) Award 2019, Iraqi Forum for Intellectuals and Academics Award (IFIA) 2019, TWAS-UNESCO Associateship (Twice) Award 2015 & 2012 and Best Paper Award at Global Conference on Energy and Sustainable Development in UK 2015, the total is 72 awards. Al-Douri is Associate Editor of Nano-Micro Letters (Q1,IF=26.6,Springer), Editor-in-Chief of Experimental and Theoretical NANOTECHNOLOGY, Editor-in-Chief of World Journal of Nano Science and Engineering.

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Oxidative dehydrogenation of 4-vinylcyclohexene in the presence of modified forms of Zr, Fe-pentasyls

In this paper, the results of studying the catalytic conversion of 4-VCH in the presence of a pentasil-type zeolite modified with zirconium, iron, and gadolinium (or neodymium) oxides, as well as the effect of adding reaction by-products on the selectivity of the process are discussed.

The initial hydrocarbon – 4-VCH was obtained by dimerization of 1,3-butadiene and clear rectification (distillation) of the dimer fraction. Ethylbenzene, styrene, ethylcyclohexane, vinylcyclohexane, and ethylcyclohexene isomers, the purity of which was determined by the GLC method, were also used. The physicochemical constants of the above hydrocarbons corresponded to the literary data.

Zeolite Na-TsVM (Na-TsVM) at a temperature of 300-500°C practically does not show activity in the dehydrogenation of 4-VCH. The products of disproportionation and dehydrogenation of 4-VCH on this contact are observed only at a higher temperature (400-450°C). The use of oxygen as an oxidizing agent (4-VCH:O_2=1:0.2) has practically no effect on the isomerizing and dehydrogenating activity of HNa-TsVM. The introduction of iron and Zr and Gd cations into the composition of HNa-TsVM leads to a sharp increase in the activity of the catalyst in the direction of dehydrogenation. The results of our studies have shown that ternary systems –Fe,Zr,Gd/HNa-TsVM, with different contents of active components, demonstrate especially high activity in the oxidative regime (tab.). The latter are characterized by the most optimal combination of redox and acid-base properties.

Table

Influence of the mass ratio of modifiers deposited on 0.75 HNa-TsVM on the yield of products of oxidative dehydrogenation of 4-VCH (T=470°C, $V_{4\text{-VCH}}$=1 h-1, mol. ratio 4-VCH:O_2=1:0.3)

Men+, mass. %			Yield, %			Yield of ethylbenzene, %	Yield of styrene, %
Zr^{4+}	Gd^{3+}	Fe	Liquid products	gas	coke		
1.0	0.5	-	93.5	5.8	0.7	12.0	3.7
1.0	0.5	3,0	94.2	5.2	0.6	27.6	5.4
2.0	0.5	3,0	91.7	7.2	1.1	33.0	13.6
2.0	0.5	5,0	91.6	7.7	0.7	36.4	16.3
3.0	0.5	5,0	92.3	7.3	0.4	39.1	18.7
3.0	1.0	0.5	92.8	6.4	0.8	39.8	19.0
3.0	2.0	5,0	95.0	4.9	0.1	42.4	21.8
3.0	2.0	-	93.6	6.0	0.4	33.7	15.2

Fe,Zr,Gd/HNa-TsVM and Zr,Gd/HNa-TsVM samples demonstrate especially high activity in the 4-VCH dehydrogenation reaction.

The depth and selectivity of the conversion of 4-VCH mainly depends on the method of their preparation, the ratio of the concentrations of modifiers and the temperature of the experiments (tab.).

As can be seen from tab. the highest yields of ethylbenzene and styrene are achieved on a sample containing 3.0 wt.% ZrO_2, 2.0 wt.% Gd_2O_3, and 5.0 wt.% Fe.

Biography

Dr. Arzu Akif Jalilova studied Chemical Technology at Azerbaijan State Oil Academy and graduated from academy as a technologist. She is a senior scientific researcher at the Laboratory of "Chemistry of alicyclic compounds" of the Institute of Petrochemical Processes of MSE of Azerbaijan Republic. She received her PhD degree on Petrochemistry in 2013 at the same institute. She conducted researches on the process of producing alkyl aromatic hydrocarbons, especially, ethylbenzene and styrene from 4-vinylcyclohexsene by oxidative dehydrogenation, preparation of catalysts in order to carry out the process, studied the impact of several factors on the process and achieved high results. The results were published in prestigious journals such as "Azerbaijan Chemical Journal", "Petrochemistry", "Applied Chemistry", "Processes of Petrochemistry and oil Refining", "Theoretical and experimental chemistry". She will be responsible for the development of catalysts and conducting oxidative dehydrogenation.

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Comparison of the heterogeneous catalytic activity of various solid acids in esterification process of methyl acetate production

Active and low-cost heterogeneous catalytic systems still need to be developed in industry. Solid acid catalysts play an important role in chemical reactions. Porous solid acid catalysts are desired according to their increased surface area as well as the catalytically active sites. Many kinds of solid acids have been found; their acidic properties on catalyst surfaces, their catalytic action and the structure of acid sites have been elucidated for a long time. Solid acid catalysts are eco-friendly and can be used as replacements for liquid acids. The use of solid acid catalyst enables a separation of the product by filtration alone; while the separation of liquid catalysts requires tough, cost and time-consuming separation processes. Then by using solid acid catalysts in synthesis process of chemicals, not only high activity, but also reusability is desired in view of the separation of products and the recycling of catalysts. Generally, the prime characteristics of solid acid catalysts can be modified in an economical and eco-friendly way to reduce the overall cost of chemical products on an industrial scale.

Esters are generally produced at industrial scale by using homogeneous catalysts such as H2SO4. However, the process has many limitations, a considerable amount of energy is required for the purification of products and catalyst removal. Furthermore, these catalysts are not reusable. To produce methyl acetate, the ester is produced by Fischer Esterification of methanol and acetic acid in the presence of a strong acid which is shown below.

$$\overset{Acid\ Catalyst}{CH_3OH + CH_3COOH \Leftrightarrow\!=\!=\!=\!=\!=\!=\!=\!=\!\Rightarrow} CH_3COOCH_3 + H_2O$$

Figure 1. Synthesis of methyl acetate via acid catalyzed Fischer Esterification

Heterogeneous catalysis typically involves solid phase catalysts and liquid or gas phase reactants. It is very important because it enables faster, large-scale production and the selective product formation. The chemical and energy industries rely heavily on heterogeneous catalysis. Traditional acid catalysts have some limitations in industrial processes. Upon completion of the reaction, the remaining acids are generally neutralized using a large amount of alkaline water. The alkali often corrodes the metallic parts of the reactor to produce metallic sludge, which contaminates the ester phase. Consequently, heterogeneous solid catalysts are favored because they are easily separated from the liquid phase and do not exert a direct caustic effect on the metallic equipment. Then they are easy to separate and recycle. Also, there is no acid pre- treatment process needed before introducing the catalyst to the reaction. Beside lower acidity strength of solids in comparison with liquid acids is the most significant disadvantage.

The above challenges are the major driving forces for the development of new catalytic systems. Many different solid heterogeneous catalysts have been recently used for esters production showing promising results with recommendable yields. In this research, we practically have tested porous catalyst supports such as silica gel, alumina, carbon active and poly styrene according to their intense surface area to synthesis solid acids for heterogeneous catalysis of esterification reaction. In the following, we will evaluate the catalytic activity of these supports in the esterification process of acetic acid and methanol.

Audience Take Away Notes

- Why Heterogeneous catalysis should be preferred over homogeneous one?
- What are the pros and cons of solid acid catalysts?
- A practical solution to optimize solid acid catalysts performance
- Improved generation of mesoporous structure as acid catalysts
- Characterization and comparison of the efficiency of functionalized solid acids in the esterification process

Biography

Nahal Majdodin received her BS degree in Applied Chemistry from Alzahra University, Tehran, Iran, in 2012, and then MS degree in Applied Chemistry from Islamic Azad University of Tehran in 2014. She is currently PhD senior student at Science and Research Branch University, Tehran, Iran and also a researcher at National Iranian Gas Company, Tehran, Iran. She is working on her PhD Thesis. Her scientific field of interest includes Catalysis, Petroleum Chemistry, Green Chemistry, Environmental Pollution and synthesis and characterization of organic and inorganic porous materials and their application in oil and gas industry.

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Tuning the photocatalytic activity of cerium oxide

Facial one-step synthesis procedure was applied to prepare porous sponge-like ceria (CeO_2) and manganese doped porous ceria (Mn-CeO_2) with different Mn content (1 to 10%) to improve its photocatalytic performance. The synthesis was performed by were prepared by using a flash combustion technique (one-step) process and water only as a solvent. Moreover, citric acid was utilized as a fuel in an aqueous medium, and the overall synthesis mixture was dried at 100°C overnight and then calcinated at 550 °C for 3 h. The obtained final solid product was characterized by Inductively Coupled Plasma (ICP), X-Ray Powder Diffraction (XRD), Diffuse Reflectance Ultraviolet Visible Spectroscopy (DR-UV-Vis), and scanning electron microscopy (SEM), which was coupled with Energy Dispersive X-Ray Analysis (EDX), N_2 sorption measurement, High Resolution Transmission Electron Microscopy (HR-TEM), and Photoluminescence (PL) analysis. The characterization data showed that the nanoparticles of the porous ceria were formed with a three-dimensional pore system. Moreover, the measured surface area of the porous sample was eight times higher than the commercially available ceria and showed that Mn ions were totally incorporated into the framework of ceria up to the applied loading. Under visible light illumination, the photocatalytic activity of the prepared samples was tested in the decolorization reaction of Methyl Green (MG) dye (wavelength greater than 425 nm). The obtained results showed that the photocatalytic activity of porous ceria was higher than that of the commercial sample and showed that increasing Mn content improved the photocatalytic activity of ceria. The sample with a Ce/Mn ratio of 10 performed 1.8 times better than bare porous ceria. The second application was the photocatalytic elimination of a gaseous mixture consisting of five short chain hydrocarbons (C1–C3). Finally, the reusability of the best-performing sample was investigated in four consecutive runs without treatment, and slight deactivation (less than 9%) was monitored after the fourth run.

Audience Take Away Notes

- A facial one-step synthesis procedure to obtain porous material
- The role of citric acid (C6H8O7) in this method compares with other fuels
- Advantages of productes materials such as (surface area, porosity, activity ..etc.)
- Can use this procedure to produce porous materials by using simple and cost-effect technique
- This research that other faculty could use to expand their research or teaching
- This provide a practical solution to a problem that could simplify or make a designer's job more efficient
- It improve the accuracy of a design, or provide new information to assist in a design problem
- List all other benefits
    - Synthesis method without any solvents and templet
    - Can used this method to obtain porous material
    - Environmentally friendly, easily and cost effect method
    - Improve properties of samples such as (photocatalysis, photoluminescence and adsorption)

Biography

Mrs. Amal Atran is a Ph.D. researcher. She is studying her Ph.D. King Khalid University, in addition, she is working as a lecturer in chemistry department, College of Science, Najran University. Her thesis about the functionalized mesoporous materials. she published 2 papers in ISI Journals.

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Finding of the helium in the petroliferous tube wells in saugor division, Southern Ganga Basin, Bundelkhand region, M.P. India

The finding of the helium gas in the petroliferous tube wells in Saugor Division, southern Ganga Basin region has been carried out in great detail in 50 Tube wells, along with the stable isotopic analysis were carried out for the gas sample were collected in Sagar and Damoh District of M.P. The discovery of the rare gas helium in hydrocarbon rich zone in the tube wells in agricultural field of Sagar and Damoh District of M.P., is a unique finding in rocks of the Vindhyan Super Group, in the history of Earth Science in India. The depth of tube wells are varying in 300 feet to 750 feet. On the basis of geochemical analysis, it is remarkable to note that average values of helium contents varies from 0.34 % to 0.732 % along with the 72% to 99 % of methane and ethane, and minor amount of oxygen, nitrogen and CO_2 gases in the hydrocarbon rich zone were recorded during the geochemical and stable isotope analysis. It has been found in the stable isotope δ C13 value the values for the methane is - 43.6 per mil w. r. t. to - 54.9 per mil w.r.t. PDB and for the Ethane gas is --24.9 to --26.4 per mil w. r. t. PDB in the gas samples collected in the saturated sodium chloride solution in the glass bottles at various sites in Sagar & Damoh District. The occurrence of rare helium gas in the Hydrocarbon rich zone is reported first time in Jan, 2007 from the tube wells of Sagar Distt, which were geochemically and stable isotopically analyzed in the labs of KDMIPE Dehradun & NGRI Hydrabad. The gaseous hydrocarbon analysis show the presence of moderate to low concentration of methane (C_1) 1 to 104 ppb, Ethane (C_2)-1 to 14 ppb, Propane (C_3) 1 to 10 ppb, i- Butane (i C_4) 1 to 9 ppb and n Butane (n C_4) 1 to 8 ppb in the soil samples collected from different locations. The result gas and stable isotopic analysis of Ethane gas in these samples δ C13 value are ranging from -24.9 per mill w.r.t. PDB and -26.9 per mill w.r.t. PDB are indicative that this gas is of thermogenic origin, which must have been formed at very high temperature & pressure condition in the deeper horizon of the Great Vindhyan sedimentary basin of an early Proterozoic (> 600 m.y.) period.

Keywords: Petroleum, Helium, Vindhyan Rocks, Stable Isotopic, Tube Wells, Thermogenic, Methane, Ethane, Butane, Geochemical, Hydrocarbon.

Biography

Prof. Arun Kumar Shandilya, I worked as Professor in Dr.H.S.G. University Sagar, having 46 years of Experience in Teaching, Research and Administration. I did my doctoral research on Himalayan Tectonics. I have worked as Head Deptt. of Applied Geology, Dr. H.S.G. University Sagar and also taught at HBNG University, Srinagar Garhwal, NEHU, KOHIMA. Also served as Chief Coordinator, DST Sophisticated Instruments centre, Dean Students Welfare, Prof. In charge of Store and Purchase, University Cultural Coordinator. I have published more than 85 Research papers in the Journals of national and international repute, supervised 8 students for Ph.D and more than 500 students for M.Tech / M.Sc Dissertations on various topics ranging from Himalayan Geology, Central India and Rajasthan Geology, Geology of Bundelkhand Tectonics, Satpura Tectonics, Coal Geology and impact of mining on the Environment of Manganese and coal, Iron, Marble mines, Phosphorire Mines etc. I have published a book on Geological and Environmental Processes, by Springer Nature. Discoveries made by me on - Discovery of Helium Gas in South Ganga Basin, Discovery of Petroleum Gas in Distt. Sagar (M.P.), Discovery of Physa Fossil in Intertrappean Limestone in Banda Tehsil, Distt. Sagar (M.P.), Discovery of Recumbent Fold in the Upper Vindhyan Rocks, Rewa group, near Ratona, Garhpehra Basona, Berkhri hills in NW of Sagar (M.P.). I ahve published Following Books - GEOLOGICAL AND ENVIRNMENTAL PROCESSES, Published by Springer Nature and other one is PENINSULAR GEOLOGY AND ENVIRONMENT Published by Oxford books NewDelhi

Gareyev Adib Akhmetnabievich
Ufa University of Science and Technology, Ufa. Republic of Bashkortstan, Russian Federation

Solving modern problems of oil production-through automation

Oil production has been and remains the basis of modern industrial development. Oil is not only a source of energy, but the basis of the chemical industry for the production of various consumer goods. Oil production will be the vector of industrial production for many years to come. Oil consumption around the world is growing steadily. At the same time, it is now becoming clear that many large deposits are being depleted. Existing methods of oil production become ineffective, as complications of operation occur everywhere.

Types of complications: These are salt deposits in centrifugal pumps, - forced transition of centrifugal pumps to a periodic operation mode. There is a complication of the study of the operation of centrifugal pumps by existing methods. The problem of exploitation of offshore fields is especially acute. The exploitation of offshore fields with existing centrifugal pumps can seriously harm the ecology of the vast oceans.

The situation in the exploitation of oil fields by centrifugal pumps is further complicated by the fact that there is no theory of control of centrifugal pumps. Due to the lack of control theory, it is impossible to train oil production engineers who can control centrifugal pumps when oil production becomes difficult.

Thus, the exploitation of oil fields is accompanied by a decrease in flow rates and an increase in the depth of dynamic levels. Decrease in the well production rate leads to the appearance of the phenomenon of salt deposition, contributes to the emergence of a method of periodic operation.

The lack of control theory forces oilmen to look for ways to combat salt deposits using the “trial and error” method. The lack of a theory of control of centrifugal pumps is pushing oilmen to look for modes of periodic operation by the “assuming method”.

The deepening of the dynamic levels of fluid in the well does not allow to investigate the flow rate of the well. All this leads to a decrease in the efficiency of oil production by installations of electric centrifugal pumps.

To solve all these impending problems is possible only by studying, creating a modern theory of control of centrifugal pumps.

Therefore, the author for the first time laid the theory of the thermodynamic state of an electric centrifugal pump when pumping multiphase mixtures. An analytical solution for the thermal state of a centrifugal pump is obtained.

On the basis of the solution obtained, the phenomenon of "thermal shock", "self-oscillation of operating modes" was discovered, and for the first time in the world, "principles of automation" of centrifugal pump control were laid down.

A textbook for teachers of higher educational institutions and for students was written and published in Russian. The textbook has been translated into English and is being prepared for publication in Amazon.

The second volume of the textbook is being prepared for publication.

The pinnacle of the author's scientific research is the creation of an automatic installation of a centrifugal pump. For the first time, automation of control solves all the above problems of oil field operation.

The dialectic of centrifugal pump automation development is from automatic installation to automated oilfield. Automated oilfield - unmanned clean oil production - is the future of the oil industry.

Audience Take Away Notes

- The author for the first time created a modern theory of the thermodynamic state of an electric centrifugal pump when pumping multiphase mixtures
- The modern theory of the thermodynamic state of an electric centrifugal pump makes it possible to understand the process of salt formation in the internal cavity of the apparatus
- The modern theory of the thermodynamic state of the electric centrifugal pump allows you to calculate the mode of periodic operation
- The modern theory of the thermodynamic state of an electric centrifugal pump makes it possible to predict the conditions for salt deposition in the pump
- The modern theory of the thermodynamic state of an electric centrifugal pump makes it possible to automate the control process
- Automatic installation will allow you to move from installation to full automation of the oil field.
- Automatic field has no analogue for offshore field exploitation
- Automation of the control process of a centrifugal pump is the key to environmentally safe oil production in the waters of the seas
- The use of automation of the control process of an electric centrifugal pump reduces the cost of oil production by up to 40%

Biography

Adib Gareev - graduated from the Faculty of Physics and Mathematics of the Bashkir State University (Russian Federation), is currently transformed into the Ufa University of Science and Technology. Works as a practicing engineer in oil production in an oil production enterprise. The author has published about 140 scientific articles on thermodynamic problems of gas-liquid mixtures. More than 15 papers on the problems of pumping multiphase mixtures by electric submersible pumps have been published in foreign scientific journals. The author received patents for inventions in the Russian Federation, China, Singapore and the USA (at the stage of issuing a patent). The author has published two monographs on the problems of operation of electric centrifugal pumps in fields with low reservoir properties. Works on a monograph on the operation of oil wells in a periodic mode.

Delia Teresa Sponza

Environmental Engineering Department, Engineering Faculty, Dokuz Eylul University, Izmir, Buca Kaynaklae Campus, Turkey

Biodiesel production from Waste Cooking Oil (WCO) using Calcium Oxide (CaO) nano-catalyst

Biodiesel production from Waste Cooking Oil (WCO) provides an alternative energy means of producing liquid fuels from biomass for various uses. Biodiesel production by recycling WCO and methanol in the presence of Calcium Oxide (CaO) nano-catalyst offers several benefits such as economic, environmental and waste management. A nano-catalyst of CaO was synthesized by thermal-decomposition method and calcinated at 500°C followed by characterization using X-Ray Diffraction (XRD) and Scanning Electron Microscope (SEM) techniques. The XRD results revealed nano-scale crystal sizes at high purity, with a mean particle size of ~29 nm. The SEM images exhibited morphology of irregular shapes and porous structure of the synthesized nanocatalysts. The highest conversion of WCO to biodiesel was estimated to be 99%, at optimized experimental conditions i.e., 40°C, 1:4 WCO oil to methanol ratio, 0\80% by weight of catalyst loading rate and 30 minutes reaction time.

Audience Take Away Notes

- Help to Share the Data
- This research that other faculty could use to expand their research or teaching
- This provide a practical solution to a problem that could simplify or make a designer's job more efficient
- It improve the accuracy of a design, or provide new information to assist in a design problem

Biography

Prof. Dr. Delia Teresa Sponza is currently working as a professor at Dokuz Eylul University, Department of Environmental Engineering. Scientific study topics are; Environmental engineering microbiology, Environmental engineering ecology, Treatment of fluidized bed and activated sludge systems, Nutrient removal, Activated sludge microbiology, Environmental health, Industrial toxicity and toxicity studies, The effect of heavy metals on microorganisms, Treatment of toxic compounds by anaerobic / aerobic sequential processes, Anaerobic treatment of organic chemicals that cause industrial toxicity and wastewater containing them, Anaerobic treatability of wastewater containing dyes, Treatment of antibiotics with anaerobic and aerobic sequential systems, Anaerobic and aerobic treatment of domestic organic wastes with different industrial treatment sludges, Treatment of polyaromatic compounds with bio-surfactants in anaerobic and aerobic environments, Treatment of petrochemical, Textile and olive processing industry wastewater by sonication, Treatment of olive processing industry wastewater with nanoparticles and the toxicity of nanoparticles. She has many international publications.

Intisar Al Busaidi
Sultan Qaboos University, Oman

Experimental investigation of low salinity polymer from pore to core scale in heavy oil sandstone reservoirs

Recently, the synergic combination of Low Salinity Water Flooding (LSWF) with Polymer Flooding (PF) has been a subject of paramount interest for the oil industry. Numerous studies have investigated the efficiency of enhanced oil recovery using Low Salinity Polymer Flooding (LSPF). However, there is no clear conclusion that can explain the incremental oil recovery, determine the main factors controlling the oil recovery process, and define the relative contribution of rock/fluids or fluid/fluid interactions to extra oil recovery. Therefore, this study aims to perform a systematic investigation of the interactions between oil, polymer, low salinity and sandstone rock surface from pore to core scale during LSP. Partially hydrolyzed polyacrylamide (HPAM) polymer, Boise outcrop, a crude oil sample and reservoir cores from an Omani oil field, and two level of brine salinities were used in the study. A multidimensional experimental approach including static bulk measurements of polymer solutions prepared with brines of high and low salinities, single phase displacement experiments, along with rheological, pH, conductivity, Total Organic Carbon (TOC) and Ion Chromatography (IC) measurements to analysis ion exchange reactions, polymer adsorption, and viscosity loss and, and finally two-phase experiments to demonstrate the oil recovery efficiency of LSP. The results obtained from this study show that the incremental oil recovery from LSP flooding related to the combination of the reduction in the water-oil mobility ratio, an increase in the repulsion forces between COBR interfaces and an increase in the pH of the aqueous solution. Moreover, lowering the salinity of the make-up brine resulted in a larger conformation (expansion) of the polymer molecules, which in turn resulted in less adsorption and a greater in-situ viscosity without any negative impact on injectivity. This plays a positive role in the oil displacement process. In addition, LSPF resulted in higher oil recovery with more acidic oil with a viscosity of 480 cP compared with that of 170 cP. However, there was loss of viscosity in the effluents of LSP that related to an increase in cations concentration which is mainly controlled by the mineralogical compositions of the rock surface.

Musaed Al-Harbi*, Sridhar Ketavarapu, Ali Al-Basri, Nadeem Waris

HSE (NK), Kuwait Oil Company, Kuwait

Oil & gas facility integrity enhancement through systematic & risk based prioritization of actions generated through inspection & corrosion reports

Objectives/Scope: The nature of Oil & Gas industry recognizes the potential human, environmental and financial consequences that can result from failing to maintain the integrity of facility and associated piping. The importance of effective Facility Integrity Management (FIM) increases as the industry infrastructure continues to age. The primary objective of Facility Integrity Management is to maintain facility & associated piping/spools in a fit-for-service condition while extending its remaining life in the most reliable, safe and cost effective manner. North Kuwait Directorate of Kuwait Oil Company is striving to attain maximum production capacity in spite of having multiple challenges including increasing water-cut and resulting corrosion issues.

Methods, Procedures, Process: A successful facility integrity management program incorporates aspects of design, material selection, operations, maintenance, corrosion mitigation, monitoring and inspection, risk evaluation and communication concepts to maximize the return. All these concepts are interlinked.

Actions Generated through Inspection & Corrosion Reports are reviewed and a method is developed to include a Prioritization Mechanism followed by Priority Setup/Ranking for each case scenario identified. The development of prioritization mechanism considers the following attributes – such as Consequences of failure (Production loss including shut down and repairs, Personal injury, environmental loss and property damage), Probability of failure (Metal thickness loss with respect to design to understand Maximum Operating parameters), Location specific hazard identification (including the location of corroded portion of pipeline/ equipment with respect to Hazardous area classification), Resource availability (material availability, other supporting resources, estimated time for completion, shutdown if required – the duration),and Incident History (Previous incidents in the same/ similar line, in the facility, history and status of clamps used etc.). The data is computed analytically through a standard outlined protocol workshop to develop the priority raking.

Results, Observations, Conclusions: This paper presents the initiative taken by Kuwait Oil Company (HSE-NK) in coordination with all Stakeholders for systematic review, risk rank and prioritize the Inspection & Corrosion Teams recommendations generally termed as “Action reports” for individual facilities based on the methodology developed. This process had resulted in a prioritizing which had resulted in curtaining any potential effect on upstream & downstream operations in the facility. The activity resulted in increased uptime of the facility and reducing any potential leak scenarios.

Audience Take Away Notes:

- AAssets in the oil and gas industry have unique issues of corrosion due to several reason - Ageing assets, dynamic change of corrosion rates based – considering different well characteristics from different reservoir, flow rate of fluid – stagnation, etc., considering various road blocks to ensure continuous production with zero downtime. The concept is to have a safe production at all times

- How to priorities, replacement and repairs resulting in minimal facility shutdown time
- Also consider, change in operation to make changes whilst in operations by raising proper MoCs
- Further, evaluate material required and pre-fab items – by making a plug and play component to ensure they are ready during the shutdown time
- Knowledge sharing to the community is an important thing at KOC and we are willing to share the practice
- Design issues are not discussed in the presentation, however MoC are used to get better control of the design to make rectification of piping inside the faculty. If such options are considered during design, it would always benefit the industry in total
- Challenges faced by aging assets are dealt technically to ensure continued & secured production without disruptions

Biography

Mr. Musaed Al-Harbi, has a Chemical Engineering degree with 20 years of varied experience. He works in Kuwait Oil Company as a Senior Safety Engineered and has always been in pursuit of enhancing operational abilities by taking a multi-disciplinary approach. His approach to support production is by reaching excellence in reducing associated issues and controlling hazards by including a structured risk management approach. He had shared his knowledge and experience is several key forums both inside and outside the company.

Kamel Fahmi Bou-Hamdan

College of Engineering, Phoenicia University, Zahrani, Lebanon, Chemical and Petroleum Engineering Department, Beirut Arab University, Debbieh, Lebanon

The innovative applications of nanomaterials in the oil and gas industry

Given the perpetual growth and new challenges that the petroleum industry encounters, the introduction of new technologies is a necessary and ongoing process. The incorporation of nanomaterials is being done to augment the efficiency of various processes in these technologies. The oil and gas industry has found these substances to be highly useful in the upstream, midstream, and downstream sectors due to their unique physical and chemical characteristics. This presentation aims to provide an overview of the nanomaterials used in the oil and gas industries and how they contribute to the industry's growth. In this discussion, we delve into the applications in which they have been implemented, which include hydrocarbon exploration, well drilling, well completion, production operations, the mechanisms of enhanced oil recovery, transportation, and refining operations. Alongside this, the discussion encompasses the examination of current challenges and the potential for future utilization. The importance of choosing the best nanomaterial type for the success of the application cannot be overstated, as indicated by the findings. The study emphasizes the importance of selecting the appropriate type of Nanomaterials for enhanced oil recovery applications based on various factors, including reservoir rock properties and conditions, reservoir fluids type, enhanced oil recovery mechanism, chemicals type (surfactant, polymer, and alkaline), chemicals concentration used in the flooding process, and nanoparticle properties and concentration.

Audience Take Away Notes

- The findings of this research provide insight into the different types of nanomaterials that are being implemented in the oil and gas industry
- The outcomes emphasize that it is critical to select the best nanomaterial type based on the application it will be used in
- The results show that the best nanomaterial to be used in enhanced oil recovery methods depend on different properties that are related to the reservoir rock, reservoir fluid, and the nanoparticles
- More experimental studies are still needed to investigate the impacts of new nanomaterials in enhancing the oil and gas operations

Biography

Dr. Kamel Bou-Hamdan is an associate professor at the College of Engineering at Phoenicia University, Lebanon and an instructor at the chemical and petroleum engineering department at Beirut Arab University, Lebanon. Dr. Bou-Hamdan holds a PhD degree in petroleum engineering from the University of Aberdeen, UK. His research interests include the applications of hydraulic fracturing and enhanced recovery methods. Dr. Bou-Hamdan was selected as a judge for different competitions such as the SPE MENA student paper contest (PhD division) in 2022, SPE section award in 2019, SPE student chapter award in 2017, and the Switch Energy Alliance Competition in 2020 and 2021. Furthermore, he published several articles in different conferences and journals.

Shruti Malik, Mayur Pal*

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Role of digital rock physics in successful implementation of sub-surface carbon storage

The rapid increase in greenhouse gas emissions has become a pressing global issue as these have debilitating impact on climate. Carbon Capture and Storage (CCS) is a method to reduce such emissions and mitigate their impact on environment through capture and storage of the carbon dioxide in the subsurface reservoirs. Prior to injecting the captured CO_2, it is necessary to identify suitable storage sites and characterize the reservoirs for long-term storage. Digital Rock Physics (DRP) enables the characterization of a reservoir by analysing the scanned volumes of the core rock samples extracted from these reservoirs. The two key parameters used to quantify subsurface rocks are porosity, which determines storage capacity, and permeability, which determines flow capacity. By utilizing 3D image volume data obtained from Micro Xray Computed Tomography scans, information on the physical properties of the rock -including porosity and permeability- can be extracted.

In the present work, we study the rock samples which are analogues to the subsurface rocks from Lithuanian reservoirs. Three-dimensional image volume data has been acquired using Micro Xray Computed Tomography and machine learning algorithm has been used for computation of optimized porosity and permeability values from a three-dimensional digital volume(s) of the core sample(s). Once the porosity is estimated, the next step is to then understand the flow behavior of the rock in presence of different fluids like CO_2 and Hydrogen. To gain insight into different aspects of porosity and its distribution on overall flow behavior of the rock, three dimensional representative elementary subsurface volumes were generated as mini models. The behavior of the rock was then analyzed by conducting flow simulations on these mini-models.

Audience Take Away Notes

- Carbon Capture and Storage (CCS) is a potent method to reduce greenhouse gas emissions by capturing and storing carbon dioxide in subsurface reservoirs
- Digital Rock Physics can help in analyzing the reservoir behavior when injected with CO_2 or H_2 and in assessing the long-term storage capacity of a reservoir
- Image based 3D quantification of the porosity and permeability helps to understand the distribution of pore space and the flow behavior in presence of different fluids respectively
- Incorporating different subsurface uncertainties is possible during flow simulations to understand the impact of subsurface heterogeneity on fluid flow

Andrii Panchuk
Ivano-Frankivsk National Technical University of Oil and Gas, Ivano-Frankivsk, Ukraine

Use of "green" technologies for methanol production

TOil and gas companies account for a significant amount of greenhouse gas emissions. The main objective of the environmental policy of oil and gas companies is to ensure efficient operation, which includes reducing environmental risks in the course of production activities. Therefore, the use of various components made from renewable raw materials for hydrocarbon production and transportation offers a promising opportunity to improve the overall economy and sustainability. One of these components is methanol.

Largely for economic reasons, methanol is still produced almost exclusively from fossil fuels. At the same time, various types of renewable feedstocks, such as biomass, biogas, or organic municipal waste, can be used to produce methanol. The paper analyzes classical, green and hybrid technologies for methanol production.

Based on the results of the research, a new technology for the production of methanol was proposed, which includes the process of gasification of biomass and steam conversion of natural gas. To implement the technology, the equipment can be manufactured and used in the form of separate blocks. The resulting methanol includes a sustainable component. The application of this technology will improve the economic indicators of production, as well as reduce its negative impact on the environment and ensure optimal use of by-products.

R L Oliveri*, B Patella, S Carbone, S Geraci, G Aiello, F Pellitteri, M Caruso, R Miceli, R Inguanta

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Performance of nanostructured Ni alloy electrodes for hydrogen and oxygen evolution reaction in water-alkaline electrolyzer

Incentives toward the Hydrogen Economy offer a very interesting scenario for the coming years. Considerable research efforts are focusing on the efficient and economical production of carbon-free hydrogen production processes. In this context, the development of electrolyzers producing high-purity hydrogen with high efficiency and low-cost electrode/electrocatalyst materials is of high importance. Electrode materials play a key role in affecting electrolyzer performance, and considerable efforts have been made in recent years to obtain highly efficient and inexpensive catalytic materials.

In this work, template electrosynthesis is used to fabricate Ni alloy nanowires featuring a very high surface area characterized by high electrocatalytic activity. We found that water-alkaline electrolyzers with Ni nanowires electrodes covered by different electrocatalysts have good and stable performance at room temperature as well. To obtain different alloy compositions, NWs electrodeposition bath concentration was varied by tuning the amount of different concentrations of metals in the deposition solution and by adjusting electrodeposition parameters (current density and deposition time). Ni Foam (NF) and Ni Sheet (NS) differently functionalized by the same electrocatalist have been used for comparison. The main results concerning the fabrication process of nickel alloy nanowires electrodes for both hydrogen and oxygen evolution reaction will be presented and the performance in alkaline conditions discussed. For each electrode, electrochemical and electrocatalytic tests aimed to establishing the performance of the electrolyzers were carried out. In addition, an innovative alkaline electrolyzer is presented based on the use of nanostructured electrodes to tests simulating real operation. The lab-scale electrochemical reactor was made by a 3D printer and the electrolysis results from the cell operated in 30% w/w KOH aqueous solution were compared with those from a conventional one employing planar electrodes and identical conditions.

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Audience Take Away Notes

- The fabrication process of nanostructured electrodes obtained by electrochemical deposition will be explained
- Template electrodeposition can provide several advantages for the fabrication of highly complex structures of appropriate geometry
- Electrochemical deposition in template is a facile method for fabricating either two- or one-dimensional nanostructured materials because it allows to easily adjust the fundamental parameters controlling their final features
- Electrochemical processes are, usually, cheap and environmental friendly and they can be easily scaled-up from lab to industrial

Biography

Dr. Oliveri studied Physics at the University of Palermo, Italy and graduated in 2003. He then joined the research group of Prof. Gaetano Ferrante and Alessandro Busacca at the Department of Physics of the University of Palermo. He received his PhD degree in 2008 at the same institution. After five years postdoctoral fellowship supervised by Prof. Carmelo Sunseri and Rosalinda Inguanta at the Chemical Physical Laboratory, he obtained the position of Researcher.

Bernardo Patella[1]*, Antonino Parisi[1], Nadia Moukri[1], Alessandro Busacca[1], Federico Gitto[1], Maria Giuseppina Bruno[1], Alan O'Riordan[2], Rosalinda Inguanta[1]

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Reduction of graphene oxide supported on paper by CO_2 laser and its application as electrochemical sensing of phosphate ions

Nowadays, the development of new analytical devices able to carry out chemical analysis in situ and in real time with fast and cheap protocols is a theme of great importance. Indeed, chemical sensors are very important in many fields, from sanity to the environmental one. Actually, many of these analysis are carried out using ICP-MS, titration, HPLC or spectrophotometric analysis that, even if very accurate and sensitive, lack of portability, simplicity and cheapness. On the other hand, electrochemical cells can be used to make chemical sensors that quantify the concentration of an analyte by monitoring its oxidation or reduction. During last years, different electrochemical sensors were developed for different analyte, such as hydrogen peroxide, glucose, nitrate, nitrite ions among others. The properties of these sensors highly depend on the electrode material and morphology. Graphene based sensors have been studied for this kind of application showing excellent results. In this work, we show the fabrication of graphene based electrochemical cells composed of reduced graphene oxide working and counter electrodes and a printed Ag/AgCl reference electrode. The as obtained cell was deposited on different substrates, ranging from paper, textile, plastic and bandaid demonstrating the flexibility of the electrode synthesis. Particularly, a solution of graphene oxide was deposited by filtering (for paper) or by drop casting (on other substrates) on top of the substrates and then it was reduced to graphene using a programmable CO_2 laser. The speed and laser power were optimized for each substrate and electrode conductivity was measured using four-point probe method. After the reduction, the electrode conductivity increased from 10^{-5} S m^{-1} to 300 S m^{-1} demostrating the reduction of graphene oxide. The electrode was then characterized using RAMAN, XRD, XPS, EDS and SEM demostrating again the effective reduction of the graphene oxide layer. This protocol thus demonstrate the possibility to obtain a full electrochemical cell made of reduced graphene oxide on different substrate for different applications. Particularly, in this work, the paper based electrode was used to quantify phosphate ions in water samples. Indeed, this quantification is currently carried out using a long and difficult spectroscopy method that doesn't allow a in situ analysis. Here, we have used the phosphomolybdenum blue method that requries the addition of sulphuric acid and ammonium molybdate to the testing solution. Using this approach, adding these chemicals manually, the proposed sensor is able to quantify phosphate ions with a limit of detection of 0.4 μM. By the way, using this approach, the sample must still be manipulted in order to add sulphuric acid and ammonium molybdate. For this reason we have choose to use paper as substrate: paper was soaked with those two chemicals and, after drying, phosphate ions were quantified without adding any reagents to the solution. Results showed that the substrate released the chemicals to the solution allowing the quantification without any pre-treatment and thus enabling a in situ and real time analysis of phosphate ions in water.

Acknowledgments: This work was supported by University of Palermo, Tyndall National Institute and Dipietro Group.

Audience Take Away Notes

- Synthesis and fabrication of planar electrochemical cell composed of reference, counter and working electrodes made of reduced graphene oxide on different substrate
- Characterization of graphene/graphene oxide and reduced graphene oxide films
- Electrochemical sensing as analytical tool for in situ and fast analysis
- Electrochemical quantification of phosphate ions using the molybden blu method
- Advantages of paper based sensors

Biography

Dr. Bernardo Patella studied Chemical Engineering at the University of Palermo, Italy, and graduated in 2015. He has got the Ph.D in “Nanoscience and nanotechnology” in 2019 at the University of Catania. After Ph.D, he joined the research group “Applied Physical Chemistry” of Prof. Rosalinda Inguanta at the university of Palermo. After three years postdoctoral fellowship he obtained the position of an Assistant Professor at the same institue. Up to now, he has published more than 40 research articles in scopus indexed journals.

Yuli Marcela Henao Hoyos[1]*, José Gregorio Carriazo Baños[1], Marco Antonio Marquez Godoy[2]

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Photo-oxidation of cyanide in aqueous solution under visible light using Fe-TiO_2 synthesized from ilmenite

Cyanide is a highly toxic substance widely used in the gold mining. Heterogeneous photocatalysis with TiO_2 is an attracted alternative to degrade contaminants in lesser toxic substances. TiO_2 needs UV light to be active which is undesirable. However, when it is doped with iron can absorb visible light.

In this work were synthesized several powders type Fe-TiO_2 with different content of iron (400FT75_0.03, 400FT75_0.08, 400FT85_3.7 and 400FT85_6.4). The powders were obtained from ilmenite originating of alluvial mining wastes using acid extraction under soft conditions. The materials synthesized were characterized by several technics. X-Ray Diffraction patterns (XRD) of TiO_2 anatase used as reference and the synthesized materials confirm the anatase phase for all of the synthesized materials. The content of iron in the materials was determinated by X-ray fluorescence showing a different amount of Fe for each material (0.03, 0.08, 3.7 and 6.4 mol %). Sortometry analysis showed a higher specific surface area for all powders with respect to the reference anatase. The optical properties of synthesized powders were obtained using UV-Vis diffuse reflectance spectroscopy and the results exhibit a red shiftment and a decrease in the band gap energy due to the presence of Fe. The powders were evaluated in the photo-oxidation of 50 ppm of cyanide in aqueous solution. The reactions were conducted under visible light of low intensity (4 W) at room temperature during 4 hours. With the purpose of follow the reactions, aliquots of solution were taken from time to time, measuring the cyanide concentration by UV-Vis spectroscopy. The higher conversion of cyanide (47 %) was reached for the powder 400FT85_3.7 with 3.7 mol % of Fe, while the lower was obtained for the anatase used as reference (23 %). In conclusion, all the materials synthesized in this work had a higher specific surface area and a lower band gap energy and also were more active in the photocatalytic photo-oxidation of cyanide under visible illumination of low intensity with respect to pure anatase.

Audience Take Away Notes

- The audience will learn about the potential use of ilmenite originating from alluvial mining wastes for the synthesis of photocatalysts more actives in the visible light region than TiO_2 in anatase phase
- The use of wastes of alluvial mining for the synthesis of active materials, represents a value on the waste. Further, the fact that the experimental conditions employed are soft, could help to develop new designs to contribute to decreasing the environmental impact of toxic substances like cyanide
- The process of synthesis of materials type Fe-TiO2 active in the visible region using ilmenite from alluvial gold wastes could be scaled and optimized, giving an added value on a mineral present in alluvial gold mining wastes. It could be elaborated a process for the production on Fe-TiO2 and to promote the remediation of waters contaminated with cyanide

Biography

MSc. Yuli studied Chemistry at the University of Antioquia, Colombia and graduated as Master in Sciences - Chemistry in 2017 at the National University of Colombia, Medellin, Colombia. She is finishing her doctoral studies in Sciences – Chemistry at the Universidad Nacional de Colombia, Bogotá D.C., Colombia.

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Performance of Nickel-Iron nanostructured electrodes at different temperatures

In recent years, the whole world has been trying to reduce CO_2 emissions through the global decarbonization of energy processes. In this view, the interest in green hydrogen has drastically increased. One way to produce green hydrogen is by water electrolysis using only electricity from renewable sources. The storage of renewable solar or wind electricity is a major challenge to building a sustainable future energy system. The electrochemical production of hydrogen, through electrolyzers, is a viable strategy to take advantage of the surplus electricity coming from renewable energy sources. Its production is pollution-free but is not economically viable. The development of more efficient electrolyzers with low-cost electrode materials plays a key role. Catalysts must have such as good electrocatalytic properties, high conductivity, high availability, low cost, and good chemical stability. Nowadays, research is focused on improving Alkaline Water Electrolysis (AE) to reduce the cost of electrode production. In the alkaline environment, it was demonstrated that transition metals, and in particular Nickel or nickel-based alloy nanostructured electrodes, have good and stable performances. Furthermore, industrial alkaline electrolyzers work at temperatures between 40 and 90°C. Therefore, electrodes must be mechanically and chemically stable at these temperatures.

An approach to improve AE performance consists of the fabrication of nanostructured electrodes because they are characterized by high electrocatalytic activity due to the very high surface area. Starting from the results obtained in previous work, the nanostructured alloy of NiFe was tested both as cathode and anode at three different temperatures (25°C, 40°C, 60°C). Nanostructured electrodes were obtained through a simple and cheap method, template electrosynthesis, using a polycarbonate membrane as a template. NiFe electrode morphology was studied by scanning electrode microscopy (SEM) and their composition was evaluated by Energy Diffraction Spectroscopy (EDS) analyses. Later, the electrodes were characterized using various electrochemical techniques: Cyclic Voltammetry (CV), Quasi Steady State Polarization (QSSP) and Galvanostatic Step. To evaluate the mid-term behavior of the electrodes, especially at high temperatures, a constant current density was applied for 6 hours. In particular, -50 mA cm^{-2} for Hydrogen Evolution Reaction (HER) and 50 mA cm^{-2} for Oxygen Evolution Reaction (OER). All the tests were performed in 30% w/w KOH aqueous solution. Temperature increase plays a key role in increasing the efficiency of both anode and cathode reactions. As expected, the best result was obtained at 60°C.

Audience Take Away Notes

- Fabrication of Nanostructured electrodes obtained with electrochemical deposition
- Template deposition can provide advantages for the fabrication of highly complex structures
- Electrochemical deposition in template is an easygoing method to produce nanostructures because it allows to adjust main parameters, controlling their final features
- Electrochemical process can be easily scaled-up from laboratory to industry

Biography

Salvatore Geraci studied Chemical Engineering at the University of Palermo, Italy and graduated as Process Chemical Engineer in 2022. He started the PhD Course in Chemical, environmental, biomedical, hydraulic and materials engineering in 2023 in the same university and joined the research group of Prof. Rosalinda Inguanta in the applied physical chemistry laboratory.

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Analytical kinetic thermometric methods: A review

Kinetic enthalpimetric methods may offer some interesting performances, like to be blind to the color and/or turbidity of the samples. This contribution paper will be related with the description of some enthalpimetric kinetic methods and their instrumentation. It will include a review on direct injection catalytic enthalpimetry, thermometric titration with catalytic endpoint detection, catalytic enthalpimetric flow injection analysis, continuous flow enthalpimetries, chip calorimetry, and trends of kinetic thermometric detection.

Audience Take Away Notes

- They will learn the advantages and drawbacks of using kinetic thermometric methods of analysis
- By using these techniques they will be able to make determinations of colored and/or turbid samples
- They will learn the different kinetic enthalpimetric methods of analysis

Biography

Victor Cerda, born in Palma de Mallorca, Spain. Graduated and PhD in Chemistry by the University of Barcelona. Lecturer of several universities: Barcelona, Tarragona, Valladolid. Full Professor of Analytical Chemistry in 1982 at the University of the Balearic Islands (UIB). He has conducted 41 Ph.D. Thesis, written 14 books, and has collaborated with 14 chapters in other scientific books. He has published 620 papers and presented 850 contributions in national and international symposia. Chief Researcher of projects funded by the CAICyT, DGICyT, CICyT, BCR (EU), ALFA (EU), AECI, MCyT, and conducted a number of contracts usually related with environmental subjects with different firms (TIRME, MAC INSULAR, ENDESA, etc) and institutions (BCR, Nuclear Security Council, etc). His main research lines is related with the development of new automatic methods in Analytical Chemistry and their application to environmental and pharmaceutical samples. Has been organizer and chairman of more than 15 international symposia. Has been the Head of the Department of Analytical Chemistry and the first Head of the Department of Chemistry of the UIB. Has been Vice-President of the Spanish Society of Analytical Chemistry.

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Thermomechanical analysis of wire arc additive manufacturing of the bell mouth component of offshore facilities

The design freedom provided by Additive Manufacturing (AM) in the production of metallic parts represents a big step in the modern method of rapid manufacturing. These AM attributes can be used to great advantage in offshore facilities in the oil and gas sector, as parts inventory can be reduced, as well as equipment maintenance operations can be better managed. Among the AM techniques, Wire Arc Additive Manufacturing (WAAM), based on a welding process, stands out for enabling the manufacture of large- scale metallic parts or adding material to pre-made workpieces with a high deposition rate and low feed material cost. However, the large amount of energy and material added during metallic deposition causes residual stress and distortion that can compromise the product's functionality and structural integrity. Numerical simulation using finite element method (FEM) offers a tool for stress and distortion predictions that occur during arc welding thermal cycles. The simulation results can be used to identify the optimized material deposition strategies as well as the manufacturing parameters that minimize part defects.

In this work, a FEM model is proposed to simulate the WAAM process in order to predict the temperature field, residual stresses and distortions in offshore facilities equipment parts. The influence of microstructural transformation on mechanical analysis is included through the mechanical properties of the filler material. The numerical simulation is implemented in a three-dimensional model of a thin wall by a transient thermal analysis coupled in series with mechanical analysis. The material deposition is modeled by element Birth and Death Techniques (B&DT) combined with homogeneously distributed heat in the activating elements. The double ellipsoid model is adopted for heat generation on already activated elements. The material deposition and heat source modeling were developed by an integrated routine in the commercial finite element software ANSYS. The model evaluation is accomplished by comparing the results obtained in the part temperature field and distortion, layer by layer, from numerical analysis. Finally, numerical simulations with different deposition strategies are carried out to investigate the influence of each layer's deposition direction on the final defects in the parts.

Audience Take Away Notes

- They will be introduced to Additive Manufacturing tools that can be applied in the oil and gas industry
- They will get to know modern modeling by finite element methods applied in Additive Manufacturing
- They will get to know numerical techniques that allows distortions and residual stresses predictions in parts of the oil and gas industry
- They will get to know material deposition strategies optimizations in Additive Manufacturing in order to reduce parts defects
- They will obtain experimental results of temperature and distortion fields for Wire Arc Additive Manufacturing

Biography

Mr. Vitor Seiji A. Tatemoto graduated in mechanical engineering at the Federal University of Santa Catarina (UFSC) in 2020. He is currently a master's student in Mechanical Engineering in the structural mechanics field at the department of mechanical engineering at UFSC, as member of the Group of Analysis and Mechanical Project (GRANTE). He is currently engaged in the Petrobras company project: Process of alternative repairs. He also graduated in mechanical engineering at the National School of Engineers of Saint-Étienne (ENISE) in 2020, through a double degree program where he began his studies and research in additive manufacturing.

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"We wish to meet you again at our upcoming event next year..."

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