International Workshop

Sustainable Engineering for Oil & Gas Industry

Sunday, May 17, 2026

Chair:

Prof. Dr. Zhaozhong Yang (Southwest Petroleum University)

Prof. Dr. Saad Ramadhan Ahmed (Tikrit University, Iraq)

Part I

Session 1

Time: 14:00 – 17:00 (Beijing Time, GMT+8)

Host: Dr. Saba A. Gheni, Dr. Junlei Tang, Dr. Rui Liu,

Time (BJT)	Activity / Role	Topic & Details
14:00 - 14:10	**Opening Ceremony**	Welcome Address by Workshop Chair
14:10 - 14:30	Invited Lecture 01 Unlocking Hydrocarbon Potential: Bridging Palynology and Geochemistry for a changing Energy landscape	**Ahmed Mansour (Egypt)** Minia University, Egypt & Southwest Petroleum University, China-Iraq Belt and Road Joint Laboratory on Oil and Gas Energy
14:30 - 14:50	Oral Lecture 02 Prediction and Analysis of Rate of Penetration via Machine Learning Methods	**Bohan CHEN (China)** Southwest Petroleum University, Petroleum Engineering School
14:50 - 15:10	Invited Lecture 03 From Energy Projects to Industrial Energy Platforms: A Systems Framework for Resource-Based Development	**Lonnie Coplen (USA)** ARC Alternative and Renewable Construction LLC

15:10 - 15:30	Invited Lecture 04 Microscope residual oil distribution and optimization of water quality criterion for dominant channels control in porous-type carbonate reservoir	**Hao LU (China)** Southwest Petroleum University, China-Iraq Belt and Road Joint Laboratory on Oil and Gas Energy & School of Geoscience and Technology
15:30 - 15:40	Break	10-Minute Intermission
15:40 - 16:00	Invited Lecture 05 Prediction of Drill Cuttings Settling Velocity via Machine Learning Algorithms	**Jinze SONG (China)** Southwest Petroleum University, China-Iraq Belt and Road Joint Laboratory on Oil and Gas Energy & Petroleum Engineering School
16:00 - 16:20	Invited Lecture 06 Integrated Wastewater-to-Hydrogen and CO_2-to-Fuel Conversion: Photo-electrocatalytic Pathways for Circular Decarbonization of the Oil and Gas Industry	**Farah Talib Jasim Al-Sudani (Iraq)** College of Chemical Engineering & Department of chemical process engineering, University of Technology, Baghdad, Iraq
16:20 - 16:40	Oral Lecture 07 Swelling Behavior and Deterioration Mechanisms of HNBR in Methanol Transportation Pipelines: Implications for Material Compatibility and Sealing Integrity	**Xueling WU (China)** Southwest Petroleum University, Petroleum Engineering School
16:40 - 17:00	Invited Lecture 08 Air and Gas Drilling Technology: Application and Practice in China, and Its Application Scheme for Curing Lost Circulation, Water Conservation in Iraq well Drilling	**Jun XIN (China)** CNPC Chuanqing Drilling Engineering Company Limited Iraq Branch (CCDC)
17:00-17:20	Invited Lecture 09 Covalent Organic Frameworks (COFs) in petrochemical fields: Challenges for the Oil and Gas Industry	**Ataf Ali Altaf (Pakistan)** Khwaja Fareed University of Engineering and Information Technology Rahim Yar Khan

Part II

Session 2

Time: 19:00 – 22:00 (Beijing Time, GMT+8)

Host: Dr. Bin Lin, Dr. Ali Hussein

Time (BJT)	Activity / Role	Topic & Details
19:00 - 19:10	**Session Introduction**	Evening Session Remarks by Host
19:10 - 19:30	Invited Lecture 10 Advances in CO_2 Enhanced Oil & Gas Recovery and Geological Sequestration	**Cheng CAO (China)** Southwest Petroleum University, China-Iraq Belt and Road Joint Laboratory on Oil and Gas Energy & Petroleum Engineering School
19:30 - 19:50	Invited Lecture 11 Enhancing Corrosion Control in Crude Oil Distillation Units Through Multi-Neutralizer pH Optimization	**Dr. Ali Hussein (Iraq)** North refinery company, Ministry of oil, Iraq, Senior Director Southwest Petroleum University, China-Iraq Belt and Road Joint Laboratory on Oil and Gas Energy
19:50 - 20:10	Invited Lecture 12 Unveiling Galvanic Effect Induced Dual-shields Strategy on HEA@C for Highly-Efficient and Ultra-Stable Acidic Hydrogen Evolution under Fluctuating Power	**Yiping HU (China)** Southwest Petroleum University, China-Iraq Belt and Road Joint Laboratory on Oil and Gas Energy & College of Chemistry and Chemical Engineering
20:10 - 20:30	Invited Lecture 13 China Natural Gas Industry Analysis and Outlook Report Blue Book	**Xiaoqiang ZHENG (China)** Southwest Petroleum University, China-Iraq Belt and Road Joint Laboratory on Oil and Gas Energy & School of Economics and Management
20:30 - 20:40	Break	10-Minute Intermission

20:40 - 21:00	Invited Lecture 14 Practical Challenges in Corrosion Towards Clean Energy in Refineries	**Saba Abdul Hussein A. Al-Najafi (Iraq)** Heavy Engineering Equipment State Company, Ministry of Oil, Iraq & Middle Technical University, Iraq
21:00 - 21:20	Invited Lecture 15 Low-Cost and Intrinsically Safe Aqueous Organic Redox Flow Batteries: From Intelligent Molecular Regulation to Application Demonstration	**Jiangxuan SONG (China)** Xi'an Jiaotong University
21:20 - 21:40	Invited Lecture 16 Toward Clean Oil Production: An Experimental and Simulation Study on Mixing and RTD Behavior in an Innovative Oscillatory Baffled Reactor for Improved Fuel Refinement.	**Safaa M.R. Ahmed (Iraq)** University of Tikrit, Tikrit, Iraq
21:40 - 22:00	Oral Lecture 17 Large-scale catalytic electrodes for efficient hydrogen precipitation in Cl^- contained water electrolysis	**Sihan LIANG (China)** Southwest Petroleum University, College of Chemistry and Chemical Engineering
		Closing Remarks

- **Host:** Introduces individual speakers and moderates the Q&A discussion during the 20-minute slots.

Software for online meetings

All participants of the Online Workshop: Sustainable Engineering for Oil & Gas Industry under the Sustainable Engineering and Green Growth 2026 (ICSEGG2026) are kindly requested to attend the session using the VooV Meeting platform (See the VooV Meeting User Guideline below). Participants from China, please use Tencent Meeting.

Non-Chinese participants:

Click the link to join the meeting, or add it to your meeting list:

https://meeting.tencent.com/dm/HLoQqaL7MiFu

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Chinese participants （中国参会人员使用腾讯会议）:

Click the link to join the meeting, or add it to your meeting list （点击链接入会，或添加至会议列表）:

https://meeting.tencent.com/dm/HLoQqaL7MiFu

Tencent Meeting ID （腾讯会议）: 907-322-390

Please NOTE: The meeting ID is same.

VooV Meeting installation guidelines

VooV Meeting is an online video conferencing platform made by Tencent. It is basically Tencent's international version of Tencent Meeting, similar to Zoom or Google Meet. you can often use VooV Meeting without installing the app, by joining directly from your web browser. Tencent officially supports a "Join from Browser" option. Best browser to use (Google Chrome) is the most recommended and supported browser for browser joining.

For conferences

If it is an important academic conference, interview, or presentation:

- installing the desktop app is usually safer,
- because browser mode can occasionally have audio/video issues.

Step 1 — Go to the official download page

VooV Meeting Official Download Page
You will see versions for:

- Windows
- macOS
- Android
- iPhone/iPad

Step 2 — Download the correct version

On Windows

1. Click **Windows Download**
2. Wait for the `.exe` installer to finish downloading
3. Open the installer file
4. Click:
    - **Yes** (if Windows asks permission)
    - then **Install**

On Mac

1. Click **Mac Download**
2. Open the `.dmg` file
3. Drag VooV Meeting into the Applications folder

Step 3 — Open the application

After installation:

1. Launch **VooV Meeting**
2. Choose language (usually English is available)

3. Allow:
    - microphone access
    - camera access
    - notifications (optional)

Step 4 — Create an account (recommended)

You can sometimes join meetings as a guest, but creating an account is better for conferences.
Common sign-in methods:

- Email
- Google account
- Apple ID
- Phone number (depends on region)

Step 5 — Join a meeting

You usually receive from the conference organizer:

- a meeting link,
- or a Meeting ID + password.

Method A — Using the link

1. Click the meeting link
2. VooV opens automatically
3. Enter your display name
4. Click **Join Meeting**

Method B — Using Meeting ID

1. Open VooV
2. Click **Join**
3. Enter:
    - Meeting ID
    - Your name
    - Password (if required)

How to join without installing

1. Open the meeting invitation link from the organizer.
2. When the page opens, look for:
    - **“Join From Browser”**
    - or **“Join Now”**
3. Enter:
    - your name,
    - meeting ID/password if requested,

    - microphone/camera permissions.
4. Join the meeting directly in the browser.

Tencent also provides a direct browser join page:

https://voovmeeting.com/user-center/join?utm_source=chatgpt.com&record-list=https%3A%2F%2Fvoovmeeting.com%2Flogin.html%3Fredirect_link%3Dhttps%253A%252F%252Fvoovmeeting.com%252Fmeeting-record%252Flist%253Freload%253D1

Lecture Information 01

I. Presentation Title

Unlocking Hydrocarbon Potential: Bridging Palynology and Geochemistry for a changing Energy landscape

Ahmed Mansour

Southwest Petroleum University, School of Geocience and Technology, China. 610500.

Minia University, Faculty of Science, Egypt, 61519.

II. Abstract

The growing global demand for sustainable energy systems encourages the transition toward low-carbon emission technologies and more efficient resource utilization. At the same time, fossil fuels remain essential to the global energy sustainability, highlighting the need for more efficient and lower-impact exploration and production strategies.

This presentation explores how traditional approaches to source rock evaluation are evolving in response to shifting energy demands, increasing environmental constraints, and the need for more efficient hydrocarbon exploration. Here, we highlight the integration of palynology, palynofacies analysis, and organic and inorganic geochemistry as powerful tools for refining petroleum systems analysis and reducing exploration risk.

The first part will revisit conventional source rock assessment methods (TOC, Rock-Eval, kerogen typing), outlining their strengths in complex or data-sparse basins followed by a discussion on how advanced palynological approaches, including palynofacies analysis, can better constrain organic matter input, depositional environments, and preservation conditions. The presentation then focuses on emerging geochemical techniques, such as elemental proxies and integrated multi-proxy datasets, to improve predictions of source rock quality, maturity, and spatial heterogeneity. Special emphasis is placed on linking climate, depositional systems, and organic matter accumulation, which is critical for understanding unconventional resource plays. Therefore, the key theme of this presentation is the transition toward multidisciplinary data integration and predictive modeling to build more robust inter-basin investigations and identify sweet spots with greater confidence.

III. Speaker Biography

Associate Prof. Ahmed Mansour is a Foreign Young talent scholar works as an Associate Professor of palynology and sedimentary geochemistry at the School of Geoscience and Technology, Southwest Petroleum University (Chengdu, China) from

January 2023 to present. He awarded his Bachelor and Master degrees in Petroleum Geology and Palynology from the Faculty of Science, Minia University (Egypt) in 2012 and 2015, respectively. He awarded his PhD in Palynology and Sedimentary Geochemistry from Minia University (Egypt) in 2019 and received a six-month training scholarship as a visiting PhD student at the University of Vienna (2018–2019). From 2013 to 2022, he worked as a full-time Teaching Assistant and Lecturer/Assistant Professor at the Geology Department, Minia University.

The applicant has secured multiple competitive research grants as Principal Investigator, including the National Natural Science Foundation of China (International Young Scientists Fund, 2025), the China Science and Technology Exchange Center Youth Scientist Program (2026–2027), and the Ernst Mach Grant funded by OeAD at the University of Vienna (2021–2022). He also received international research training support from the Czech Academy of Sciences, Prague (Czech Republic).

He has 77 peer-reviewed SCI-indexed papers, along with two book chapters. At Southwest Petroleum University, he established a dedicated palynology laboratory equipped with advanced microscopy systems for fossil pollen and spore analysis as well as palynofacies microscopy. He has actively supervised several MSc and PhD candidates and training them in palynological techniques and research methods.

The applicant has also played a key role in promoting international collaboration, particularly between Chinese and Egyptian institutions, facilitating academic exchange visits and joint research initiatives.

In addition to academic work, he has extensive industry experience as a consulting palynologist for Core Laboratories Inc. (USA) and several universities, including Chengdu University of Technology, contributing to kerogen analysis and stratigraphic studies across multiple geological intervals.

He has received repeated recognition for his scientific output, including eight consecutive awards (2018–2025) from Minia University for outstanding international SCI publications.

IV. Technical Requirements & Photo

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Google scholar: https://scholar.google.com/citations?hl=en&user=c9YahZ4AAAAJ

Lecture Information 02

I. Presentation Title

Prediction and Analysis of Rate of Penetration via Machine Learning Methods

Bohan Chen

Petroleum and Natural Gas Engineering School, Southwest Petroleum University, China

II. Abstract

With the rising global energy demand, oil and gas exploration has progressively expanded into low-permeability, deep/ultra-deep, and unconventional reservoirs, where drilling operations encounter increasingly complex geological conditions, leading to low rates of penetration (ROP) and high costs. This presentation focuses on leveraging interpretable machine learning to predict and analyze ROP, aiming to optimize drilling strategies, improve efficiency, and enhance safety.

The study utilizes actual drilling data from five wells in northwestern China and constructs three predictive models: Back Propagation Neural Network (BPNN), Support Vector Regression (SVR), and Random Forest Regression (RFR). Among them, the RFR model achieves the best performance with an R^2 of 0.9971, and the lowest RMSE and MAE, significantly outperforming the other two models.

To overcome the "black-box" nature of traditional machine learning, the SHAP (SHapley Additive exPlanations) method is employed for interpretability analysis. The results consistently reveal that hook load is the most influential factor on ROP, exhibiting a strong negative correlation, while top drive torque shows a stable positive effect across all models, indicating its critical role in enhancing drilling efficiency. Parameters such as weight on bit, riser pressure, and inlet flow exhibit complex nonlinear relationships with ROP. Additional validation with XGBoost and LightGBM models shows feature importance rankings (hook load > riser pressure) consistent with those of the RFR model, further strengthening the reliability of the findings.

Based on the above analysis, hook load and riser pressure are selected as target parameters for optimization. Genetic Algorithm (GA) and Differential Evolution (DE) are applied separately. The DE algorithm yields superior results, increasing the ROP to 27.4 m/h, approximately 20.65% higher than the 22.7 m/h achieved by GA.

This study demonstrates that the RFR model combined with SHAP not only provides high prediction accuracy but also effectively reveals the intrinsic relationship between influencing factors and ROP, offering a scientific basis for real-time drilling parameter optimization and decision-making.

III. Speaker Biography

Bohan Chen is a master's candidate in the Petroleum and Natural Gas Engineering School at Southwest Petroleum University, China. His research focuses on intelligent drilling engineering, machine learning applications in ROP prediction, and drilling parameter optimization. He has participated in related research projects and contributed to developing an interpretable ROP prediction model that integrates SHAP analysis and optimization algorithms.

IV. Technical Requirements & Photo

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Lecture Information 03

I. Presentation Title

WORKING TITLE: Integrated Energy and Hydrocarbon Processing Infrastructure for Industrial Platform Development in Resource-Producing Regions

FINAL TITLE: From Energy Projects to Industrial Energy Platforms: A Systems Framework for Resource-Based Development

II. Abstract

This lecture presents a systems-based framework for rethinking energy and industrial development in resource-producing regions, with a focus on Iraq. Conventional infrastructure models rely on centralized processing, long-distance transport, and fragmented system design, resulting in inefficiencies, emissions, and limited local economic value creation.

An alternative approach is proposed based on integrated industrial energy platforms. In this model, energy production, hydrocarbon processing, and industrial activity are co-designed within coordinated systems that incorporate multiple energy sources, including oil and gas, renewables, and waste-to-energy. Rather than optimizing individual assets, the framework emphasizes the development of industrial clusters that integrate energy, feedstock, logistics, labor, and market access.

A central contribution of this framework is the integration of Measurement, Reporting, and Verification (MRV) within a lifecycle governance structure. Drawing on established standards such as ISO 14001 and ISO 55000, this approach establishes a continuous linkage between capital investment, operational performance, emissions outcomes, and financial value. This governance layer addresses a critical constraint in infrastructure development: the inability to generate investor confidence due to inconsistent performance data and weak accountability mechanisms.

The lecture also examines the role of distributed energy resources, digital monitoring systems, and real-time optimization in enabling coordinated, flexible energy systems. These technologies support the transition from centralized infrastructure to interconnected networks capable of improving reliability and reducing system costs.

Rather than proposing specific projects, the framework provides a structured lens for evaluating industrial development opportunities. Conceptual examples are used to illustrate how integrated systems can reduce flaring, improve energy reliability, support local industry, and create financeable infrastructure assets.

The implications for Iraq are significant. By adopting a systems-based approach that integrates engineering design, governance, and financial structuring, Iraq can

enhance energy sovereignty, attract private capital, and develop industrial capacity aligned with global market expectations.

III. Speaker Biography.

Lonnie Coplen is the President and CEO of ARC Alternative and Renewable Construction LLC, a U.S.-based firm focused on sustainable infrastructure development, integrated energy systems, and project governance. Her work centers on bridging engineering design, operational performance, and financial structuring to enable real-world infrastructure delivery.

With over two decades of experience across transportation, environmental engineering, and energy systems, Lonnie has worked on major public infrastructure programs and complex project environments in both the United States and internationally, including post-conflict reconstruction efforts in Iraq. Her background includes project management, system oversight, and development of performance-based governance frameworks that integrate cost control, sustainability, and operational reliability.

Her recent work focuses on the development of integrated industrial energy platforms that combine distributed energy systems, hydrocarbon processing, and industrial production. A key area of interest is the application of lifecycle governance frameworks—drawing on ISO 14001 and ISO 55000—to enable investment-grade Measurement, Reporting, and Verification (MRV) systems that support scalable infrastructure financing and carbon-linked asset development.

Lonnie's work emphasizes practical implementation, systems thinking, and the alignment of engineering performance with financial outcomes. She is particularly focused on enabling resource-producing regions to capture greater local value from their energy assets through integrated, financeable infrastructure models.

IV. Technical Requirements & Photo

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Lecture Information 04

I. Presentation Title

Microscope residual oil distribution and optimization of water quality criterion for dominant channels control in porous-type carbonate reservoir

Hao Lu

Southwest Petroleum University, China-Iraq Belt and Road Joint Laboratory on Oil and Gas Energy

II. Abstract

The carbonate reservoirs in central Iraq has diverse pore type combinations and complex pore structures, leading to complex distribution pattern of remaining oil and low oil recovery.

This study conducted a detailed investigation into the distribution of remaining oil in carbonate reservoirs in central Iraq and proposed a method to enhance oil recovery through the optimization of water quality parameters. The research indicates that the central Iraqi reservoirs exhibit strong heterogeneity, with the main pore combinations being: moldic pore-interparticle pore, matrix dissolution pore-moldic pore, and intrafossil pore-moldic pore. The identified remaining oil types include: clustered oil, moldic pores oil, intrafossil oil, film-like oil, dead pore oil, and islands oil. The distribution of remaining oil varies significantly among different pore combinations, with dominant channels being one of the primary causes of remaining oil formation. The current water injection practice using existing water quality parameters results in low oil recovery. By optimizing the suspended solids concentration within the existing water quality parameters, effective plugging of the dominant channels was achieved, thereby improving oil recovery. Furthermore, the microscopic mechanism by which water quality parameter optimization enhances oil recovery was elucidated.

This study will provide a theoretical foundation for improving oil recovery via the injection of produced water in oilfields.

III. Speaker Biography

Lu Hao, male, Han ethnicity, Ph.D. His research primarily focuses on oil and gas field development geology, carbonate reservoir geology, and oil and gas reservoir protection technology. He has received one second prize of the Sichuan Provincial Science and Technology Progress Award (ranked 2nd), one third prize of the Chongqing Municipal Science and Technology Progress Award (ranked 2nd), and two provincial-level association awards. He has published over 20 academic papers in domestic and international journals, including more than 10 SCI-indexed papers. Among these, he has published 7 SCI papers as the first author in journals such as

Energy & Fuels. He holds 4 authorized invention patents. He serves as a reviewer for journals including Energy for Sustainable Development and Frontiers in Earth Science.

IV. Technical Requirements & Photo

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Lecture Information 05

I. Presentation Title

Prediction of Drill Cuttings Settling Velocity in Deep Well via Machine Learning Algorithms

Dr Jinze Song
Permanent research scientist at the China-Iraq Belt and Road Joint Laboratory on Oil & Gas Energy
Deputy Director of the Drilling & Completion Research Center
Southwest Petroleum University, China

II. Abstract

The extensive drill cuttings settling leads to sticking pipe and other accidents, resulting in high economic losses, especially in ultra-deep wells. Therefore, it is crucial to accurately estimate the drill cuttings settling velocity to determine the minimum mud flow rate required for cleaning the well. Traditional mathematical methods of predicting settling velocity require repetitive and time-consuming iterations. This study aims to use machine learning algorithms to develop a model for estimating the rate of drill-cutting settlement and to compare the advantages of different algorithms to find the most suitable predictive model. The study compares the performance of five machine learning algorithms, namely artificial neural network (ANN), classification and regression tree (CART), extreme gradient decision tree (XGboost), K-nearest neighbors (KNN) and support vector regression (SVR), on the prediction of drill cuttings settling velocity based on a specific dataset and constructing five input parameters, namely drill cuttings sphericity, drill cuttings density, drill cuttings diameter, drilling fluid viscosity and density. Evaluating the model by two performance metrics, R^2 and RMSE, the results show that the XGboost algorithm has the highest prediction accuracy, with an R^2 of 0.9808 and an RMSE of 0.0194, and also outperforms other algorithms in terms of model training speed. By comparing it with the algorithms in the literature, the XGboost model has better accuracy in predicting the settling of drill cuttings. At the same time, the SHAP method was used to analyze the contribution of each eigenvalue to the model, and it was found that the drill cuttings' sphericity had the most significant influence on the drill cuttings settling velocity and was positively correlated; the mud viscosity was second and negatively correlated, and the mud density had the minor contribution. In conclusion, the XGboost model is an ideal choice for predicting the settling velocity of rock cuttings, and the algorithm in this study is reproducible, which provides an effective method for predicting the settling velocity of rock cuttings in drilling engineering.

III. Speaker Biography

Dr. Jinze Song is a Permanent research scientist at the China-Iraq Belt and Road Joint Laboratory on Oil & Gas Energy and Deputy Director of the Drilling & Completion Research Center at Southwest Petroleum University, China. His research focuses on intelligent drilling, smart analysis of hydraulic fracturing, and optimization algorithms.

IV. Technical Requirements & Photo

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Lecture Information 06

I. Presentation Title

Integrated Wastewater-to-Hydrogen and CO_2-to-Fuel Conversion: Photo-electrocatalytic Pathways for Circular Decarbonization of the Oil and Gas Industry

II. Abstract

The oil and gas industry is facing a critical transition in which environmental protection, clean energy production, and carbon management can no longer be treated as separate challenges. Large volumes of produced water, refinery wastewater, oily effluents, and CO_2 emissions are generated across petroleum operations, creating both environmental pressure and an opportunity for resource recovery. This lecture presents an integrated photo-electrocatalytic strategy that links wastewater-to-hydrogen production with CO_2-to-fuel conversion as a circular pathway for sustainable oil and gas decarbonization.

In this concept, organic pollutants in wastewater are not viewed only as contaminants, but as reactive species that can assist the oxidation process and promote charge separation during photo-electrocatalysis. While pollutants are degraded at the catalyst or photoanode surface, the generated electrons can be directed toward hydrogen evolution. The produced hydrogen can then serve as a clean energy carrier or as a reducing agent for captured CO_2 conversion into value-added products such as syngas, methanol, methane, or liquid fuels. Therefore, wastewater treatment, hydrogen generation, and carbon recycling are combined within one sustainable engineering framework.

The lecture highlights the role of semiconductor catalysts, heterojunction design, electrode architecture, interfacial charge transfer, and reactor configuration in improving pollutant degradation efficiency and hydrogen production. It also discusses how the generated H_2 can support downstream CO_2 utilization through photocatalytic, electrocatalytic, catalytic, or plasma-assisted routes. Particular emphasis is placed on oil and gas applications, where contaminated water streams and CO_2 emissions coexist and where renewable-energy-assisted treatment technologies can provide practical routes toward cleaner production.

Despite its strong potential, this integrated approach still requires further development before industrial implementation. Key challenges include catalyst stability in complex wastewater matrices, electrode fouling, hydrogen purity, CO_2 conversion selectivity, long-term operation, and reactor scale-up under realistic field conditions. Overall, coupling wastewater valorisation with hydrogen production and CO_2-to-fuel conversion offers a promising route for transforming waste and carbon

emissions into valuable energy carriers, supporting the future development of circular, low-carbon, and hydrogen-based oil and gas systems.

III. Speaker Biography

Associate Professor Dr. Farah Talib Jasim Al-Sudani is a faculty member in the Department of Chemical Engineering, University of Technology, Baghdad, Iraq. She received her B.Sc., M.Sc., and Ph.D. degrees in Chemical Engineering from the University of Technology, Iraq, in 1998, 2002, and 2007, respectively, and completed postdoctoral research at Newcastle University, United Kingdom, from 2020 to 2022 .

Her research interests cover multiphase reactors, trickle-bed reactor hydrodynamics, periodic reactor operation, CO_2 capture, CO_2 conversion to clean fuels, wastewater treatment using catalytic wet oxidation, photocatalysis and photo-electrocatalysis, Fischer–Tropsch synthesis, biofuel production, and plasma technology for CO_2 conversion and organic compound removal. She has extensive academic experience in teaching mass transfer, unit operations, transport phenomena, reactor design, and chemical reaction kinetics, and has supervised several postgraduate projects related to wastewater treatment, CO_2 capture, biodiesel production, photocatalytic fuel cells, hydrogen generation, and advanced adsorbent development.

Dr. Al-Sudani has published research in areas including CO_2 absorption and capture, wastewater treatment, plasma-assisted pollutant removal, biodiesel production, Fischer–Tropsch synthesis, and sustainable catalytic processes. Her recent publications include studies and reviews on biodiesel production, post-combustion CO_2 capture, zeolite-based CO_2 adsorbents, hybrid adsorbents, and plasma-assisted CO_2 splitting for sustainable carbon utilization.

IV. Technical Requirements & Photo

- **Portrait:**

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Lecture Information 07

I. Presentation Title

Swelling Behavior and Deterioration Mechanisms of HNBR in Methanol Transportation Pipelines: Implications for Material Compatibility and Sealing Integrity

Xueling Wu

Smart Pipeline and Safety Team, School of Petroleum and Natural Gas Engineering, Southwest Petroleum University

II. Abstract

This lecture presents a systematic investigation of the swelling behavior and deterioration mechanisms of hydrogenated nitrile butadiene rubber (HNBR) under methanol-related conditions relevant to oil and gas storage and transportation systems, with emphasis on material compatibility and sealing integrity.

Part One: Background, Objective, and Experimental Design

Under the global energy transition and China's dual-carbon strategy, methanol is increasingly considered a clean liquid fuel and hydrogen carrier, raising new medium–material compatibility challenges for elastomeric seals in pipeline equipment. HNBR was selected as a representative sealing material. Carbon-black-filled HNBR specimens with a hardness of 90 Shore A were immersed for 7 days in anhydrous methanol and methanol containing 8 wt% water using a high-pressure autoclave. Four conditions were designed by coupling temperature, pressure, and methanol water content.

Part Two: Swelling Behavior, Deterioration Mechanisms, and Engineering Implications

The results show that HNBR exhibits evident swelling, softening, and mechanical property deterioration after methanol immersion. The most severe response occurs in anhydrous methanol at 30 ℃ and 8 MPa. Such dimensional expansion and strength loss may reduce medium–material compatibility and increase the risk of sealing performance degradation. SEM and FTIR evidence indicates that deterioration is mainly associated with methanol penetration, physical swelling, extraction of weakly bound constituents, and interfacial damage, rather than chemical deterioration of the HNBR backbone.

Conclusion

This lecture concludes that methanol-induced swelling and deterioration of HNBR should be considered in sealing-material selection, medium-material compatibility assessment, and pipeline sealing integrity management under emerging methanol-related transportation conditions.

III. Speaker Biography

Xueling Wu is a Ph.D. candidate in the Smart Pipeline and Safety Team, School of Petroleum and Natural Gas Engineering, Southwest Petroleum University. Xueling Wu has received the National Scholarship, Wang Tao Talent Scholarship, Shi'ai Scholarship, First-Class Academic Scholarship for Graduate Students, and the title of Outstanding Graduate Student. Ms. Wu also won the Excellence Cup in the Comprehensive Group of the 13th CHINA PETROLEUM ENGINEERING DESIGN COMPETITION and the Third Prize in the 2024 China University Student Mechanical Engineering Innovation and Creativity Competition, Zhuoran-Dushun-Hongtu Cup Process Equipment Practice and Innovation Competition.

Ms. Wu's research focuses on pipeline safety and integrity management in oil and gas storage and transportation systems, with particular attention to the adaptability of non-metallic sealing materials and sealing integrity under emerging low-carbon energy transportation conditions. Ms. Wu has published several high-quality SCI-indexed journal papers, obtained multiple authorized Chinese invention patents, and participated in field-oriented research on station and pipeline safety. Through academic research and engineering practice, Ms. Wu is committed to embedding safety into China's pipeline systems.

IV. Technical Requirements & Photo

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Lecture Information 08

I. Presentation Title

Air and Gas Drilling Technology: Application and Practice in China, and Its Application Scheme for Curing Lost Circulation, Water Conservation in Iraq well Drilling

Jun Xin
CNPC Chuanqing Drilling Engineering Company Limited (CCDC)

II. Abstract

Iraq is a country facing severe water scarcity, water management is a critical constraint on the development of the oil and gas industry. Against this backdrop, water conservation and reduction have been established as common goals for the entire petroleum industry. During drilling operations, due to the widespread development of fractures and vugs in carbonate formations, over 90% of drilled wells have experienced lost circulation, resulting in significant non-productive consumption of precious water resources. There is an urgent need to develop water-saving drilling technologies suitable for loss zones.

This lecture will introduce a water-saving drilling technology—air and gas drilling technology—which has been validated through long-term engineering applications in China. This technology uses air or other gases instead of conventional liquid drilling fluids, fundamentally achieving less water consumption during the drilling process. Field applications have shown that compared to conventional mud drilling, it can reduce water consumption by more than 70% (saving over 4,000 m³ of water per well), while significantly reducing non-productive time caused by lost circulation and water-hauling operations. In response to the frequent shallow total-loss circulation encountered during drilling in the western oilfields of Iraq, this lecture proposes a two-step water-saving drilling strategy:

•Step 1: Apply mist drilling technology in the first spud section within 1,000 meters to achieve water-saving drilling in the early interval.

•Step 2: Extensively conduct trials of reverse-circulation drilling technology to develop a more environmentally friendly, lightweight water-free drilling solution for shallow loss zones.

The above strategy is intended to provide an efficient, environmentally friendly, and sustainable technical pathway for large-scale water-saving drilling in Iraq. This lecture will offer practical experience and scientific methods for water conservation and lost-circulation control in real drilling scenarios, helping to alleviate Iraq's water resource crisis and prioritize the allocation of more fresh water for local livelihoods and agricultural production—truly achieving the engineering and humanitarian goal of "benefiting the local communities."

III. Speaker Biography

Dr. Jun Xin is a seasoned senior reservoir engineer with over 15 years of domestic and international professional experience in oil and gas development, reservoir engineering, and gas production engineering, primarily affiliated with CCDC. He earned his Ph.D. and Master's degrees in Oil & Gas Field Development Engineering (2008–2011, 2005–2008) from Southwest Petroleum University, China.

Dr. Jun Xin served as a Senior Reservoir Engineer at CCDC from 2011 to April 2025. During his tenure, he accumulated seven years of reservoir engineering experience in Iran and Iraq, specializing in water flooding development of porous carbonate oil fields, and four years of gas production engineering experience across the Chuanqing Sulige project, Weiyuan shale gas project, and the Amu Darya Gas Field project in Turkmenistan. He has gained extensive expertise in water drainage and gas production in "three-low" tight sandstone gas fields, unconventional shale gas development, and fracture-cavity type carbonate gas field development.

Dr. Jun Xin has received numerous prestigious recognitions, including the 8th Top Ten Grass-roots Managers of Enterprises in Sichuan Province, Model Worker of CCDC in 2022, Scarce Talent under the "Dongjiao Huazhang Plan" in Chenghua District in 2021, Member of the Innovation Team with Outstanding Contributions of CCDC in 2021, and the Title of "Outstanding Innovative Talent" of CCDC in 2019. His work integrates advanced reservoir engineering techniques with real-world field applications, contributing significantly to the development of oil and gas resources in the Middle East and Central Asia.

Currently, he serves as General Manager of the CCDC Iraq Branch, where he is responsible for the overall coordination of all units within the responsible region, ensuring strict implementation of production organization, engineering technology, quality, safety and environmental protection, material and equipment management, and business objective management.

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Lecture Information 09

I. Presentation Title

Covalent Organic Frameworks (COFs) in petrochemical fields: Challenges for the Oil and Gas Industry

Ataf Ali Altaf

Institute of Chemistry, Khwaja Fareed University of Engineering and Information Technology Rahim Yar Khan, Pakistan

II. Abstract

Covalent Organic Frameworks (COFs) have emerged as a promising class of crystalline porous materials for applications in the oil and gas industry owing to their high surface area, tunable pore chemistry and structural designability. This lecture critically discusses the current status and challenges of COFs in important oil and gas processes, including natural gas sweetening, CO_2 /CH_4 and H_2S separation, oil-water separation and produced water treatment, heterogeneous catalysis for refining, and corrosion sensing and inhibition. High selectivity and capacity for CO_2 and H2S capture and efficient oil rejection in COF based membranes have been demonstrated in laboratory studies, but most data are derived from ideal, dry, single component systems. The key challenges are hydrolytic and thermal stability under sour, wet and high-pressure conditions, scalability of the synthesis, processability into robust membranes or pellets, and cost competitiveness with incumbent materials such as zeolites and polymeric membranes. The translation should be advanced by future work on stability-first molecular design, testing under realistic mixed-feed conditions, hybrid material engineering, and techno-economic assessment. The overview offers a balanced guide for researchers toward impactful, industrially relevant development of COFs for the oil and gas sector.

III. Speaker Biography

Dr. Ataf Ali Altaf is Professor at the Institute of Chemistry, Khawaja Fareed University of Engineering and Information Technology, Rahim Yar Khan, Pakistan. He earned his M.Sc. in Inorganic Chemistry from Bahauddin Zakariya University in 2006, M.Phil. and Ph.D. in Analytical/Inorganic Chemistry from Quaid-i-Azam University, Islamabad in 2008 and 2012, respectively. He completed a postdoctoral fellowship in Inorganic Chemistry at Cornell University, Ithaca, NY, USA in 2023 under Prof. Alireza Abbaspourrad.

Dr. Altaf's research interests lie in computational and synthetic chemistry of porous materials, with a focus on covalent organic frameworks and metal-organic frameworks for catalysis, energy storage, and water purification. He also works on

inorganic materials, ferrocene-based organometallics, medicinal inorganic chemistry, and computational docking for enzyme inhibitor design. His work integrates advanced characterization techniques including XRD, NMR, FTIR, SEM/EDX, and electrochemistry.

He has held academic and administrative positions at University of Okara and University of Gujrat, where he served as Associate Professor and Assistant Professor, respectively. He has supervised graduate and undergraduate research and held roles including Chairperson of Chemistry, Director Administration and Coordination, and Director of the Board of Advanced Study and Research.

Dr. Altaf has led or co-led 5 HEC Pakistan-funded research projects worth over PKR 15 million, and received event grants from the American Chemical Society for outreach and student chapter activities. He has authored 110+ research articles in international journals such as ACS Applied Materials & Interfaces, Nature Communications, Advanced Materials, Dalton Transactions, and Inorganica Chimica Acta, with a total impact factor exceeding 360 and over 3000 citations. He has also contributed 8 book chapters with Springer and Wiley, and presented at numerous ACS National Meetings.

He serves as a reviewer and editorial board member for 25+ journals, including New Journal of Chemistry, Physical Chemistry Chemical Physics, Inorganica Chimica Acta, and ACS Applied Materials & Interfaces. His contributions have been recognized with the HEC Postdoctoral Fellowship, PCST Research Productivity Award 2014-15, and multiple travel grants from HEC and PHEC.

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Lecture Information 10

I. Presentation Title

Advances in CO_2 Enhanced Oil & Gas Recovery and Geological Sequestration

Cheng Cao

Southwest Petroleum University, China-Iraq Belt and Road Joint Laboratory on Oil and Gas Energy & Petroleum Engineering School

II. Abstract

With the global and Chinese carbon-neutral visions becoming increasingly clear and mitigation actions accelerating, the role of CCUS has grown more prominent, and its status has undergone a significant transformation.

This presentation highlights the contribution of CCUS to carbon emission reduction and provides an overview of CCUS project development worldwide. It places particular emphasis on technological research progress in CO_2-enhanced oil recovery and geological storage, including microscopic visualization and evaluation of CO_2 flow in porous media, CO_2-brine-rock interaction evaluation technology, evaluation techniques for CO_2-EOR and CO_2-EGR, CO_2 storage capacity evaluation and storage scheme optimization, and CO_2 storage safety evaluation in saline aquifers. It also presents the field application results of relevant technologies at units such as Jilin Oilfield.

III. Speaker Biography

Cheng Cao is an associate professor at Southwest Petroleum University and also serves at the Huairou National Laboratory. He received his Ph.D. from Clausthal University of Technology in Germany in 2021. His primary research focuses on CO_2 geological utilization and storage. He has participated in over 20 research projects, including the National Major Science and Technology Projects and the National Natural Science Foundation of China. He has received the First Prize of the Jilin Provincial Science and Technology Progress Award. Additionally, he has published one English monograph, two Chinese books, and over 50 academic papers.

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Lecture Information 11

I. Presentation Title

Enhancing Corrosion Control in Crude Oil Distillation Units Through Multi-Neutralizer pH Optimization

Ali Hussein Khalaf
North Refineries Company (NRC), Baiji, Iraq

II. Abstract

Corrosion in crude oil distillation units (CDUs) remains one of the most persistent operational challenges in petroleum refineries, particularly in regions processing high-sulfur and high-acidity crude oils. In atmospheric and vacuum distillation units (ADU/VDU), the overhead system is especially vulnerable due to the condensation of hydrochloric acid, organic acids, and other corrosive species. Ineffective corrosion mitigation leads to equipment degradation, unplanned shutdowns, increased maintenance costs, and potential safety risks.

This presentation addresses an integrated strategy for enhancing corrosion control in crude oil distillation systems through optimized multi-neutralizer injection and pH control. Drawing on over two decades of industrial experience at North Refineries Company (NRC), Baiji refinery, the study combines field data, process monitoring, and modeling approaches to evaluate the effectiveness of different neutralizing amine formulations under varying operating conditions.

The work focuses on identifying optimal injection points, dosage strategies, and combinations of neutralizers to maintain stable pH levels in the overhead system while minimizing salt deposition and fouling. Special attention is given to the interaction between ammonia, organic amines, and chloride content, as well as their influence on corrosion rates and salt formation. The study also evaluates the impact of operational parameters such as temperature, pressure, and crude composition variability on corrosion behavior.

Advanced process monitoring techniques and data-driven approaches are incorporated to improve prediction and control of corrosion trends. Insights from artificial intelligence and machine learning models—developed in previous research for corrosion rate prediction—are discussed as tools to enhance decision-making in real-time refinery operations.

The results demonstrate that multi-neutralizer strategies, when properly optimized, significantly reduce corrosion rates, stabilize pH levels, and improve overall system reliability compared to single-neutralizer approaches. Furthermore, the study highlights the importance of integrating chemical treatment programs with process control systems to achieve sustainable corrosion mitigation.

This presentation provides practical guidelines for refinery engineers and operators, emphasizing cost-effective and scalable solutions applicable to existing distillation units. The findings contribute to improving operational efficiency, extending equipment lifespan, and enhancing safety in oil refining processes.

III. Speaker Biography

Ali Hussein Khalaf is a Senior Chief Process Engineer at the North Refineries Company (NRC) in Baiji, Iraq, with more than 20 years of experience in the oil and gas industry. He holds a Ph.D. in Chemistry and Chemical Engineering from Southwest Petroleum University, China (2025), where he was recognized as an outstanding doctoral student and awarded by the Minister of Oil.

Dr. Khalaf has extensive industrial expertise in refinery operations, particularly in atmospheric and vacuum distillation units (ADU and VDU), naphtha hydrotreating (NHT), reforming units, flare gas recovery systems, and oil storage facilities. He has held multiple leadership roles, including Chief Process Engineer and Unit Manager, where he was responsible for process optimization, troubleshooting, and operational safety.

His research interests focus on corrosion monitoring and prediction, artificial intelligence applications in the oil and gas industry, process modeling and simulation, and environmental pollution control. He has authored and co-authored numerous peer-reviewed publications in high-impact journals, covering topics such as machine learning-based corrosion prediction, advanced coating technologies, and material performance in harsh oilfield environments.

In addition to his technical and research contributions, Dr. Khalaf is an active member of the Iraqi Engineers Union and has participated in several technical committees, including process troubleshooting and environmental control. He is also a certified trainer and lecturer, contributing to workforce development within the refinery sector. His work bridges the gap between academic research and industrial application, with a strong focus on practical solutions to improve efficiency, reliability, and sustainability in oil refining operations.

IV. Technical Requirements & Photo

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Lecture Information 12

I. Presentation Title

Galvanic Effect Regulated Carbon-Coated High-Entropy Alloy Catalysts for Hydrogen Evolution under Fluctuating Power

Hu Yiping

Southwest Petroleum University, SILKROAD Research Center of Sustainable Energy Conversion and Utilization & School of Chemistry and Chemical Engineering

II. Abstract

This report presents a systematic study on galvanic effect regulated carbon-coated high-entropy alloy catalysts for hydrogen evolution under fluctuating power. The presentation is structured into two main parts: the construction of a galvanic-effect-induced dual-shields strategy in carbon-coated high-entropy alloys, followed by the regulation of hydrogen evolution reaction performance through interfacial galvanic effects.

Part One: Galvanic Effect Induced Dual-shields Strategy on HEA@C

Under fluctuating renewable electricity, frequent start–stop operation can induce reverse current and accelerate catalyst corrosion, especially in acidic hydrogen evolution environments. To address this challenge, carbon-coated high-entropy alloy catalysts were designed to transform the traditionally detrimental galvanic corrosion into a positive interfacial protection mechanism. The carbon shell serves as a physical barrier to suppress direct electrolyte penetration, while the galvanic interaction between the HEA core and carbon shell promotes electron redistribution and induces the formation of passivation species at defect sites. This dual-shields strategy effectively enhances the anti-dissolution corrosion resistance and structural stability of HEA@C catalysts under open-circuit and dynamic operating conditions.

Part Two: Galvanic Effect Regulates HER Performance

Beyond durability enhancement, the galvanic effect also plays a critical role in regulating HER activity. By establishing the galvanic potential difference as an electronic descriptor, the relationship between interfacial electron transfer and HER performance was clarified. An appropriate galvanic driving force promotes electron penetration from the HEA core to the carbon shell, optimizes the electronic structure of surface active sites, and improves hydrogen adsorption/desorption behavior. As a result, catalysts with moderate galvanic effect exhibit superior HER activity and long-term stability under fluctuating power conditions.

Conclusion

This work demonstrates that rational regulation of the galvanic effect provides an effective strategy to simultaneously improve the activity and durability of carbon-coated high-entropy alloy catalysts. The proposed mechanism offers new insights for

designing robust HER catalysts compatible with renewable-energy-driven water electrolysis.

III. Speaker Biography

Hu Yiping is a Distinguished Associate Researcher and Master's Supervisor at Southwest Petroleum University. His research focuses on catalyst development for China's national energy security and "dual carbon" goals, covering electrocatalytic water splitting for hydrogen production, including HER and OER, CO_2/CO electrocatalytic conversion, fuel cells, and rechargeable zinc–air batteries. The research scope includes catalyst design, performance evaluation, mechanism investigation, and device development.

Hu Yiping has led one Young Scientists Fund project supported by the National Natural Science Foundation of China and one industry-sponsored project. As a key project member, Hu Yiping has participated in or is currently involved in nine national-level, provincial/ministerial-level, and industry-funded projects. More than 30 SCI papers have been published in internationally recognized journals, including Advanced Functional Materials, Journal of Materials Chemistry A, Small, and Journal of Power Sources. In addition, two Chinese invention patents have been authorized, and two standards have been drafted.

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Lecture Information 13

I. Presentation Title

China Natural Gas Industry Analysis and Outlook Report Blue Book

Zheng Xiaoqiang

Southwest Petroleum University, China-Iraq Belt and Road Joint Laboratory on Oil and Gas Energy & School of Economics and Management

II. Abstract

This report provides a comprehensive overview of the China Natural Gas Industry Analysis and Outlook Blue Paper (2025). The presentation is structured into two main parts: an introduction to the Blue Paper itself, followed by a detailed analysis of the industry's current status and future outlook.

Part One: About the Blue Paper

Since its first release in 2017, the Blue Paper has evolved significantly, undergoing major revisions and expansions. Key milestones include its first major revision in 2018, another in 2021, a collaborative release with an industry association in 2022, and the start of overseas copyright distribution in 2024. The 2025 edition continues this international outreach. The report's core framework combines a retrospective analysis of the period from 2013 to 2024 with a long-term forecast extending to the year 2035.

Part Two: Current Status and Outlook

In 2025, China's natural gas industry showed resilience with stable supply and demand growth. Production reached 261.9 bcm (up 6.26%), the ninth consecutive year of growth above 10 bcm, with unconventional gas accounting for 17.21%. Apparent consumption hit 426.6 bcm, driven by industrial fuel switching and power generation, though gas's share in primary energy remained low at 8.81%. Imports fell 2.86%, reducing external dependence to 41.32%; LNG made up 53.54% of imports, mainly from Australia, Qatar, and Russia. National policies focused on supply security, pipeline safety, and green development, including building a unified pipeline network and deepening pricing reforms. During the 15th Five-Year Plan (2026–2030), production is forecast to exceed 270 bcm (possibly 330 bcm), while consumption may approach 500 bcm by 2030. By the end of the 14th Five-Year Plan, China had 42 storage facilities, over 128,000 km of pipelines, and 39 LNG terminals.

Conclusion

China's natural gas industry continues to show strong growth vitality and resilience amidst complex global dynamics. The Blue Paper will persist in providing in-depth analysis to support the nation's high-quality and sustainable energy development.

III. Speaker Biography

Professor Zheng Xiaoqiang is a Second-Level Professor, Doctoral Supervisor, and Dean of the School of Economics and Management at Southwest Petroleum University (SWPU). He is a leading academic and technical talent in Sichuan Province, selected for the Chengdu Top Talents (Rongcheng Talent) Program. He heads the provincial high-level social science team on "Energy Green and Low-Carbon Transition" and serves as a young researcher for a CAST decision-making advisory team on hydrogen-electric coupling and green transition.

Professor Zheng's research focuses on energy strategy, security management, and sustainable development, particularly China's oil and gas industry dynamics and pathways to carbon neutrality. He has led over 14 provincial and ministerial-level research projects, including sub-projects of the National Major Science and Technology Program for Oil and Gas, National Social Science Fund projects, and key projects for the Sichuan Provincial Philosophy and Social Science Foundation. He has published more than 50 academic papers and 5 books.His contributions have earned him a First Prize for University Social Sciences in Sichuan Province and a Third Prize for Outstanding Achievements in Philosophy and Social Sciences.

Professor Zheng is an active member of numerous academic societies. He serves on the Energy Environment Management and Engineering Management branches of the Society for Management Science and Engineering, as a standing director of several energy and systems engineering organizations, and on the Carbon Neutrality and Standardization committees of the China Petroleum Enterprise Association. Through his leadership, research, and professional service, Professor Zheng continues to shape China's academic and policy discussions on sustainable energy strategy.

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Lecture Information 14

I. Presentation Title

Practical Challenges in Corrosion Towards Clean Energy in Refineries

II. Abstract

Refinery systems operate under severe conditions including high temperature, pressure, and corrosive environments, which lead to serious material degradation and operational challenges. Corrosion in distillation trays, tray valves, and pipelines causes equipment damage, frequent maintenance, reduced efficiency, and increased energy loss.

Localized corrosion such as pitting and crevice corrosion is commonly observed in chloride-rich refinery environments, especially in stagnant areas. Traditional materials such as carbon steel and stainless steel are still widely used; however, their corrosion resistance is often insufficient for long-term operation under harsh conditions.

This presentation discusses practical corrosion challenges observed in refinery equipment and highlights the potential of advanced protective coatings as a sustainable engineering solution. Special focus is given to nano-coatings and eco-friendly coatings, including nano-silica reinforced coatings and waterborne epoxy systems, for improving corrosion resistance and reducing maintenance requirements. Improving corrosion protection can significantly enhance operational efficiency, reduce shutdowns, minimize energy losses, and support cleaner refinery operation. Therefore, corrosion control plays an important role in achieving sustainable and energy-efficient industrial systems within the oil and gas sector.

III. Speaker Biography

Saba Abdulhussein A. Al-Najafi is a PhD student in Technical Materials Engineering at Middle Technical University (MTU), Iraq, and is professionally affiliated with the Heavy Engineering Equipment State Company (HEESCO), Ministry of Oil, Iraq.

Her research interests focus on corrosion engineering, protective coatings, nano-coatings, and sustainable materials for refinery and oil & gas applications. Her current research investigates practical corrosion problems in refinery systems, particularly localized corrosion affecting distillation trays and pipelines operating in harsh industrial environments.

Through industrial field observations and refinery visits, her work focuses on applying advanced coating technologies to improve corrosion resistance, reduce

maintenance requirements, and support cleaner, safer, and more efficient refinery operation.

IV. Technical Requirements & Photo

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Lecture Information 15

I. Presentation Title

Low-Cost and Intrinsically Safe Aqueous Organic Redox Flow Batteries: From Intelligent Molecular Regulation to Application Demonstration

II. Abstract

Large-scale energy storage demands technologies that simultaneously achieve long lifetime, low cost, and high energy density. Aqueous organic redox flow batteries (AORFBs) are attractive due to their intrinsic safety and molecular tunability, yet their development is limited by insufficiently matched and stable redox-active molecules.

In this talk, we present the rational design of catholyte and anolyte molecules, focusing on redox potential regulation within the aqueous stability window and the stabilization mechanisms of organic redox species. Based on these principles, a series of TEMPO-based catholytes and viologen-based anolytes are developed, enabling improved stability, reversibility, and solubility.This work provides a viable pathway toward low-cost, safe, and scalable energy storage, and offers molecular-level design principles for next-generation flow battery systems.

III. Speaker Biography

Jiangxuan Song is a full professor at the College of Materials Science and Engineering, Xi’ an Jiaotong University. His research focuses on the development of functional polymer- and organic-based materials for high-energy-density batteries and aqueous organic redox flow batteries. He is particularly interested in structural engineering, interfacial chemistry, and electrochemical mechanisms in advanced energy storage systems, aiming to advance the practical deployment of safe, low-cost, and long-lifespan battery technologies.

IV. Technical Requirements & Photo

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Lecture Information 16

I. Presentation Title

Toward Clean Oil Production: An Experimental and Simulation Study on Mixing and RTD Behavior in an Innovative Oscillatory Baffled Reactor for Improved Fuel Refinement.

Safaa M.R. Ahmed

Department of Chemical Engineering, College of Engineering, University of Tikrit, Tikrit, IRAQ

II. Abstract

The shift towards sustainable oil production and renewable fuel production necessitates highly intensive reactors that achieve effective mixing with minimum power requirement. Recently, oscillatory baffled reactors (OBRs) have been considered promising reactors owing to their superior mixing efficiency in laminar flow regime. In this research, a novel design of OBR with improved baffle geometry was studied both experimentally and numerically to assess its mixing and residence time distribution (RTD) properties before being utilized in clean oil production. Two-dimensional computational fluid dynamics (CFD) modeling was performed to simulate the oscillatory flow pattern in the reactor and correlate the reactor geometry with its hydrodynamics. Some critical flow features such as vortex formation and alternating flows were simulated, and they are known for promoting radial mixing. RTD experiments were conducted using different oscillation frequencies from 1 to 4.3 Hz and amplitudes from 1 to 5 mm to examine the flow behavior of the reactor. It was found that higher oscillation intensities lead to better mixing efficiency and a flow behavior that gradually shifts from a dispersed flow to plug flow, together with reduced axial diffusion coefficients and narrow RTD profiles. There was a reasonable agreement between experimental data and CFD results. The better mixing and controllable hydrodynamics obtained through the proposed OBR configuration show great promise in the use of the concept in the process of producing clean oil and fuels.

III. Speaker Biography

Prof. Dr. Safaa M.R. Ahmed is a faculty member in the Department of Chemical Engineering, College of Engineering, Tikrit University. He received his B.Sc. and M.Sc. degrees in Chemical Engineering from Tikrit University in 2002 and 2010, respectively, and earned his Ph.D. in Chemical Engineering from Newcastle University in 2018. His research interests focus on chemical reaction engineering, biofuel production, reactor modeling and simulation, process intensification, and sustainable chemical processing technologies. He has contributed to several research studies related to

advanced reactor systems and process enhancement for energy and environmental applications.

IV. Technical Requirements & Photo

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Lecture Information 17

I. Presentation Title

Industrial Preparation of Catalytic Electrodes for Efficient Hydrogen Precipitation in Seawater Electrolysis Based on Atmospheric Plasma Spraying Technology to Address the Stability Challenges of Seawater Electrolysis

Sihan Liang

Southwest Petroleum University, China-Iraq Belt and Road Joint Laboratory on Oil and Gas Energy & School of Chemistry and Chemical Engineering

II. Abstract

Seawater electrolysis for hydrogen production is considered a highly promising route for large-scale green hydrogen production because it directly utilizes the Earth's abundant seawater resources, avoids competition with freshwater resources, and can be coupled in situ with offshore renewable energy sources (such as wind and solar power). However, the high concentration of chloride ions (Cl^-) in seawater causes severe electrode corrosion and catalyst poisoning, and competes with the oxygen evolution reaction (OER) to trigger the chloride evolution reaction (CIER), significantly reducing catalyst activity and stability. Developing non-precious metal electrocatalysts capable of withstanding complex seawater environments over the long term while maintaining both high activity and stability, and achieving their industrial-scale production, has long been a major challenge in this field. To address this challenge, this study proposes and implements a low-cost solution. We employed the well-established industrial technique of atmospheric plasma spraying (APS) to efficiently prepare a porous, multi-component disordered alloy coating. This design ingeniously leverages the synergistic effects among different metallic elements (Ni, Co, Cr, Fe, Al) and the multi-level pore structure within the coating. The resulting NiCoCrFeAl catalyst demonstrated exceptional performance in an alkaline seawater electrolyte at 80 °C: its hydrogen evolution reaction (HER) overpotential was as low as 44 mV @ 10 mA/cm^2, and it could stably deliver a high current density of 1.7 A/cm^2. Crucially, the catalyst operated continuously for over 2,000 hours under such harsh conditions without significant performance degradation, demonstrating exceptional long-term stability.

III. Speaker Biography

Sihan Liang, a PhD candidate at the School of Chemistry and Chemical Engineering, Southwest Petroleum University.

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