Posters List (Day 3)

Abstract (#19192)

Title: Determination of Maximum Adsorption Capacities of Modified Apricot Stone for Wastewater Decolorizati

Authors: Shadia M. Sirry, Ebtesam A. Al.

Taibah University

In this research, maximum adsorption capacities of apricot stone and modified apricot stone were determined by application of Langmuir model for the adsorption of methylene blue dye (MB). Apricot stone was modified with petroleum ether, sodium carbonate, and hydrochloric acid. The adsorption capacities of apricot stone were 0.424, 1.074, 0.392, and 1.704 mg/g for raw and treated with petroleum ether, sodium carbonate, and hydrochloric acid respectively. The adsorbents were characterized by FTIR spectroscopy.

Abstract (#19196)

Title: Application of Natural Biproduct Plum and Pomegranate Seeds as sorbents for Removal of Methylene Blue

Authors: Hend Almitiry, Samah.

Taibah University

Natural biproduct pomegranate and plum seeds were used as adsorbent to remove methylene blue (MB) dyes from aqueous solutions. The seeds treated by HCl, Na2CO3 and petroleum ether, respectively. The effect of initial dye concentration, adsorbent dose, the particle size, temperature, and contact time were examined. The equilibrium adsorption data were analyzed by using the Freundlich and Langmuir models. The Adsorption equilibrium of MB on pomegranate seeds was represented by the Langmuir model with coefficient correlation r2 are 0.9965,0.9996,0.9599, and 0.9819 for raw seeds, seeds treated by HCl, Na2CO3 and petroleum ether, respectively. And Langmuir model for adsorption MB on plum seeds was represented by the with coefficient correlation r2 are 0.9998, 0.9996, 0.9998, and 0.9997 for raw seeds, seeds treated by HCl, Na2CO3 and petroleum ether, respectively. Equilibrium was best described by Freundlich isotherm model for adsorption of MB on pomegranate seeds (R2 = 0.9794,0.9908,0.9795 and 0.9896) for raw seeds, treated by HCl, Na2CO3 and petroleum ether respectively. And freundlish isotherm adsorption of MB on plum seeds was also studied, according to coefficient correlation r2 are 0.9831,0.9999,0.9999 and 0.9998 for raw seeds, treated by HCl, Na2CO3 and petroleum ether respectively. These results revealed that by pomegranate and plum seeds can be used as an alternative adsorbent to remove methylene blue from aqueous solutions due to good efficiency and low cost.

Abstract (#19468)

Title: Vibration Analysis Using Motion Magnification Techniques

Authors: Hala Abualsaud.

Saudi Aramco

This paper presents a novel method for monitoring asset vibration and measurement of their displacement over time. Using the Eulerean Video Magnification (EVM) technique; the technology looks at a sequence of images and amplifies the vibration motion, further analysis allows abnormalities to be detected. This technology will assist operations and reliability engineers in predicting assets vibrational patterns and behaviors allowing planned and preventative maintenance, minimizing asset down time. Initial research work has already shown the possibility of improving such maintenance practices through theoretical predictions. The work presented here has considered challenges associated with inspection of rotating machinery displacement over time where maintaining this equipments health is vital to avoid catastrophic failure. This research work is planned for future validation and deployment on field assets.

Abstract (#19593)

Title: Human Interaction: The Key to Automation

Authors: Ron Byrd, Kevin Solomon.

Athlon, a Halliburton Service

Article Published in Hydrocarbon Engineering, September 2018
Human Interaction: The Key to Automation Effective specialty chemical automation starts with people and service

Refineries and petrochemical plants are complex operations. There is a lot at stake, including revenue goals that hinge on asset protection, maximum throughput and steady-state operations. Specialty chemical programmes help refineries reach their goals. To meet them, use automation to boost a specialty chemical programme. It is an excellent way to collect data continuously from all parts of an operation. However, it will result in little if it is not steered and interpreted by experienced people who are committed to helping the refinery. A good chemical team uses automation at a refinery to collect and interpret data like a doctor uses medical knowledge, skills, methods and experience to make the best medical assessment for a patient. Without human interaction, automation is just a tool.

Abstract (#19467)

Title: Fast and Reproducible SARA Fractionation of Oil Fractions and Crude Oil by Accelerated Solvent Extra

Authors: Frederick Adam, Faisal Al-Rasheed, Mansour Al-Zayer.

Saudi Aramco

Crude Oil and even crude oil cuts are complex mixtures that can contain several millions of different compounds. The characterization of these samples is essential across the refinery industry at all levels such as process design, optimization, monitoring and even troubleshooting. Due to their complexity, the characterization of these hydrocarbon samples is often challenging and unsatisfactory. Therefore, a simplification of these samples — by fractionation into subfractionations that are easier to characterize separately — has become essential in supporting refineries. A very common approach consists in separating hydrocarbons samples into saturates, aromatics, resins and asphaltenes, also known as SARA fractionation. SARA fractionation is traditionally performed using gravimetric column chromatography while applying a sequence of solvents having an increasing polarity. While gravimetric column chromatography is an effective way for performing a SARA fractionation, it generally requires a day-long experiment. As such, these experiments can be very costly due to their time-consuming and resource-consuming nature. Alternatively, high performance liquid chromatography (HPLC) has been implemented. Besides the limited sample quantities that can be fractionated by HPLC, this approach remains both time and solvent consuming.

The development of a method to quantitatively separate crude oil or its fractions into its corresponding SARA subfractions using Accelerated Solvent Extraction (ASE) technique will be presented in this poster. The accelerated solvent extraction (ASE) technique, which is a liquid solvent extraction technique at an elevated temperature and pressure, has been developed as a faster alternative to existing preparative SARA separation methods. In this work, parameters including solid adsorbent, temperature, pressure, solvent type and quantity on the ASE performance were all optimized for the objective to reduce both the solvents consumed and manpower effort/time to less than 15 min, and also to enhance the efficiency of separation for SARA separation from crude oil. A comparison between ASE and the conventional solid-liquid chromatography will also be discussed.

Abstract (#19181)

Title: Alternative Semisolid Growth Media for Aerobic Bacteria Count at SpecifitpH Range in Water Streams

Authors: Mohamed Mahmoud, Ahmed Al-Salman; Hassan malki.

Saudi Aramco

Biofilm cause deterioration of the microbiological quality of water by inducing bio corrosion and bio fouling. The corrosion and weathering caused by this biofilm can lead to considerable damage, ranging from contamination of pharmaceutical or microelectronic products, to reduced efficacy of heat

exchangers, unexpected corrosion of stainless steel, and premature destruction of mineral materials. An alternative semisolid Growth Media for Qualitative and quantitative determination of General Aerobic Bacteria counts (GAB), at a specific pH range of 5.5-7.5 in water samples, was verified and counterchecked with commercial ready-made rapid media (Paddle testers), to prove the possibility to utilize the Total Coliform and Heterotrophic Plate Count media, for a 2-day incubation at 35°C, for qualitative and quantitative determination of the GAB colonies in the process water stream. Several trials were conducted using both medias, with a positive sources of GAB and Coliform. The alternative medias produced acceptable results, with minor accepted differences. This method could be utilized as an alternative to the traditional technique, to minimize site visits. The method focused on the GAB species that grow at a pH range 5.5-7.5 (Zymomonaslindneri, Escherichia coli, Erwiniacaratovora, Pseudomonas aeruginosa, Thiobacillusnovellus & Nitrobactersp), derived from gram negative bacteria.

Abstract (#19465)

Title: Effect of Material Surfaces on Calcium Carbonate Precipitation and Scaling: A Comparison of Inline

Authors: Waleed Al Nasser, Yasser Al Jeshi and Qiwei Wang.

Saudi Aramco

Calcium carbonate (CaCO3) scale is one of the most common types of inorganic deposits occurring in industrial water systems, oil and gas production as well as processing operations such as boilers, cooling towers and surface facilities. It may form at different locations due to changes in the water composition or physical conditions such as pressure and temperature. Calcium carbonate deposition occurs when Ca++ and CO3- - ions in water react to form an insoluble solid. In order to prevent potential scaling problems, it is important to understand the mechanism of calcium carbonate deposition. The impacts of CaCO3 scale range from reduced process efficiency and increased maintenance cost due to unscheduled system shutdowns.

This paper reports an extended study on the understanding of calcium carbonate crystal formation and deposition on different surfaces, and a comparison between inline and offline techniques to determine the scaling and deposition of calcium carbonate is presented. The inline technique is based on laser scattering technique measurements. The effect of calcium ion concentrations on the scale rate is determined at various temperatures. The inline results were validated using an offline scale measurement technique using surface weight. In this work, the effect of different materials on the morphology and precipitation of calcium carbonate are investigated. The scale precipitates are characterized using X-ray diffraction (XRD), and Environmental scanning electron microscopy (ESEM).

The present techniques not only determine the precipitation and scaling mechanisms under different conditions and surfaces, but can also be used to evaluate calcium carbonate precipitation and scaling in the presence of inhibitors or when employing other scale prevention methods.

Abstract (#19238)

Title: Scale Nucleation and Inhibition During Water Flooding

Authors: Tawfiq Shafai, Qiwei Wang.

Saudi Aramco

Water injection is a common practice in oil production to enhance hydrocarbon recovery. Seawater is often used as injection water due to the cost and availability. For formation waters rich in divalent cations such as calcium, strontium and barium, formation of sulfate scales is inevitable when the injected seawater is mixed with the formation water. Sulfate scales can be formed in reservoir, perforation, wellbore, production tubing, wellhead, and surface equipment. Unlike carbonate scale, sulfate scale is notoriously difficult to remove once formed. Therefore, proactive prevention is critical for the successful sulfate scale mitigation.

In this presentation, we report the latest understanding on calcium sulfate (gypsum) formation and inhibition associated to seawater flooding of a carbonate reservoir containing high calcium formation water. The gypsum nucleation kinetics and scale inhibitor performance were determined using a laser turbidity method at various mixing ratios of seawater and formation water. Test results demonstrated the significant impact of water mixing ratio on nucleation induction period, resulted from the changes in saturation state with respect to gypsum and the relative concentrations of calcium to sulfate. These factors also affect the scale inhibitor effectiveness. It was found that the phosphonate based inhibitor was more sensitive to water mixing ratio than the polymeric scale inhibitor, which led to a change of relative performance between these two types of inhibitors as seawater increase in the mixed water. Results attained in this study provide useful information for scale management in fields using seawater flooding.

Abstract (#19202)

Title: Sulfur Recovery Plant Test

Authors: Ibrahim Alghamdi.

Saudi Aramco

Comprehensive plant performance test and engineering evaluation was carried out at RR where set of recommendations were generated for better performance.

Abstract (#19200)

Title: Reformer Technology

Authors: AlGhamdi I, Adeeb Albesheri & Abdullah AlShawaf.

Saudi Aramco

The purpose of this report is to evaluate applications of the pre-reformer, Haldor Topsoe convention reformer (HTCR), and Haldor Topsoe exchanger reformer (HTER) technologies in increasing hydrogen production.

The fuel specifications become stringent and will be more so in the future, e.g., low product sulfur and aromatic contents. Hydrogen is the essential component in the modern conversion refineries to remove impurities, saturate aromatics, and meet the product specifications. Refiners always face tight hydrogen supply, and require revamp to increase hydrogen production if specifications become stricter.

Abstract (#19705)

Title: Microbial composition analysis of Microbiologically-Influenced Corrosion in seawater and oil pipeline

Authors: Budoor Nasser.

Saudi Aramco

The corrosion of ferrous metals in the crude oil industry costs hundreds of millions of dollars annually. It was estimated that about 15% of metal corrosion is due to bacterial activities in a process known as microbiologically-influenced corrosion (MIC). The aim of this study is to develop the method to identify microbial organisms that play key roles for MIC by an analysis of metagenome with bioinformatics. I obtained scraper samples that were generated in pipe wash operations from seawater injection pipelines and oil pipelines of the oil plants in KSA. We extracted DNA from the samples and generated the 16S rRNA amplicon metagenomes. We also retrieved publically available metagenome data of MIC sites (mainly from USA) from NCBI, using them for the comparison with our metagenomes. The metagenomes of the scraper samples clearly showed that microflora in seawater were very similar among samples and among oil pipeline samples, respectively. On the other hand, microflora were quite different between seawater and oil pipeline samples. The clustering analysis of our data together with public metagenomes also showed that metagenomes of seawater and oil pipelines were clustered separately. In addition, we found that metagenomes of oil pipeline formed a cluster with metagenomes of MIC sites at deep subsurface environments, showing that microflora in oil pipeline shared the common characteristics of the microbial composition among MICs in anaerobic environments. These results suggest that we should take different strategies against MICs at least between seawater and oil pipelines. the results suggest that key microorganisms of MIC are distinct between seawater pipeline and oil pipeline. Because we are producing the Big Data of the MIC metagenomes, we are planning to utilize AI for functional annotation from

taxonomic information. Our study leads to the development of a new method to predict, diagnose and provide appropriate treatment for MIC.

Abstract (#19594)

Title: Improving Desalter Performance with Emulsion Breaker Chemistry

Authors: Harold Eggert.

Athlon, a Halliburton Service

Improving Desalter Performance with Emulsion Breaker Chemistry: Emulsion breaker chemistry can improve the performance of desalters by injecting wash water into the suction of the crude charge pump.

Improving the removal of sodium, magnesium and calcium in the desalter coupled with reducing or even eliminating caustic usage can result in numerous benefits to crude and downstream processing units. Fluid catalytic cracker (FCC) unit analysis performed for the equilibrium catalyst demonstrates the benefits that can be realized. Despite the potential for great variation in the samples, catalysts serve as a great 'composite sample' of the feed to the FCC unit. Enhanced desalting can positively impact units that are not processing atmospheric or vacuum residuum. By moving a high percentage of wash water to the suction of the crude charge pump when using an effective emulsion breaker, refiners can improve desalter performance. Refiners should see desalter KPI improvements such as lower corrosion rates and fouling issues.

Abstract (#19212)

Title: The Influence Of Corrosion Inhibitor On Calcium Carbonate Scale Formation And Inhibition

Authors: Faez Al-Dawood, Qiwei Wang, Shafai, Tawfiq A..

Saudi Aramco

As part of oilfield chemicals evaluation, chemical interactions is a major concern. In particular, corrosion inhibitor with scale inhibitor; the reduction on performance and effectiveness of both chemicals is acknowledged. The incompatibility issue could be a result of mixing anionic and cationic groups of the scale and corrosion inhibitors respectively. However, their complex interactions are not well-recognized. In this study, the influence of commonly used corrosion inhibitors in Saudi Arabia on frequently scale inhibitors are evaluated by using dynamic tube blocking method. All these test results are based on the calcium carbonate scale formation and inhibition observation.
Therefore, the assessment objective is using effective chemicals in industry and targeting the interferences of mixing scale inhibitor with corrosion inhibitor. The common water soluble corrosion inhibitors, which generic groups are either Quaternary Ammonium salt with Amine, Imidazoline with Amine, or a mixture of Quaternary Ammonium salts and Fatty acids. On the other hand, the frequent used

scale inhibitors, which are based on either polyacrylate, tri-phosphonate, or penta-phosphonate. Interesting tests results showed that the corrosion inhibitor has minimal influence on calcium carbonate formation. However, the corrosion inhibitor impacted significantly the scale inhibitor\'s performance. Based upon the results observed, careful consideration must be given to chemical compatibility subject when evaluating oilfield chemicals. Certainly, the products selection would not interfere with one another, and not affecting individual performance.

Abstract (#19490)

Title: Study the Effect of Addition Nanocomposite Materials on the Corrosion Behavior and Electrochemical

Authors: Muhammad Sharif.

KFUPM

The development of sustainable processes for chemical synthesis, energy and petrochemical technologies is one of the major challenges and noteworthy task for 21sr century. Notably, catalysis is a key technology for achieving more sustainable processes in the chemical, pharmaceutical and material industries. Currently, more than 80% of all chemical products are made via catalysis. In this regard, the development of more selective, cost-effective and durable catalysts constitutes a key factor for the production of all kinds of chemicals today and in the future.
Novel unsaturated C10 diesters are produced via alkoxycarbonylation of ?-lactone 1 (3-ethylidene-6-vinyltetrahydro-2H-pyran-2-one), derived from the telomerization of CO2 and butadiene. Key for the selective valorization of 1 is the use of a catalytic system based on PdCl2, a chelating phosphine bearing electron-withdrawing groups and an acidic promoter. The unsaturated C10 methyl diester can be easily hydrogenated on Pd/C under mild conditions to afford its corresponding saturated diester. Subsequent hydrogenation using the homogeneous [Ru(acac)3]/Triphos catalysts gives 2-ethyloctane-1,8-diol in high yield. The overall procedure allows synthesizing new building blocks for the manufacturing of renewable polymers and polymers processing materials.

Abstract (#19377)

Title: Synthesis of Pd @Highly Reduced Graphene Oxide (HRG) Nanostructures for Efficient Catalytic Reaction

Authors: Muhammad Ashraf, Muhammad Nawaz Tahir.

KFUPM

Graphene in combination with metal nanoparticles are recently exploited by many researchers for the catalytic conversions for many industrially valuable chemicals. In this contribution, we reported the solution and synthesis of Pd@HRG based nanocomposites for the Suzuki Coupling reactions. The HRG surfaces are tailored with amine groups using 1-aminopyrene (1-AP) as functionalizing molecules. The

aromatic rings of 1-AP sit on the basal planes of HRG through ?-? interactions, leaving amino groups outwards (similar like self-assembled monolayer (SAMs) on 2D substrates). The amino groups provide the chemically specific binding sites to the Pd nucleation which subsequently grown into nanoparticles. The as prepared Pd@HRG nanocomposite demonstrated both uniform distribution of Pd nanoparticles on HRG surface as well as excellent physical stability and dispersibility. The surface functionalization and synthesis of Pd@HRG was confirmed using powder X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS) ultraviolet-visible (UV-Vis), Fourier transform infra-red (FT-IR) and Raman spectroscopy. The size and distribution of Pd nanoparticles on the HRG were confirmed using high resolution transmission electron microscopy (HRTEM). The kinetics of the catalytic reaction (Suzuki coupling) using Pd@HRG nanocomposite was monitored using gas chromatography (GC).

Abstract (#19474)

Title: Petrokemya ABS Plant Start-up

Authors: Alsubaie, Nasser, Elshokafy, Ahmed; Slimane, Rachid.

SABIC

The Arabian Petrochemical Company (Petrokemya) was established as a petrochemical complex in May 1981 in Jubail Industrial City, Saudi Arabia. To create value to SABIC and add to downstream industries expansions as part of the developmental growth vision of the Kingdom, Petrokemya decided to build a plant to produce Acryilonitrile Butadiene Styrene (ABS) . ABS is a common thermoplastic polymer that widely used in multiple applications, such as home appliances, electronics, automotive, and constructions. This plant was designed based on SABIC emulsion ABS technology. This Poster will talk about start-up of the plant and the approach that team followed to achieve safe and smooth start-up. The performance test run success leading to the successful commercialization of the product.

Abstract (#19405)

Title: Linear Isomerization of 2-Butene to 1-Butene Over Magnesium Oxide (MgO) at High Temperatures

Authors: Afnan Alghannam, Mohammad Marri, Sohel Shaikh, Munir Khokhar, and Mohammad Alalouni.

Saudi Aramco

Production of 1-butene from low-value raffinate III stream can be economically attained through positional isomerization of 2-butene over magnesium oxide (MgO) catalysts. Herein, a single bed catalyst system composed of magnesium oxide was employed to maximize 1-butene production from 2-butene stream. This was achieved by fabricating magnesium oxide (MgO) via hydrothermal method using magnesium nitrate hexahydrate and urea as precursors. It was found the hydrothermally treated MgO and commercial MgO catalysts were both inactive at lower temperatures (<400?). When the temperature reached 400?, 12% of 1-butene was formed over commercial MgO catalysts compared with only 6% for

synthesized MgO catalyst. Surprisingly, 1-butene yield of hydrothermally treated MgO catalyst was dramatically enhanced to 37% at 500?, making it 68% higher than commercial MgO. Depending on reaction temperature, fabricated MgO catalyst maybe the optimal choice for enhanced 1-butene yield from 2-butene isomerization at high temperatures.

Abstract (#19592)

Title: Keep Oil in The Unit

Authors: Troy Davis.

Athlon, a Halliburton Service

Published in Hydrocarbon Engineering, January 2019

Keep Oil in the Unit: Challenges and solutions to keeping hydrocarbons in refinery processing units and out of the wastewater treatment plant.

There are several reasons to keep oil in a refinery's processing units and out of the effluent headed to the wastewater treatment plant. Key among them are operating economics, avoiding downtime, protecting assets, and, of course, maximizing crude oil processing. Preventing oil from leaving the unit is less expensive than equipment repairs, energy costs, and solutions to oily water at the wastewater treatment plant. To develop a preventive plan, refiners can implement a specialty chemical treatment plan and take advantage of built-in features within processing units. Doing so will allow refiners to identify why and when oil leaves the unit and plan for it rather than resort to emergency unconventional or unique chemical treatments, which are most effective when working with a specialty chemical provider that understands both process and water-side chemistries and applications.

Abstract (#19188)

Title: Modeling of Multistage Membrane Process for Helium Recovery from Natural Gas using TFC Membrane

Authors: Sara Alkazzaz, Seung-Hak Choi.

Saudi Aramco

Modeling of Multistage Membrane Process for Helium Recovery from Natural Gas using Multilayer Thin Film Composite Polymeric Membrane

Aspen HYSYS-based process modeling was conducted using Saudi Aramco developed membrane extension unit to evaluate the technical feasibility of multistage membrane process for the recovery of helium from natural gas using multilayer thin-film composite membranes. In this study, the followings

were assumed: (i) quaternary mixture which contains 1,400 ppm of helium with nitrogen, methane and carbon dioxide were fed to membrane system at 1000 psia; (ii) permeate pressure remains at 15 psia; and (iii) membrane element was in spiral-wound configuration.
The target purity and recovery of helium were 10 vol.% and 90%, respectively. To meet these requirements, membrane process has been designed as multistage process including re-compression of the permeate from prior stage with recycling.
The economics and technical feasibility of membrane process were evaluated in term of the membrane area and compression power requirement. In this study, the permeation and separation properties of commercially available membrane has been adopted as a benchmark. The economics of the membrane process was compared to in-house developed novel thin-film composite membrane

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Abstract (#19296)

Title: Multicomponent Reactions for The Synthesis of Heterocycles Compounds by Q-Tube

Authors: Rawanalhazmi.

University of jeddah

The project focused on developing a novel approach to the synthesis of functionally substituted enaminoes utilizing green economically methods. The study involved synthesis of enaminonitrile derivatives using traditional methods, US irradiation and Q-tube. The biological activity of these compounds were examined. Preparation was achieved under high pressure (Q-tube) using MCRs.

Abstract (#19375)

Title: Selective Extraction of Lithium Ion from Sea Water Using Macrocycle and Cage Based Separation System

Authors: Abdulmajeed Hashem.

KAUST

Lithium is widely used for many industrial applications. Its low atomic mass and high electrode potential make it a very useful battery component, leading to its extensive use in power storage and supply. Lithium use in car batteries yields a high environmental advantage as it does not lead to harmful gas emissions, so it is expected that global demand for lithium will rise as environmental protection becomes an increasing world concern. Therefore, processes to economically extract lithium are becoming increasingly necessary. Here we introduce a design to continuously separate lithium ion from seawater using a specially built system of macrocycles and cages. Using a pH sensitive system containing trianglamine macrocycles which bind lithium very well and hydrogen well, and molecular cages which bind carbonate very well and chloride well. We can adjust the pH of the system using carbonic acid, and in so doing allow the replacement of bound lithium ions with hydrogen and chloride with carbonate respectively, leading to the subsequent release of pure lithium chloride.

Abstract (#19360)

Title: Exploiting MOFs in Hollow Fiber Sorbent Architecture to Enable Energy-Efficient CO2 capture

Authors: Dong-Yeun Koh, Young Hun Lee, Aqil Jamal.

KAIST

Solid sorbents are promising low-energy platforms for CO2 capture but must overcome several major challenges including: i) low productivity ii), difficulty in regenerating sorbents and iii) large capital cost for solid handling systems. This study aims to overcome these challenges by combining the advantages of the hollow fiber sorbent system1 with the next-generation high performance MOFs2. The highest performing MOFs to date, demonstrating excellent CO2 capacity and selectivities, tend to be materials that are unstable in humid or aqueous conditions. Developing techniques that enable use of the versatile MOF materials as adsorbents in fiber contactors would be a tremendous improvement upon current structured-sorbent capabilities. Demonstrating the synthesis of fiber sorbents with critically water-sensitive MOFs in a ready-to-use mass transfer contactor with minimal handling steps is the purpose of this work. This will opens the door for the use of many more “un-spinnable” MOF materials that exhibit tremendous adsorption capacities but have not moved beyond powder-scale experiments

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Abstract (#19428)

Title: Controlled-Size Nanoclusters Formation Using an Amino Acid-Functionalized Metal-Organic Framework

Authors: Abdulaziz Alruwaithi.

KAUST

In the study of nanocluster, the size of the cluster can dictate its activity. For instance, Au8 has an enzymatic activity towards the conversion of CO to CO2. On the other hand, Au6 is found to be inactive.

To control the size of the nanocluster, we are proposing the use of Metal-Organic Framework with positively-charged amino acid-functionalized linkers. Where the size of MOF and the repulsion force between the charged metal particle and the charged amino acids, push the positively charged metal ions together and hold them in a specific size that only fits the space of the cavity of the MOF used. Lastly, they can be reduced using a reducing agent (eg. NaBH4) into a specific size of interest without the need for any further treatment.

Abstract (#19353)

Title: Preparation of Nano-Co3O4-Coated Albizia Procera Derived Carbon by Direct Thermal Decomposition Meth

Authors: Ismail A. Buliyaminu, Md. Abdul Aziz, Zain Hassan Yamani.

CENT, KFUPM

Hydrogen fuel production by electrochemical method is a promising approach for energy production and storage. An efficient water oxidation is needed for molecular hydrogen generation by electrochemical method as necessary protons are produced in this process. Moreover, the clean oxygen generated in this process is useful in clinical applications and fuel cell fabrications. Therefore, for the construction of efficient and economical electrochemical cells for hydrogen and oxygen production, it is important to develop an efficient anode system that can oxidize water efficiently. Herein, nano-Co3O4 coated-Albizia procera (Roxb.) leaves derived carbon anode materials were prepared using a simple and straightforward thermal decomposition of Co(NO3)2.6H2O at 300 ?C without any pre-reaction. Six different samples (electrocatalysts) were prepared by varying the amount of the Co precursor with the fixed amount of carbon using the same thermal decomposition parameters. The prepared samples were characterized by different techniques including X-ray powder diffraction (XRD), Scanning electron microscopy (SEM), Energy dispersive spectroscopy (EDS), Thermo-gravimetric analysis (TGA), X-ray Photoelectron spectroscopy (XPS), and Raman spectroscopy. TGA data revealed that nano-Co3O4-C is stable at temperatures ? 320 ?C. The calculated size of the prepared nano-Co3O4-C is ~10 nm. The prepared samples were immobilized on the filter paper derived carbon electrode to study the electrocatalytic properties of the samples. The electrocatalyst prepared using highest amount of cobalt precursor yields high activity towards water oxidation and good stability.

Abstract (#NA)

Title: 3D Porous g-C3N4/Co3O4 QD p-n Heterojunction for Visible Light Driven Photocatalysis Using Fibrous Nanosilica (KCC-1)

Authors: Issam Gereige, Junbeom Cho†, Kyeong Min Cho†, Chansol Kim, Issam Gereige and Hee-Tae Jung.

Saudi Aramco

Photocatalysis is next generation technology for the degradation of pollutants and green synthesis of chemical and fuels using clean and sustainable solar energy. Recently, graphitic carbon nitride (g-C3N4) has attracted much attentions as a visible-light-driven photocatalyst with an appropriate band energy level and good chemical and photo- stability. To increase the photoactivity of g-C3N4, various nanostructures and composites have been studied for obtaining high surface area and fast electron separation. KCC-1 of novel mesoporous silica support has a unique fibrous structure, which has a highly accessible mesoporous structure compared to existing mesoporous support. Herein, we fabricated the 3D opened porous photocatalyst using the KCC-1 as a sacrificial template, which has a hierarchical porous structure from mesopore to macropore. The surface area and mesopore volume is 12 and 16 times greater

than bulk g-C3N4. In addition, the cobalt oxide quantum dot was 14niformly synthesized and p-n heterojunction increase the light harvesting properties. As a result, it has 4 times higher rate for photodegradation of methylene blue under visible-light than bulk one. Thus, the KCC-1 is a promising templates to make an effective photocatalyst due to not only unique structure but also hybridization of nanomaterial.

Abstract (#19544)

Title: Crucial role of hydrogenation to create FM properties in C-doped CdO nanocrystallite TCO

Authors: A. A. Dakhel.

University of Bahrain

CdO incorporated with C (CdO-C) nano-crystallites were synthesised by sol-gel method including sucrose (C12H22O11) as a source. This investigation is aimed to fix the necessary conditions to create room-temperature ferromagnetic (RT-FM) properties. Therefore, structural, optical and magnetic properties of the synthesised CdO-C samples were systematically investigated. The X-ray diffraction (XRD) method was used to study the structural properties and diffuse reflection spectroscopy (DRS) technique was used to study the optical properties. It was established that the hydrogenation is necessary process to create d0-FM. The magnetic properties of CdO-C were studied here for the first time. It is important to discover that CdO-C material can be used as a candidate for physical applications of tailored magnetic properties.

Abstract (#19458)

Title: Development of Porous Carbon Nanomaterials from Petroleum Waste for CO2 Capture and Mineralization

Authors: Almaz S. Jalilov, Abdualilah I. Albaiz and Mohammad A. A. Alsaidan.

KFUPM

The proposed research will focus on developing mineral carbonization technology using porous carbons from vacuum residue to generate products that are best suited economically for CO2 sequestration. We plan to accomplish this by in situ preparation of porous low density carbon materials from industrial waste, which serve as a support for CO2 mineralization in pores and use final carbonate enriched porous carbons, MCO3-PC, as a composite for a potential development of concretes with properties adopted from porous carbons such as high mechanical strength, electrical and thermal conductivity, magnetic properties and hydrophobicity.

Abstract (#19422)

Title: Integrating High-Throughput Technologies in The Quest to Mitigate Iron Sulfides Scale Formation in U

Authors: Harry D. Oduro, Hameed Al-Badairy, Mohammed H. Khaldi, and Anaam Al-ShaikhAli.

Saudi Aramco

There is an inherent problem of controlling iron sulfide scale formation and deposition challenges in ultra-sour oil and gas fields across the globe, and it costs billions of US dollars a year to mitigate. The heightened costs of FeS scaling and deposition issue can be attributed to the scant knowledge available on FeS formation mechanisms and reactions in sour-gas reservoirs. Reactions of reduced hydrogen sulfide, and sulfur intermediate species (from thermochemical sulfate reduction -TSR and bacterial sulfate reduction - BSR) with ferric and ferrous irons are difficult to control, because of their fast oxidation kinetics, variable non-linear behavior, exotic thermodynamic stability in reservoir downhole conditions [1, 2]. The multi-stage formation of FeS scale through reaction of reduced iron and sulfur species nucleation, aggregation, and bio-mineralization via a combination of aging and Ostwald ripening processes in many oil and gas reservoirs can have serious consequences on quality and quantity of natural gas (NG) produced per day, (ii) impact reservoir permeability downhole as well as plugging pressure control devices, and (iii) leading to eventual shutdown of oil or gas plants [3]. One of the most difficult problems currently facing operators and engineers in the hydrocarbon industry is how to economically control and prevent FeS scale formation and deposition phenomena in upstream and downstream operations, which is found to be affected by reservoir formation water pH, redox chemistry, and high pressure – high temperature (HPHT) conditions. Conventional chemical and mechanical treatment are the only scaling removal techniques suited for restoring reservoir productivity and flow assurance problems in oil and gas fields. The mechanical cleaning techniques are very expensive and laborious process, and do not adequately remove most of the hard, dense gray metastable/stable FeS scales formed under saturation under HPHT reservoir conditions. A significant technological advancement implemented recently to manage FeS scale formation involved the development of new in-house chemical formulation solvents coupled with advanced analytical techniques such as rear-time in-situ voltammetry for speciation analyses, environmental scanning electron microscopy (ESEM), and X-ray diffraction (XRD) to evaluate the microstructural and compositional phases of FeS scale materials prior to mitigation. In this paper, we present a novel solvent technology and a multifaceted analytical workflow technologies, which offer a rapid, more accurate quantification of FeS scale formation that could serve as a guide to obtain a suitable or fit-for-purpose blend for effective treatment of multi-FeS phase deposition/scaling risks in ultra-sour reservoirs.

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[2] Kamyshny et al., 2009. Geostand. Geoanal. Res. 33: 415–435.
[3] Oduro et al., 2008. Geochim.et Cosmochim. Acta, 72(12) 697.

Abstract (#19553)

Title: Nanocellulose film from agriculture by-products of palm date tree pods to be a precursor for textile

Authors: MA Habib, Abdulrahman G. Alhamzani.

Al Imam Mohammad Ibn Saud Isla

Palm date tree is more cultivated in Arabian Gulf Regions. The palm date farms generate huge amounts of agriculture by-products which considered a store of cellulose materials. This work has been devoted to study the possibility of obtaining value-added cellulosic nanofilm from the pods of the palm date tree. The pulp has been extracted through basic treatment in isobutanol/water using phenylhydrazine as a catalyst. High-quality white pulp has been obtained after bleaching with peracetic acid (in situ). Studying the optimal conditions of obtaining Nanocellulose from the bleached pulp has been achieved. It was found that the optimal conditions for nano-cellulose film formulation were hydrolysis with mineral acid at 60? C for 60 minutes followed by sonication for 45 minutes. The structure of the formulated nano-film has been tested by XRD and SEM techniques. The properties of the film (transparency, density, and degree of crystallinity) have been studied. The formulated film has a density of 1.28 g/cm3, 60% crystallinity, and 60 % transparency. The formulated nanoparticles are expected to display largely probable for the formulation of new nanocomposite resources to be precursor for textile and leather industries.

Abstract (#19215)

Title: Surface Microstructural and Thermal Evaluation of Coke Formation in Reforming Catalysts

Authors: Hameed Al-Badairy, Ali Alshareef, Mohammad Rebh, Amer Tuwailib and Anaam Al-ShaikhAli.

Saudi Aramco

Reforming catalysts are heterogeneous catalysts that are widely used in refining and petrochemical industries to produce higher octane products for gasoline blending and aromatics production. One of the factors affecting the performance of these catalysts is coke formation, which has a detrimental effect on the activity and selectivity of the catalysts. In this paper, microscopic, spectroscopic, and thermal analytical techniques, including high resolution environmental scanning electron microscopy (ESEM), energy dispersive X-ray microanalysis (EDS) and thermogravimetric analyzer (TGA), were applied to assess the extent of coke formation on an in-house reforming catalyst. Characterizing the catalysts microstructure and measuring level of coke formation may be used as an indicator to evaluate the catalyst activity and useful life service. The studied catalysts were fresh and spent reforming catalysts developed in-house. The spent catalyst was previously tested in a pilot plant with heavy naphtha feedstock at various reaction conditions. Throughout this study detailed surface morphology, chemical compositions and thermal stability measurements were carried out for the in-house synthesized catalysts. The acquired data showed that the studied catalysts comprised of irregularly-shaped micro and nano-scale particles with high degrees of particles agglomerations. For the in-house synthesized spent catalysts the level of carbon was found to vary from 11wt% to 30wt%. Also, fibrous C-rich structure was detected on the surface of the spent catalysts. The level of coke formation may be used as an indicator to evaluate the catalyst

activity and useful life service. Thus, the studies also proved that ESEM and TGA were powerful tools to study coke formation, morphology, and chemical compositions of fresh and spent reforming catalysts. Hence, the results may be utilized to assess the reforming catalysts activity and correlate it with the coke formation through the use of both ESEM and TGA data,

Keywords: Microstructural and Thermal Evaluation, Reforming Catalyst, Coke Formation, In-house synthesized catalyst

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Abstract (#19191)

Title: Reservoir Description Insights from Inter-well Gas Tracer Test

Authors: Abdulaziz Al-Qasis, Sunil Kokal and Sven Hartvig.

Saudi Aramco

Tracer technology has gained considerable attention recently as an effective tool in the reservoir monitoring and surveillance toolkit, particularly in IOR operations. Gas flow paths within the reservoir can be quite different from liquid (oil and water) flow path. This is primarily due to gravity override, and differences in density and relative permeability between the gas and liquid phases.

Inter-well gas tracer test (IWGTT) is a key monitoring and surveillance tool for any IOR projects. IWGTT should be designed and implemented to track the flow behavior of gas phase. The test generally entails injecting a small amount of unique perflouro-hydrocarbon tracers into the gas phase injectant stream. IWGTT have been conducted on a limited number of fields across the globe, and sample results of some will be presented.

The sampling frequency of the tracers from the producers should be designed carefully to collect the necessary data that will provide insights about the connectivity between the injectors and producers well pairs, gas breakthrough times ("time of flight"), and possible inter-well fluid saturations. Different fit-for-purpose unique tracers can be deployed in the subject injector(s) stream and their elution can be monitored in the corresponding up-dip producer(s).

In addition to reservoir connectivity and break-through times between injector and producer pairs, an IWGTT helps in optimizing WAG operations and production strategies for gas injection projects, improve sweep efficiency and ultimately enhance oil recovery. It can also be used to identify source of inadvertent gas leakage into shallow aquifers or soil gas, and help in the planning and placement of future wells.

This paper reviews the workflow and necessary logistics for the successful deployment of an inter-well gas tracer test. It will provide the best practices for designing, sampling, analyzing and interpretation of a gas tracer deployment. The paper also highlights the benefits of gas tracer data and their usefulness in understanding well interconnectivity and dynamic fluid flow in the reservoir. The results can be used to refine the reservoir simulation model and fine tune its parameters. This effort should lead to better reservoir description and an improved dynamic simulation model. The challenges associated with IWGTT will also be shared.

Abstract (#NA)

Title: Heating Effects in Silicon Solar Cells

Authors: Lujia Xu, Thomas Allen , Mohammed Al Aswad, Wenzhu Liu 1, Michele De Bastiani , Hang Xu , Jingxuan Kang , Xinbo Yang Erkan Aydin , Konstantinos Kotsovos, Ahmed AlSaggaf , Aqil Jamal , Issam Gereige , Stefaan De Wolf.

KAUST

For the sustained growth of the silicon PV market, a continued increase in cell efficiency, traditionally characterized at 25 oC, is a prerequisite. However, the energy yield under field conditions, in which the cell temperature can deviate considerably from standard test conditions, is of primary importance. In this work, we analyze the thermal effects that contribute to cell heating, and so energy yield loss, in a variety of silicon solar cell designs. This knowledge will be of consequence for cells and modules deployed in high insolation, high temperature environments which are suitable for PV generation.
To demonstrate the significance of heat generation in silicon solar cells, first we analyze the energy loss in the ideal Shockley-Queisser limit of a single junction solar cell with a bandgap of 1.12 eV operating under the AM1.5 spectrum. Here, only ~34% energy from the solar spectrum is converted to electricity. The remaining energy is lost, either via transmission (19%), re-emission (15%), or thermalization (32%). It is the latter process which is the main source of heating, accounting for an increase in cell temperature above the ambient. In real devices, additional energy losses that decrease the cell efficiency from the theoretical limit contribute further to cell heating, e.g. resistive losses, extrinsic recombination and parasitic absorption.
In the above calculation, sub-gap photons are transmitted through the device. However, recent emissivity measurements on an aluminum back surface field (Al-BSF) cell by Riverola et al. demonstrate that over 80% of this energy is actually absorbed, further contributing to the thermal load of the cell. In this study we assess the absorption of sub-gap photons in the most prominent cell architectures – AL-BSF, passivated emitter and rear cell (PERC), silicon heterojunction (SHJ) – via spectrophotometry measurements over the entire AM1.5 spectral range. We complement these measurements with quantum efficiency, and temperature dependent current-voltage (TD-IV), to assess both the current losses and the cell's temperature coefficients.
We build up an analysis platform to analysis the heating source of silicon solar cells under AM1.5 and develop a simulation program to simulate the outdoor working temperature of the solar cells. With all the information from the analysis, some guidelines for mitigate the heating effects are proposed.

Abstract (#19451)

Title: Improved Oxygen Evolution Kinetics by Hematite Modified Photoanode

Authors: Abdul Zeeshan Khan, Tarek Kandiel, Khalid Alhooshani.

KFUPM

Nowadays, fossil fuels are the major source of energy. However, the extensive consumption of them has detrimental effects on the environment. In addition, the expected depletion of fossil fuels causes an alarming situation. Solar energy is one of the abundant resources of energy coming to the earth. It is renewable, inexhaustible, clean and giving the earth more energy than required annually. To utilize and store the solar energy, photoelectrochemical water splitting has recently attracted more attention due to its potential application in clean production of hydrogen gas. In this work, the modification of hematite photoanodes with bismuth to enhance the efficiency of the hematite-based photoelectrochemical cell has been investigated. The synthesized materials have been characterized by SEM, XPS, and XRD. The hematite photoanodes have further investigated by using impedance spectroscopy technique. The modified photoanodes exhibits 2.5 times higher photocurrent than bare hematite. At optimized conditions, 2.26 mA /cm2 at 1.6 V vs RHE can be achieved in the alkaline medium under AM 1.5 G illumination. This high photocurrent is attributed to the enhanced charge carrier separation and the facile charge transfer as proven by the analysis of the impedance spectroscopy data.

Abstract (#19237)

Title: Formation Mechanism and Dissolution of Calcium Sulfate Scale

Authors: Qiwei Wang, Tawfiq Al-Shafai.

Saudi Aramco

Heavy scale buildup, in the form of gypsum, occurs in some of the newly drilled wells shortly after production commencement. These wells are completed in a carbonate reservoir with low calcium, in formation water, and supported by seawater injection. Gypsum deposition in the well system restricted the fluid flow and resulted in severe productivity decline. Studies were carried out to determine the scaling mechanism and the potential chemical solution for scale removal.
To determine the root-cause of gypsum deposition, scaling tendency was simulated and bottle tests were conducted at different mixing ratios of formation water, injection water, and well completion fluid. Prediction results and bottle test observations were also compared to validate the application range of prediction models. Scale precipitates formed were also characterized for calcium sulfate polymorph and crystal shape. In the second part of study, scale dissolvers with pH values ranging from <2 to >12 were evaluated over various test durations, and their dissolving capacities were determined at a range of temperatures.
Test results indicate that the scale formation was caused by the lost CaCl2 completion brine during well operation. Gypsum precipitation took place when the completion brine was commingled with either seawater, formation water, or a mixture of both. It was also found that the prediction models were applicable even at very high calcium concentrations. By comparing the test results with model predictions,

the critical supersaturation value for gypsum formation was determined. Dissolver tests showed that, in general, the alkaline dissolvers were more effective than the acidic products, although their dissolving powers declined quickly with time, partially due to the formation of secondary precipitation. Temperature had a moderate influence on scale dissolution for most dissolvers.
This study shows that sulfate scaling risk assessment should be performed and scale protection treatment could be required when CaCl2 brine is used for well operations. This paper also attempts to provide the guidelines for calcium sulfate descaling treatment and the further development of dissolver technology.

Abstract (#19332)

Title: Quantitative determination of biocide

Authors: Faisal A. Alrasheed, Xiangyang Zhu and Saroj K. Panda.

Saudi Aramco

Water injection into reservoirs has been a common practice in the oil industry for secondary oil recovery. The injection water needs to be filtered, disinfected, deoxygenated, and treated with anti-corrosive and anti-scaling agents, before transportation to faraway reservoirs for injection. Uncontrolled microbial growth in a large transportation network can lead to deterioration of water quality, creating many costly problems such as pipeline corrosion and fouling, injection well plugging, formation damage, and reservoir souring. To reduce the damaging effect of microbial growth, the oil industry typically uses a variety of toxic organic and inorganic chemicals (biocides), to control the microbial growth and activities in the potentially affected systems. One of the most common active ingredients in the biocide products used in various Saudi Aramco systems is glutaraldehyde, a more environmentally friendly alternative of formaldehyde. The conventional colorimetric/spectrophotometric method used in Saudi Aramco field laboratories, is based on the reaction with 3-methylbenzothiazol-2-one hydrazine (MBTH), which does not have sensitivity for detection of low concentration of glutaraldehyde residual, and is not sufficient by itself to ensure the environmental compliance of biocide residual, allowed in the water discharge near the treatment facilities. Therefore, a fast, accurate, and more sensitive analytical method for the quantitation of glutaraldehyde biocide is needed.
The presentation describes a quantitative analytical method for glutaraldehyde measurement in biocide products using high performance liquid chromatography (HPLC) technique. The method is based on the derivatization of glutaraldehyde using 2,4-dinitorphenylhydrazine. The derivatized product glutaraldehyde bis-2,4-dinitrophenylhydrazone boosts the sensitivity in UV-Vis detection and allows for a detection limit as low as 1 ppm. Furthermore, the separation of glutaraldehyde bis-2,4-dinitrophenylhydrazone on the C-18 column enhances the selectivity of the method by eliminating interferences from other aldehydes and ketones in the water sample matrices. The method is superior to the conventional methods, such as colorimetric and spectrophotometric methods in terms of sensitivity, accuracy, precision, and selectivity. The HPLC method has been applied to determine the biocide penetration rate from crude oil phase to water phase. With low detection limit, the method is also applicable for Saudi Aramco sea water treatment facilities, to ensure the environmental compliance of discharge water and determine the impact of residual biocides on the marine ecology.

Abstract (#19221)

Title: Evaluation of Anti-Knock Quality of Dicyclopentadiene-Gasoline Blends

Authors: Mohannad Al-Khodaier, Bhavani Shankar, Vijai Shankar; Waqas, Muhammad; Naser, Nimal; Sarathy, Mani; Johansson, Bengt.

Saudi Aramco

Increasing the anti-knock quality of gasoline fuels can enable higher efficiency in spark ignition engines. In this study, the blending anti-knock quality of dicyclopentadiene (DCPD), a by-product of ethylene production from naphtha cracking, with various gasoline fuels is explored. The blends were tested in an ignition quality tester (IQT) and a modified cooperative fuel research (CFR) engine operating under homogenous charge compression ignition (HCCI) and knock limited spark advance (KLSA) conditions. Due to current fuel regulations, ethanol is widely used as a gasoline blending component in many markets. In addition, ethanol is widely used as a fuel and literature verifying its performance. Moreover, because ethanol exhibits synergistic effects, the test results of DCPD-gasoline blends were compared to those of ethanol-gasoline blends. The experiments conducted in this work enabled the screening of DCPD auto-ignition characteristics across a range of combustion modes. The synergistic blending nature of DCPD was apparent and appeared to be greater than that of ethanol. The data presented suggests that DCPD has the potential to be a high octane blending component in gasoline; one which can substitute alkylates, isomerates, reformates, and oxygenates.

Abstract (#19297)

Title: Expandable lost circulation material

Authors: Raed Alouhali, Jothibasu Ramasamy, Md Amanullah.

Saudi Aramco

Loss circulation is a common and highly diverse drilling challenge. During loss circulation, total or part of the drilling fluid is diverted into areas of the formation commonly referred to as thief zones. Total loss can be the result of encountering a highly permeable zone, vugular formation, or intersecting with natural or induced fractures. Losing drilling fluid to the formation reduce the hydrostatic pressure in the annuls thus allowing other formation fluids to flow into the wellbore. This is not desirable because new fluids could be hazardous, flammable, or could simply change the rheology and chemistry of your mud, which will require time and money to rectify.
In this study a new loss circulation system is tested and evaluated. The base for this system is liquid sodium silicate with water and Urea as the activator at a ratio of 10:1:1 respectively. Sodium silicate, also known as waterglass, is an inorganic chemical made by combining sand and soda ash (sodium carbonate) at high temperature. The expansion is promoted by using four different metal slurries two Zinc metal slurries and

two Aluminum metal slurries. The last components for this system were ARC plug as a filler material and calcium carbonate as bridging material.
The expansion rate for each sample was evaluated at different time interval: after 1 hour, 4 hours, 24 hours and 48 hours. Swelling rate varied from 10% to 50% in the first hours depending on the type of metal slurry used with the liquid sodium silicate. Some samples exhibit rapid expansion followed by rapid shrinkage. Others had a slow but steady expansion rate through the test.
The results shows that this system is highly customizable allowing the operator to design the time and rate of expansion to fit their operational need. By changing the filler and bridging material the density and viscosity of the system can easily be optimized, too. This could be used as a standalone solution or with combination with other lost circulation material.

Abstract (#19338)

Title: Analysis of Total Sulfur and Nitrogen Species in Crude and Process Streams

Authors: Ganesh Bhat, Dr. Asraf Ali and Asad Naqvi.

SABIC T&I

Olefins and aromatics are major building blocks for petrochemicals and are produced by hydrocracking process of oils & gases in the presence of a catalyst. The presence of heteroatomic molecules such as nitrogen and sulfur are known to poison the noble catalyst and therefore removed by hydro treating. Still traces of these molecules present in the crude feed stocks and is a major catalyst poisoning in different process. These nitrogen and sulfur compounds get strongly absorbed on the catalyst surface during the process causing deactivation of the catalyst. Hence, determination of these compounds at trace levels are very important to know their concentration in the feedstock.
Gas Chromatography coupled with Nitrogen Chemiluminescence Detector is an excellent tool for nitrogen and sulfur monitoring up to ppm level but high boiling liquids cannot be directly analysed by GC since it does not elute completely. In the present work, such samples are analysed by combustion at high temperature followed by UV detection for sulfur and Chemiluminescence detection for nitrogen. The quantitative total nitrogen and total sulfur data obtained by combustion technique at 10000C was compared with data obtained by GC technique.

Abstract (#19373)

Title: Impact of Geochemical Analysis on Inorganic Scale Management

Authors: Ali Al-Tawfiq, Qiwei Wang.

Saudi Aramco

Scale formation is one of major flow assurance challenges faced in many oilfields. It can occur from reservoir and wellbore to surface flowline and processing facilities. Scale deposition not only restrict fluid

flow and decrease productivity, it also induces localized corrosion and stabilizes emulsion. Effective scale management is essential for the effective, efficient and safe hydrocarbon recovery and transportation. This presentation discusses the key role of chemical analysis in the development and implementation of scale management program. An effective scale management program consists of scale prediction, treatment, monitoring and optimization. Chemical analysis is an integral part in all these steps. Scale prediction is based on water composition to identify the likelihood of scale type, scaling location and severity of produced water. Inaccurate chemical analysis could lead to erroneous conclusions. Consequently, real problems may be overlooked and non-existent problems may be treated. During development of scale treatment program, chemical analysis provides essential information on scale inhibitor performance and guides the selection of the most cost-effective inhibitor product. For scale inhibitor squeeze studies, chemical analysis is used to determine the interactions of injected scale inhibitor with reservoir rock and the retention and release behaviors of scale inhibitor under downhole application conditions. For treatment monitoring, the efficiency of scale treatment program often depends on chemical analysis of collected water samples. Depletion of scaling ion concentrations is a direct indication of ineffective treatment. In scale inhibitor squeeze treatment, the treatment frequency depends on the residual inhibitor concentration in produced water measured by water analysis. Once the inhibitor residual is below the minimum required level, squeeze treatment must be repeated to avoid scale buildup. Therefore, it is essential to have high quality data through chemical analysis in order for responsible parties to respond to duties accurately and make conclusive recommendations to the operation. Case histories will be highlighted in this presentation to illustrate the impact of chemical analysis in oilfield scale management.

Abstract (#19445)

Title: Novel Condensate Removal with In-situ Pressure Generation via Thermochemicals

Authors: Ayman R. Al-Nakhli.

Saudi Aramco

With the increasing demand on gas worldwide, condensate banking represent a challenging problem in tight reservoirs and can significantly impair production rate. Gas injection and water-altering gas are the common techniques used to maintain reservoir pressure above dew point and avoid condensate development. However, these methods are not economical due to the large initial investment and high operational costs, as well they are considered temporary methods.

The objective of this study is to present a novel approach for permanent removal of condensate banking using thermochemical treatment. Chemicals will be injected to react downhole and generate in-situ pressure and heat. High pressure will raise the gas pressure above the dew point, and generated heat will change the phase of liquid condensate to gas. In addition to that, the generated pressure pulse will create micro fractures in the near-wellbore region. The creation of micro fractures in this region will change the relative permeability due to significant reduction of capillary forces, which will permanently prevent condensate banking.

Results showed that thermochemicals fluid increased the reservoir temperature and pressure beyond the

dew-point curve, which results in removing the condensate banking and enhancing the reservoir/well deliverability. The generated heat raised near-wellbore temperature up to 480 °F, which reduced condensate viscosity. Generated in-situ gas increased the pressure by 3200 psi and created several fractures. NMR and Micro CT images revealed development of many micro fractures and significant increase in porosity of the core samples. Created fractures increased permeability by 50 %, which therefore reduced the capillary pressure significantly.

The novelty in this paper is that heat and pressure pulse generated downhole due to the reaction created micro fractures in tight sandstone. This reduced the capillary forces holding the condensate which enabled permanent removal. Moreover, huff and buff treatment was fond very practical to elevate and remove condensate.

Abstract (#19562)

Title: Hydrodearylation: Upgrading Aromatic Recovery Complex Bottoms to BTX

Authors: Robert Hodgkins, Omer R. Koseoglu.

Saudi Aramco

Commercially available catalyst formulations to the refining and petrochemical industry are typically offered based on generic crude oil types with little consideration given to the added constraint of unit configuration, design and refinery feedstock/products. Saudi Aramco's Research & Development Center took the initiative and collaborated with JGC Catalysts and Chemicals—a leading catalyst developer and manufacturer in Japan—to develop a hydrocracking catalyst specifically for the Riyadh Refinery hydrocracker unit, designed to process heavy oil. Since this initial development, over 100 catalysts have been developed, tailored to target various feedstock and refineries. The series of catalysts are referred to as the CAN-HC-X series of catalysts.

Aromatic recovery complexes typically produce a low-value bottoms reject stream that comprises heavy alkyl-bridged noncondensed multi-aromatics in major proportions and condensed diaromatics in minor proportions. Depending on the refinery configuration, the reject stream is typically considered as a fuel oil blending component, as this heavy aromatic stream is dark in color, has a high density and exhibits a high final boiling point, which, if directed to a gasoline blending pool, impacts quality.

Hydrodearylation is a newly-developed and patented technology that provides a solution to upgrade the low-value aromatic bottoms stream to recover lighter mono-aromatic compounds (BTX).

The presentation will demonstrate how value creation is maximized by optimizing the process conditions through advanced analysis.

Abstract (#19208)

Title: Kinetic and Reaction Pathways of Hydrocarbon Reforming via Nano Zeolite Catalyst

Authors: Ali N. AlJishi, Emad N. Al-Shafei.

Saudi Aramco

Zeolites are potential catalysts for Refining and Petrochemical industry applications. This study was conducted on naphtha reforming process to produce higher octane and aromatic rich reformate to extract BTX for Petrochemicals. The synthesized nanocrystal zeolite catalysts were characterized by ammonia temperature programmed desorption (NH3-TPD), XRD, NMR, and N2 physisorption. The catalytic activity testing of hydrocarbon cracking was carried out in a fixed bed reactor at a space velocity of 10 h-1 to investigate the reaction pathway. In zeolitic reactions, there are two main pathways, which might occur: primary cracking and secondary cracking. Those mechanisms could be resulted from the micropores of the zeolites where the reaction takes place. The developed lumping kinetics of dodecane cracking involved n-paraffins, iso-paraffins, olefins, napthenes, and aromatics. They were described via fourteen rate constants in order to recognize the key reaction pathways and draw mechanism of short-path length pores of nano zeolite. The presentation will discuss the kinetic modeling of dodecane cracking over nano zeolite catalysts to predict products distribution as well as estimated rate constants parameters of hydrocarbon reforming.

Abstract (#19601)

Title: NiFe/NiFeOx/PANI Core/Shell Nanostructure for Highly Efficient Oxygen Evolution Reaction

Authors: Mohammad Alharthy, Abdulrahman Al-Betar, Mohamad Qamar, and Munzir Suliman

Saudi Aramco

There is an overwhelming increase in the scientific interest in water splitting due to its significance in enabling the storage of intermittent renewable sources of energy in the form of hydrogen gas. As renewable energy, such as sun energy, gets converted to electricity, it then can be used to produce hydrogen gas through water electrolysis. The overall efficiency of the electrolysis is currently restrained by the sluggish kinetics of the oxygen evolution reaction (OER). Herein, we demonstrate a simple synthesis of a novel nanocomposite comprising nickel iron oxide (NiFeOx) and polyaniline (PANI) for highly efficient OER. The nanocomposite is prepared by a simple solvothermal method with potential to scale up. Studies indicate that NiFeOx tend to assemble in a core-shell type structure; NiFe alloy as a core and thin oxide layer as a shell. The PANI is employed as a polymeric support for the dispersion of NiFeOx nanoparticles. The propensity of the as-prepared electrocatalyst to oxidize water is investigated by monitoring OER reaction in alkaline electrolyte. The as-prepared NiFeOx/PANI exhibits remarkable OER performance, substantially higher than that of NiOx/PANI and Fe3Ox/PANI. Furthermore, the as-prepared NiFeOx/PANI produces 10 mA cm–2, a benchmark current density, at 325 mV (overpotential), while NiFeOx without PANI requires 450 mV to generate the same current density. The core-shell structure and better dispersion qualities of NiFeOx into PANI matrix impart highly favorable electrochemical features in the as-prepared

electrode. The higher performance of NiFeOx/PANI is correlated to electrochemically active surface area, intrinsic electrical conductivity, surface charge transfer kinetics, and turnover frequency. The findings provide a fresh impetus to design highly efficient electrocatalysts for electrochemical energy conversion application using PANI as a polymeric and semiconducting support.