Posters List (Day 2)

Abstract (#19529)

Title: Assessing The Performance of Aniline Based Octane Booster Additive on Low Octane Number Naphtha Usin

Authors: Abdullah Algam, Amani Musharah and Ahmad Wedhaya.

Saudi Aramco

Saudi Aramco uses Methyl Tert-Butyl Ether (MTBE) to increase the octane number of its motor gasolines. Octane booster additives can be used to enhance the octane number of motor gasoline instead or in conjunction with MTBE. Usage of such enhancer can reduce the cost of motor gasoline production due to the elimination of naphtha reforming process which required to convert low octane naphtha to high octane reformate.
R&DC has assessed the octane number improvement of a new aniline based octane booster additive using a Cooperative Fuel Research (CFR) engine as per the standard analytical method ASTM D2699. The findings of this study confirmed that Low octane number naphtha (56 RON) could be upgraded into 92 RON product with 8% volume of the aniline based octane booster additive. It can also enhance the 91 RON gasoline to 95 and 98 RON by adding 1.0 and 2.5 vol. % of octane booster, respectively.

Abstract (#NA)

Title: Multicolor Carbon Dots as Barcoded Fluorescence Nanoagent Tracers for Oil Field Application

Authors: Wei Wang, Amr I. Abdel-Fattah.

Aramco Services Company

1. OBJECTIVE/SCOPE
Tracer technology has been increasingly used in inter-well tests to investigate reservoir performance, reservoir connectivity and residual oil saturation for providing useful information to improve decision making in reservoir management. Multifunctional barcode tracers with high-sensitive real-time detectability are highly desired. In this research, we report novel methods to synthesize carbon dots (C-Dots) from various natural carbon-containing precursors and manipulated their optical properties to create fluorescence barcode functionality for tracer application.
2. METHODS, PROCEDURES, PROCESS
Various naturally available carbon-containing materials were used as precursors for C-Dots synthesis through controllable oxidization reactions in solutions. These inexpensive starting materials include coal, graphite, charcoal, petroleum coke, lignin, vegetable oil and coffee powders, etc. Resulting colloidal C-Dots from different precursors exhibit different fluorescence properties, suggesting their potential barcoding capability for tracer applications. Transmission Electron Microscopy (TEM) was used to study the geometry and size of the synthesized C-Dots, and their carbon structure and surface chemistry were

studied with Raman and Fourier Transform Infrared (FTIR) spectroscopy. Their zeta potential was measured via electrophoresis using Dynamic Light Scattering (DLS).

3. RESULTS, OBSERVATIONS, CONCLUSIONS

The synthesized water-dispersible C-Dots were mostly spherical dots with size range in 5-50 nm as depicted by TEM images and Raman spectroscopy confirmed their carbon structure. The C-Dots have negative zeta-potential and were readily dispersible in water, seawater and brine solutions. FTIR spectroscopy revealed the existence of hydroxyl (-OH) groups on the C-Dot surfaces. Two-dimensional (2D) fluorescence profiles showed that different C-Dots can be identified by their featured fluorescence, demonstrating their optical barcoding capability. Our results suggest that the synthesized C-Dots have excellent fluorescence properties, thermal stability, photostability, and water dispersibility, demonstrating great potential in a variety of O&G applications, such as multifunctional reservoir tracers and well integrity monitoring tracers.

4. NOVEL/ADDITIVE INFORMATION

C-Dots were synthesized from inexpensive naturally available materials. They exhibit stability in hot brine and featured fluorescence properties, enabling their use as optically barcoded nanoagent tracers in oil field application. They enable near real-time feedback from tracer data and reduce the cycle-time associated with conventional detection methods such as GC/MS used for molecular tracers. Their excitation-dependent fluorescence emissions overcomes a major drawback in existing optically-detectable carbon nanodot tracers (e.g., A-dots; Kosynkin and Kanj, 2016).

Abstract (#19269)

Title: Interactions of Stimulation Acids with Oil Cement

Authors: Ali A. Al-Taq, Basil M. Alfakher, Abdullah A. Alrustum.

Saudi Aramco

Acids are commonly used in oil industry to remove formation damage and enhance well productivity. This practice will expose cement, used behind casing and in water shut-off treatments (cement bridge plug), to acids attack. Severity of acids attack on cement varies upon several factors, such as acid type, concentration, acid/cement ratio and exposure time.

Acids attacks on cement result in dissolution, degradation and weaken of cement. One of the common techniques used to assess acid/cement intercalation is analysis of spent acids due to reaction with cement.

Composition of corroded layers of cement attacked by acid varies upon acid type. A detailed study of the corroded layers of oil cement attacked by HCl, HCl/HF, acetic acid, citric acid and retarded HF acid using EDS/SEM is presented in this paper. Also, thickness of corroded layer was assessed using both SEM and EDS analysis.

This study presents in detail acid/cement interactions aspects addressed in cement weight loss, key ions leached from cement into spent acids: HCl, HCl/HF, retarded HCl/HF, citric acid and acetic acid and concentrations of cement key ions such as Ca, Mg, Si, Fe and Al in spent acids as a function of acid type and exposure time. It also presents the effect of acid resistant additives on severity of acid attack.

Abstract (#19577)

Title: Interaction between Bacteria and Calcium Carbonate Precipitation at Different Temperatures

Authors: Laila Alabdrabalnabi, Hamad Alsaiari.

Saudi Aramco

The formation of inorganic scale deposition is a persisting challenge in wellbores and pipelines of oil and gas industries. There are different compositions of oilfield scale such as calcium carbonate, calcium sulfate, iron carbonate, iron sulfide. The accumulation of the scale deposits can result in hindering the fluid flow in the pipelines and damage valves and pumps during the production process. Hence, inadequate inhibition of inorganic scale formation affects significantly the integrity of the production systems and disrupts the revenue negatively. Several factors have impact on the thermodynamics, kinetics of precipitations, and the level of scale deposits adhesion. These factors include, but not limited to, concentrations of the constituent ions, temperature, pressure, solution pH, ionic strength, and brine impurities. Many studies have been conducted in regards to understanding the factors affecting oilfield scale formation. However, very few studies focused on the impact of bacteria on the precipitation kinetics of oilfield scale.

The stream of the production systems host various bacterial genera and species that presumably interact with its surrounding. Currently, there is a clear lack of knowledge on how bacteria impact the formation of oilfield scale. Building knowledge and competency to understand the area of bacteria-scale-interaction is important in order for the scientists and engineer to provide accurate interpretation and effective technical recommendations to the field operations. In this study, laser detection method was used to develop trend that reflects the interaction between bacteria and calcium carbonate precipitation. Several experiments has been to understand the impact of bacteria on the precipitation kinetics of calcium carbonate at different temperatures.

Abstract (#19580)

Title: Predicting Waxing Tendency Using Some Paraffin Content

Authors: Muqbil Alkhalaf, Okechukwu Egbukole.

Saudi Aramco

OBJECTIVE
Achieving smooth transportation of produced reservoir fluid from bottom hole to surface, production facilities and export terminals are key objectives in flow assurance. This involves handling various challenges posed by the desired hydrocarbon, produced water and solids as they migrate to surface facilities. One of these challenges to flow assurance is wax deposition.

Predicting paraffin wax (macrocrystalline wax) and naphthenic wax (microcrystalline wax) deposition tendency of crude oils is essential in mitigating the costly remedial action required to keep the flow lines and storage facilities free of wax deposits.
This paper illustrates the challenges resulting from wax deposition due to temperature drop while transporting or storing oil, and a method to predict the tendency of oil to form a wax layer based on its n-hexane (C6),nonane (C9), n-heptadecane (C17) and n-pentacosane (C25) contents. In addition, this paper will go over the validation of this method with another waxing appearance temperature measurement techniques and the advantage of this simple method over others. Finally, techniques to remedies and prevent wax formation will be discussed.

METHODS / PROCEDURES
In this study, fingerprint peak heights of the hydrocarbons are obtained using the gas chromatograph. The hydrocarbon peaks height ratios are calculation and plotted on a scaled table and the point of intersection of the ratios used to predict the probability of wax deposition from the crude oil sample.
The methodology used in this study involves the following steps:
1) Conducting fingerprint analyses of the crude oil sample to obtain the peaks heights of the hydrocarbon components using high resolution gas chromatograph.
2) Integrating the peaks to obtain accurate peak heights.
3) Calculate the ratio of the required components and plot them on the scaled table.
The position or point of intersection of the vertical and horizontal components ratios on the plot is then used in predicting the waxing tendency of the crude.

RESULTS / DISCUSSIONS
In the results section, the values obtained from the ratio and predictions were compared with the results obtained using the cross polar microscopy (CPM) method and the physical properties of the crudes oil samples analysed.

BENEFITS / ADDITIVE INFORMATION
This simple application of chemical behaviour of some paraffin components of crude oil to predict waxing tendency is less expensive and deploys the use of existing laboratory equipment in solving potential flow assurance problems.

Abstract (#19612)

Title: Solubility Pattern of New Environmentally Friendly Pipe Dope Removal: A Laboratory Study

Authors: Noorah Almulhim, Jamal Alaamri, Hussain Abbass, Khalid AlZahrani and Abdullah Alhajri.

Saudi Aramco

Since the beginning of the petroleum industry, it is common to use pipe dope during well construction for both casing and tubing to lubricate, seal and protect against corrosion of segment-connecting threads. However, excess running pipe dope is squeezed out into the annular space where it can gain access to wellbore fluids and cause formation damage in producing wells and injection wells. It should be cleaned and washed out from the tubular goods before it gets to the wellbore or the formation. Many solvents

designed for the removal of pipe dope are available; however, the solubility pattern and their efficiency are varied and need to be always optimized. The objective of this study is to study the performance and the solubility pattern of a newly cleaning solvent for pipe dope and compare it to the performance of a commercial one.
The evaluation of pipe dope remover was mainly based on the results of two laboratory tests: (1) Static solubility tests to measure the maximum dissolving capacity of the solvent; and (2) Dynamic solubility tests at different temperatures (25, 50 and 75 °C) to measure the pipe dope remover efficiency. In the static solubility, all of the solvents removed all the hydrocarbon contained in the pipe dope samples and left the solids below the saturation limit. All of these samples were comparable to the theoretical value of 60 percent solids and 40 percent hydrocarbon. In the dynamic solubility, both of pipe dope removals were able to dissolve all available pipe dope at room temperature in one hour. At 50 OC, pipe dope removal A dissolved more than 96% of the original pipe dope weight after 35 minutes while pipe dope removal B dissolved more than 99% after 55 minutes. Pipe dope remover A was more efficient than pipe dope removal B at 50 °C. At 75 °C. Pipe dope removal A dissolved more than 99% at 25 minutes and Pipe Dope remover B dissolved all of the pipe dope at 10 minutes. Pipe dope remover B showed higher dissolving power for the pipe dope at 75 °C compared to pipe dope remover A.
The novelty of this work was to provide a scheme of evaluating new pipe dope removal and to introduce more environmentally friendly solvent with high dissolving power solvents.

Abstract (#19415)

Title: GC Fingerprinting to Assist Oil Wells Downhole Corrosion

Authors: Talal Alghamdi.

Saudi Aramco

Part of any well completion jobs is the installation of multiple casings to isolate the well from any other reservoirs such as water aquifers. The space between each two casings is called annulus. There are two kinds of annuli; Tubular-Casing Annulus (TCA) and Casing-Casing Annulus (CCA). While CCA is maintained at zero pressure, TCA should be maintained at positive pressure and this is usually accomplished by displacing the TCA with inhibited diesel. This practice would enable the quick detection of any possible casing leaks or downhole failure due to corrosion leading to TCA communication either surface or downhole during production. The composition of diesel is mainly C9+ with very minimum amount of light ends C3 to C7. Arab light crude oil on the other hand is rich in light ends mainly because of the associated gas. In this paper, we have studied the ratio between light ends to heavy ends in different mixtures of diesel with two grades of crude oil utilizing gas chromatography. This will help production engineers for the early detection of any possible downhole communication caused by corrosion to maintain the well integrity. This study was conducted to assist one of the giant Arab light reservoirs in the world as well as two additional reservoirs.

Abstract (#19493)

Title: Evaluation of the Electrical Conductivity of Ultra-Low Sulfur Diesel

Authors: Hajar Al-Essa.

Saudi Aramco

Saudi Aramco assessed the feasibility of producing ultra-low sulfur diesel fuel (maximum sulfur content 10 mg/kg), e.g.: the new A-861 grade, as part of a Clean Fuels initiative.1 Handling such type of fuel can be hazardous, since, the poor electrical conductivity resulting from the removal of sulfur and other polar compounds during the manufacturing process can lead to accumulation of dangerous levels of static charge during fuel handling, where, a sudden discharge of this static electricity can act as an ignition source and trigger the explosive combustion of flammable hydrocarbon vapors.2
Selected additives are commonly added to ultra-low sulfur diesel fuels to enhance the electrical conductivity of fuel and avoid the threat of such catastrophe occurrence during fuel handling due to static discharge. To ensure safe production, handling and distribution of this low conductivity diesel across Saudi Aramco fuel operations, R&D center conducted a comprehensive study to identify suitable conductivity additives for the enhancement of electrical conductivity of fuel.
This investigation was conducted in collaboration with SWRI (USA). In this work, a review of electrical conductivity-additive market for diesel fuel, initially undertaken, resulted in the selection of six additives, from five world-class suppliers. The characterization of additives was applied and followed by additive performance after mixing with ultra-low sulfur diesel fuel. After that, the targeted diesel, with different properties were segregated and characterized and evaluated for conductivity enhancement performance. The performance study was carried out at different parameters, such as: level (range from 0.25 – 3 mg/L), temperature (0, 22 and 40?C) and time (0, 2nd, and 7th day) in order to simulate real-life usage condition. Finally, and most important, the performance of the electrical conductivity additive at high concentrations to understand the possible harmful effects which might occur if the additives were overdosed into the fuels.
It was found that all additives satisfactorily met the conductivity enhancement criterion, but at different extent. The overall findings on additive performance was summarized into a ranking “score”. Such findings can be corporate-wide useful for operation crew and process engineers, as well as, industrial hygiene and asset management teams.

Abstract (#19556)

Title: Significance of Clay Mineralogy for Reservoir Quality Prediction

Authors: Muzzammil Shakeel, Hicham El Hajj.

Halliburton

Clay minerals can play an important role in reservoir quality prediction, affecting both the reservoir capacity and production. Because the grain size of clay minerals is generally very small and can result in very low effective porosity and permeability, its presence in a reservoir may have direct consequences on

the reservoir properties. This paper provides the results of laboratory testing and characterizations of unconventional reservoir formations, including type of formation and clay content.
This paper includes quantitative characterizations of shale field samples. X-ray diffraction and X-ray fluorescence techniques were used to analyze the mineral and elemental compositions, respectively, of the shale field samples. Cation exchange capacity was then conducted to determine the clay content present in the formations. Capillary suction tests and liner swelling meters were also used to help understand the swelling properties of the clay content in the field samples, which can be of use in drilling fluid selection.
For the operator, it is crucial to know whether the current treatment of clay stabilization is effective. Knowing the type and abundance of clay is important in understanding the necessary response for petrophysical analysis as well. Diagenetic clays such as smectite and illite are of particular interest because of the pronounced effects these clays can have on production rates, as well as the damage that can be caused by improper treatments resulting from a lack of understanding of the lithology of the targeted formation. Therefore, in order to properly evaluate and explore these shales, rock property data need to be measured and cross checked with log data. These integrated data provide operators with critical parameters to help define the best brittle reservoir interval and avoid exploration failure by choosing compatible drilling and hydraulic fluids or recommending special blends for a more effective approach with abnormal mineralogy and complex shale.
This paper can help operators gain a better understanding of clay mineralogy in shale formation. In addition, it could help operators determine appropriate solutions for drilling fluid selection by indicating whether productive fluid should be used to help control the swelling properties of clay minerals.

Abstract (#19504)

Title: Effect of Temperature and Concentration on The Corrosion Inhibition Mechanism of Alkyl Pyridine Benz

Authors: Abdulrahman K. Huwaiji, Muthukumar Nagu, Nayef M Alanazi.

Saudi Aramco

The corrosion inhibition mechanism of the commercially available corrosion inhibitor (Alkyl pyridine benzyl chloride quaternary based) on carbon steel surface in carbon dioxide saturated 3.5% sodium chloride solution has been studied. The inhibition efficiency increases with increasing concentration of corrosion inhibitor at both tested temperatures. The inhibition efficiency decreases with increasing temperature. EIS results show that the mechanism of its corrosion inhibition is forming a protecting layer. The inhibitor could primarily be physically adsorbed at low concentrations, while chemisorption is favored as concentration increases. Excellent inhibition with protection efficiency of about 90% was achieved on addition of corrosion inhibitor. Surface characterization techniques namely Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD) and Fourier Transform Infrared (FTIR) spectroscopy were employed to elucidate the mechanism of the inhibition.

Abstract (#19246)

Title: Identification and Compositional Characterization of Polar Organic Components from Unknown Deposits

Authors: Nadrah Alawani, Faisal Alghamdi and Hendrik Muller.

Saudi Aramco

Unknown deposits can be generated and accumulate in different parts and equipment in oil refineries and gas plants such as: crude oil tanks, refinery products tanks, desalters, and elsewhere during oil production and processing. These deposits in most cases lead to problems that can be summarized as following; desalting upsets, corrosion, fouling, and deposits in distillation units and hydrotreaters, as well as foaming of amine treating units. To solve these problems, identify the root causes, and prevent reoccurrence, there is a continued need to characterize the associated deposits.
Generally, deposits may form from a wide variety of oil and gas operations, resulting in complex mixtures containing different quantities of:
1- Inorganic materials, such as corrosion or scaling products, minerals, composites, and/or degradation products.
2- Petroleum based, or derived, hydrocarbons such as asphaltenes, coke, heavy oil components, lubrication oil, waxes, middle distillate-based solvents, etc.
3- Polar organic components such as polymers, oil field chemicals, additives, etc.
4- Water, including high-salinity industrial/sea water.
5- Microbial content and fouling products.
A sequence of several methods is necessary for the comprehensive compositional characterization of such deposits. Here, an analytical method was developed to extract and analyze polar materials in industrial sludge deposits. After extraction, the materials are analyzed using electrospray ionization mass spectrometry (ESI-MS) that can provide detailed information about their chemistry and potential source. Coupling an ESI source with high accuracy and high resolution mass analyzer, like a Fourier transform ion cyclotron resonance mass spectrometer (FT-ICR MS), enables the assignment of a unique elemental composition to each peak in the mass spectrum, even in complex mixtures.
This method was applied on several real-life deposits to identify their polar components, and helped link the materials to their sources, which ultimately facilitated deposit removal and mitigation.

Abstract (#19287)

Title: An Overview of Recent Trends in FCC Catalysts

Authors: Adeel Ahmad, Abdallah Al-Shammari ,Shakeel Ahmed.

Saudi Aramco

With the depletion of crude oil reserves, more focus have been shifted towards the catalytic cracking of heavier hydrocarbons for the production of transportation fuels. Fluidized catalytic cracking (FCC) of vacuum gas oil (VGO) is considered as a promising process for enhancing the gasoline yield to fulfill the

global energy demand. Recent literature on FCC catalyst indicates the room for increasing the efficiency of regular FCC zeolites based catalysts. This is due to the complex feed compositions, diffusion limitations, less yield of desired hydrocarbons and instability of the catalyst due to the coking and poisoning by the sulphur, nitrogen and oxygen bearing species in the feedstock. The inclusion of hierarchical zeolite catalyst systems have been considered as most suitable option. Although, it has been proved that FCC catalyst mesoporosity enhances the catalyst performance but it does not mean that ultra large pore size of zeolite are necessarily suitable active component of FCC catalysts. Both MCM-41 and USY zeolites have been tested for the large molecules cracking but MCM-41 performs poorer due to its low thermal stability at the high temperature which prevents its use in severe FCC cracking process conditions. Apart from ZSM-5 and Y zeolite, Beta zeolite has also been tested for the FCC cracking but thermal stability and economics impedes its application to use it in large scale. Medium pore size MCM-22 shows less activity in the testing of large molecules. Zeolite ITQ-7, in FCC cracking, shows improved olefin selectivity and higher gasoline yield. On the other hand, ITQ-21 and ZSM-20 which had similar structure and pore opening compared with zeolite Y shows same cracking characteristics except for a high propylene and LPG yield but less olefinicity in ITQ-21. A new Zeolite which had three dimensional channel system named as ITQ-39 performs better for cumene production from the alkylation of benzene and considered a good additive for FCC catalyst. A catalyst mixture of ZSM-5 and ITQ-33 had more yield of middle distillate and propylene as compared to US-Y Zeolite but stability and economics limits its widespread applications. These new trends of catalyst made possible to process heavier crude oil fractions to increasing amount of propylene and gasoline range fuels.

Abstract (#19180)

Title: Mitigation of Internal Microbiological Influenced Corrosion for Sweet Crude Pipelines Using Corrosio

Authors: Abdulla Aldossary, Sultan Al-Mutairi.

Saudi Aramco

This study is intended to evaluate and specify the type of corrosion inhibitors (CI) that are combatable to two biocide chemicals to be injected simultaneously into sweet crude pipelines in order to mitigate the internal microbiological influenced corrosion. Six corrosion inhibitors were assessed under simulated field operational conditions to assess their performance and their compatibility to biocide chemicals. The assessment program consisted of performance evaluation of proposed corrosion inhibitors in high pressure and high temperature autoclave facility in addition to thermal stability and foaming tendency tests. Based on laboratories studies, two corrosion inhibitors were effectively compatible to the biocides chemicals under the field simulated conditions. The dosage of the injected chemicals were optimized to obtain the maximum corrosion protection rate.

Abstract (#19248)

Title: Optimal Temperature Control of a Batch Tanke Equipped with a Steam Heating Coil System

Authors: Anas Safar.

Saudi Aramco

Abstract: Heat transfer occurs in a large number of processes. This phenomenon is encountered whenever there is a temperature difference in the system. The predictability of the heat transfer rate of the process is essential not only to increase the efficiency of the process, but also to ensure safe operations. Although CFD has been successfully applied to describe the heat transfer mechanisms, modelling the heat transfer of irregular geometries remains a huge challenge. In this work, both of computational and numerical investigations were performed to study how modelling can be employed in describing the heat transfer on a batch tank provided with a steam heating system, which allows for optimal control on the temperature of the fluid. A preliminary study on the vessel (filled with water) was carried out to develop some methodologies that can be used in estimating the overall heat transfer coefficient and the required mass flow-rate of steam. The results were verified using the data available in the literature. In addition, a three dimensional simulation models were conducted using the commercial CFD code "ANSYS FLUENT-15.0". Basically three different simulation models (pure conduction, free convection, and fully mixed) were used to synthesis and provide fundamental understandings of the heat transfer behaviour in the system. The simulation results revealed that, a wave-like propagation of heat was noticed in the pure conduction mode which indicates that the heat is transferred by the vibrations of the water molecules. On the other hand, the macroscopic movements of the fluid in the free conviction mode resulted in a significant heat transfer enhancement in the system in which the heat was nearly distributed equally through the fluid. In all the cases, a high convergence level was achieved with excellent accuracy. Finally, it was found and proved that there is a linear relationship between the true inner wall temperature and the fluid temperature.

Abstract (#19199)

Title: Determination of Arsenic in Naphtha by Micro Emulsion Sample Stabilization and Gf-Aas Technique

Authors: RAVINDRA BELOSE, Prakash Nayak.

Saudi Aramco

Naphtha is crude oil refinery product used in gasoline blending, as feedstock in naphtha cracker, fertilizers etc. Presence of trace Arsenic has a tendency to deactivate costly catalyst, besides the threat of release of toxic vapors to the atmosphere. Hence precise and accurate quantification of Arsenic in naphtha is vital. There exist a UOP-946 method for determination of Arsenic in naphtha. This method is laborious and time-consuming. Needs six hours to complete. Also recently ASTM organization has published a research paper for analysis using ICP-MS technique. ICP-MS is expensive instrument.
The proposed approach is simple involving sample preparation by micro emulsion stabilization, followed by direct analysis GF-AAS with Zeeman background correction. The stabilization was achieved by mixing

the sample with 0.014 M HNO3 and Iso-Propanol solution at 3:0.6:6.4 volume ratios A total of 30 ?l of the stabilized sample as well as 5 ?l of the Ni(NO3)2 modifier solution were then injected in the graphite furnace. Calibration was performed with aqueous (0.2% v/v HNO3) arsenic standards. This technique is studied, validated using IUPAC single laboratory and Eurachem method validation guidelines.
The method was assessed using two types of naphtha samples (Whole naphtha and NGL). The method was found to be robust and fit for purpose. Obtained detection limits in 5 ppb-wt, making this method in compliance with Saudi Aramco specification for Arsenic 20 ppb max.. Percent recoveries were within the prescribed range of 98 – 105 % and method repeatability were assessed with %RSDs below 10% over nine replicates each for three different concentration.

Abstract (#19225)

Title: Hydrocracker Performance Evaluation and Optimum Unit Utilization Plan

Authors: Ibrahim AlGhamdi.

Saudi Aramco

Hydrocracker unit and catalyst performance evaluation and optimum utilization plan, including DMO processing were outlined. Moreover recommended operational guideline to meet the end of run cycle Sep 2019 was provided. Furthermore, two case studies; (1) Extending the catalyst life cycle, and (2) Increasing reactors peak temperature, for optimum catalyst and unit utilization were included. During 2017 CFTP shutdown, the reactors were loaded with fresh catalyst; DHC-8 and HC-43LT. Therefore, predicting the catalyst life cycle for optimum unit and catalyst utilization is essential. Hence, the catalyst deactivation analysis was evaluated. As a result, higher deactivation rate was indicated in DHC-8 catalyst, while HC-43LT was lower. Overloading the DHC catalyst was required to meet the clean fuel products specifications. However, since Riyadh Refinery is not planning to produce clean fuel products specifications during 2017-2019 cycle. Therefore shifting the load from DHC to HC reactors was a target, to ensure full catalyst utilization by the planned end of run date. Furthermore, processing DMO was crucial to positively impact the refinery gross margin.

Abstract (#19452)

Title: Synthesis of Nickel/Zeolite Catalyst by Chemical Deposition

Authors: Dr. Ali Rinaldi, Yahia Hakmi, Mohammed Sanhoob, Dr. Arief Wibowo, Dr. Oki Muraza.

KFUPM

Saudi Arabia 2020 vision demands better utilization of its oil and gas resources to higher value chemicals. The chemical conversions of oil and gas feedstock require stable catalyst to sustain high temperatures under net oxidizing or reducing conditions. Nickel supported catalyst is

commonly used in many hydrocarbon reaction processes such as dehydrogenation, partial oxidation, steam-reforming and dry reforming reactions. The loss of nickel catalytic activity during operation has been assigned to be the result of nickel sintering and coke or carbon fiber formation. Hence designing a highly-dispersed and stable nickel catalyst is crucial for a stable operation under extended period.
Stability of nickel catalyst is affected by various parameters in the catalyst preparation stage, catalyst activation stage, and finally the working condition of the catalyst. In this work we focus on the catalyst preparation stage by studying three different nickel deposition methods onto zeolite support. The deposition methods are wet-impregnation, adsorption and adsorption with an organic additive. The nickel dispersion of the calcined catalysts were evaluated based on ICP, FESEM, EDX and X-ray diffraction characterization methods. The stability of the calcined catalysts were assessed by analyzing the carbon fibers formed after exposure to pure methane at 800oC. The carbon fiber growth step were used as an accelerated test or abuse test to simulate the deactivation process commonly observed in hydrocarbon reactions. Here we show that the impregnation method exhibits the lowest dispersion and stability of the nickel nanoparticles. Long carbon fibers with a broad range of diameters were formed on the catalyst prepared from the wet-impregnation method. Whereas only short and small diameters of carbon fibers were observed when the catalysts were prepared from the adsorption method with an organic additive. Our results show that the dispersion and stability of the nickel catalyst demonstrate the following order: wet impregnation < adsorption < adsorption with organic additive. We will show more details in the poster presentation. We will also discuss how the dispersion and the stability are linked with the nickel-zeolite support interaction. We anticipate that the bottom-up approach used in this work will lead to a better understanding on how to prepare stable supported metal and/or metal oxide catalyst for reactions involving hydrocarbons.

Abstract (#19596)

Title: Reviewing Advantages and Disadvantages of Three Approaches to Reverse Osmosis

Authors: Gary Engelgau, Richard Fruit.

Athlon, a Halliburton Service

Reverse osmosis (RO) is a highly effective water purification process widely used in numerous industries. To optimize process runtime and operational costs, it is vital to determine the system's true operational performance. Three approaches to performance monitoring are discussed along with advantages and disadvantages for each method. Understanding these methods will allow owners/operators to optimize their RO system to maximize membrane life, minimize downtime, and reduce operational costs.

Abstract (#19361)

Title: Light Naphtha Aromatization Using Metal-doped Mesoporous MFI Zeolite Catalysts

Authors: Yaming Jin, Hamzh J Alhmadh, Abdullah Banai, and Emad Shafei.

Saudi Aramco

Direct aromatization of light paraffinic naphtha is typically carried out at an elevated temperature, i.e. above 500°C, using a multifunctional zeolite based catalyst. The conversion process involves a complex reaction network including cracking, oligomerization, cyclization, dehydrogenation and coking. Of these, coking is an undesirable side reaction that leads to formation of carbonaceous deposit or coke precursors, which can block the reactant hydrocarbon molecules from accessing the active sites located inside zeolite micro channels, and aromatic product molecules from escaping. Mesoporosity is a desirable feature for zeolitic aromatization catalysts. The textural characteristics of mesoporous zeolite, i.e. higher external surface area and shorter micro channels, permit better accessibility of hydrocarbon molecules to the active sites located inside the zeolite micropores. It has been found catalysts with high mesoporosity performs better in overcoming the diffusion limitation of the reactants, intermediates and products, and show improved tolerance to carbon deposition. In addition, Mesoporosity facilitates dispersion of extra-framework metal dopants. For gallium doped HMFI zeolite catalyst, close proximity of GaOx to the zeolitic Brønsted acid sites is beneficial for high aromatics yield. A controlled base-leaching technique has been investigated to generate intracrystalline mesopores in MFI zeolite crystallites while at the same time keeping zeolite micropore system intact. The partially desilicated mesoporous MFI zeolite is then further processed to form aromatization catalysts. In this paper, we will present results of a systematic study of desilication process variables and their impact on zeolite textural properties, crystallinity, and acidity. Fixed-bed results of light naphtha aromatization using the gallium doped mesoporous HMFI catalyst will also be presented.

Abstract (#19547)

Title: Identification of Diesel Contamination in Jet-A1 By Simulated Distillation Gc Technique

Authors: Imran A. Naqvi, Saleh Al Abbas and Ahmad Wedhaya.

Saudi Aramco

The presence of small amount of diesel in Jet A-1 fuel may effect on the specifications that globally provided by British Ministry of Defense DEF STAN 91-91. This specification defines the minimum property requirements for Jet A-1 aviation turbine fuel and lists acceptable additives for use in civil operated engines and aircrafts. Specification ASTM D1655 is directed at civil applications, and maintained as such, but may be adopted for military, government or other specialized uses. Recently, a study was conducted to identify the diesel which is mixed with Jet A-1 fuel. The study comprises the minimum brink of diesel mixed with Jet A-1 that may effect on DEF STAN 91-91. Gas chromatography (GC) with Flame Ionization Detector (FID) simulated distillation (SimDis) is one of the best technique to identify the diesel mixed with Jet A1. It allows a larger selection of columns and analysis

conditions such as packed and capillary columns as well as a Thermal Conductivity Detector in addition to the Flame Ionization Detector. Analysis turnaround time range from 14 min to 60 min. Several standard ASTM (American Society for Testing and Material) can be applied for determination of boiling distribution range of hydrocarbons, subject to their boiling range. ASTM D2887 test method covers the determination of the boiling range distribution of petroleum products. The test method is applicable to petroleum products and fractions having a final boiling point of 538 °C (1000 °F). This test method is limited to samples having a boiling range greater than 55.5 °C (100 °F), and having a vapor pressure sufficiently low to permit sampling at ambient temperature. Hence, based on the criteria of this method, contamination of diesel in Jet A1 can be identified. A nonpolar open tubular (capillary) gas chromatographic column is used to elute the hydrocarbon components of the sample in order to increasing boiling point. Boiling points are assigned to the time axis from a calibration curve obtained under the same chromatographic conditions by analyzing a known mixture of hydrocarbons covering the boiling range expected in the sample. When operating at this sensitivity level, detector stability must be such that a baseline drift not more than 1 % of full scale per hour is obtained. The detector must be capable of operating continuously at a temperature equivalent to the maximum column temperature applied.
Jet A1 samples mixed with 0.1, 0.2, 0.3, 0.4 and 0.5%vol of diesel, were analyzed by SimDis in order to identify the lower amount of diesel that can effect on boiling range of Jet A1. The diesel peaks were appeared, at the end of chromatogram, even at level of 0.1%vol in Jet A1.

Abstract (#19276)

Title: Synthesis and Characterization of Mixed Carbonyl Amine Molybdenum Complexes

Authors: Mayar Alraba.

King Abdulaziz University

The molybdenum complexes of various Schiff base ligands have interest great consideration due to their different medicinal, biological and catalytic activities. The Schiff-base compounds [1,2-Ethanediamine, N,N\'-bis(phenylmethylene)]L1 , [1,2-Ethanediamine, N,N\'-bis(2-thienylmethylene)]L2 , [1,2-Ethanediamine, N,N\'-bis[(4-methylphenyl)methylene])]L3 , [1,2-Ethanediamine, N,N\'-bis[[4-(dimethylamino)phenyl]methylene])]L4 , [1,2-Ethanediamine, N,N\'-bis[(4-methoxyphenyl)methylene] L5 has been synthesized from the reaction of ethylenediamine and different types of aldehydes . When the bidentate Schiff bases ligands L1-L5 :, [1,2-Ethanediamine, N,N\'-bis(phenylmethylene)]L1 , [1,2-Ethanediamine, N,N\'-bis(2-thienylmethylene)]L2 , [1,2-Ethanediamine, N,N\'-bis[(4-methylphenyl)methylene])]L3 , [1,2-Ethanediamine, N,N\'-bis[[4-(dimethylamino)phenyl]methylene])]L4 , [1,2-Ethanediamine, N,N\'-bis[(4-methoxyphenyl)methylene] L5 reacted with Mo(CO)6 in refluxing hexane, the complexes [Mo(CO)4(1,2-Ethanediamine, N,N\'-bis(phenylmethylene)]1 ,[Mo(CO)4(1,2-Ethanediamine, N,N\'-bis(2-thienylmethylene)]2 , [Mo(CO)4(1,2-Ethanediamine, N,N\'-bis[(4-methylphenyl)methylene)]3 , [Mo(CO)4(1,2-Ethanediamine, N,N\'-bis[[4-(dimethylamino)phenyl]methylene)]4 , [Mo(CO)4([1,2-Ethanediamine, N,N\'-bis[(4-methoxyphenyl)methylene)]5 were obtained. All prepared complexes were investigated using elemental analysis, IR, NMR , mass spectrometry,UV–vis absorption spectra . The spectroscopic studies show that schiff base ligands are coordinated to the central metal as bi-dentate ligands coordinating via their imine N donor atoms in (1-5). In their IR spectra, the tetracarbonyl metal complexes display four carbonyl

stretching bands. The 13C chemical shifts of the carbonyl groups are particularly useful in the characterization of the molybdenum compounds.

Abstract (#19204)

Title: Corrosion Study for Inhibitor

Authors: khalid Alquaemy, Anas Rushaid, Abdullah Aldossary.

Saudi Aramco

The optimization of corrosion inhibition requirements while ensuring proper design of the chemical recipe would enhance the efficiency of the acid treatment in a cost effective manner. Corrosion inhibitors are an essential part of the fluid mix pumped downhole when a well is acidized. To prevent acid from damaging well tubulars, inhibitors must function for at least two hours during a fracturing job and up to 24 hours when acid is being used to clean wellbore damage or scale.

Abstract (#19435)

Title: MIC Prediction and Treatment Selection through Water Accumulation Assessment Model

Authors: Arij Ruwaii, Biswas Avidipto, Canto Maya Christian, Abdullah Zubail

Saudi Aramco

Microbial Induced Corrosion (MIC) is a persistent threat in internal corrosion failures of pipelines. MIC can be triggered by water accumulation along the pipeline where critical flow conditions are not met. Critical flow conditions are typically represented with the Froude number. Low Froude numbers (Fr<1) could lead to water accumulation and deposition of solids at the bottom of the pipes. This scenario represents a favorable environment for microbial activities. Critical flow conditions are use to develop a theoretical model to identify the water accumulation location and the solid deposition along the pipeline. Based on the outcome of the model an integrity strategy is proposed. A further MIC model development is also discussed.
Key Words: MIC, Critical flow velocity, Solid deposition, MIC treatment

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Abstract (#19258)

Title: Behavioral Study of Model Compounds Interaction with Polymeric and Inorganic Adsorbents

Authors: Elaf Ahmed, Guillaume Raynel

Saudi Aramco

Produced water is as complex as crude oil, due to the large number of different components that may be found in it, to the variation in organic and inorganic composition between wells, and to the evolution of its constituents with the age of the oilfield reservoir. From either laboratory studies or other industries, these dissolved organic compounds has proven to be the most fouling agent in numerous experiments and/or applications. The main goal of this study is to provide a better understanding of the interactions of these different contaminants with several adsorbents. This goal was achieved by testing different materials, such as polymeric beads, inorganic and organic adsorbents, to interact with different model compounds in water samples. A variety of approaches were conducted to obtain a comprehensive understanding of phenol adsorption and other model compounds. The experiments were conducted in a batch mode (Fluidized and packed beds) at different ranges of acidity and salinity. Kinetic experiments were also performed to confirm the adsorption capacity. UV-Vis spectroscopy was used to evaluate the track of the contaminants concentrations in water samples. Fluorescence Emission Excitation Matrix (FEEM) showed that polymeric beads expel undesirable molecules/monomers into the solution. Hence, adding more contamination to the water samples. Different cleaning methods were conducted to reach the optimum performance of the adsorbent materials. NMR and ES-MS analyses were performed to identify the leached molecules.

Abstract (#19396)

Title: Multi-method Compositional Study of Petroleum Products: Gas Chromatography Data Unification

Authors: Enas Tarooti, Frederick M. Adam, Asim H. Al-Saleh, and Ali S. Al-Hayek.

Saudi Aramco

Physical properties, and combustion properties of hydrocarbon samples are closely linked to the molecular composition. Therefore the molecular characterization of petroleum cuts is drawing a lot of attention in refining industry across the board. The molecular composition is also needed by refinery engineers to manage processes, increase productivity, maximize profitability and troubleshoot processes. Because of the tremendous number of different compounds they contain, describing the hydrocarbon samples down to molecular level is often a complex tasks. While gas chromatography and two dimensional gas chromatography are well established techniques to characterize naphtha (bp ranging between 30°C and 200°C) and diesel (bp ranging between 150°C and 350°C) range products respectively, both techniques yield partial data for samples covering both the naphtha and the diesel range products.

This poster presents a methodology to establish the detailed hydrocarbon composition of such samples comprising simultaneously of naphtha and diesel range products. The method relies on the fractionation

by distillation of the original sample into two fractions that are compatible respectively with gas chromatography and two-dimensional gas chromatography. Unification of GC and 2D-GC data will be presented and illustrated on the basis of a set of real life samples. The same set of samples will also be used to validate the method and illustrate the strength of the methodology proposed.

Abstract (#19578)

Title: Process Intensification and Enhanced Mass-Transfer Control via Taylor-Couette Flow Annular Reactors

Authors: Mohammad F Aljishi.

Saudi Aramco

Designing efficient reactors with optimum process intensification is of great importance to many industrial applications. Intensified processes, with higher mass transfer rates, can lead to lower energy costs and capital costs, due to compact equipment size, as well as increased efficiency and higher product yields of better quality. Enhanced intensification can be approached through increasing the input of energy through external force fields, enhancing the reactor surface configuration, or by operating in high throughput continuous-flow mode. Although continuous stirred tank reactors (CSTR) provide significant mixing intensity, they lack the advantage of tightly controlling the process history as in the plug flow reactor (PFR), where narrow residence time distribution allows all fluid elements to spend equivalent time in the reactor. This research explores the use of vortex flow in a continuous Taylor-Couette Reactor (TCR) in applications that require enhanced mixing and process intensification, as a unique approach to overcome the technical barrier in multiphase reactions.
As a form of novel intensified plug flow reactor, where flow takes place in the annulus between two concentric cylinders, the TCR offers the opportunity to have enhanced control on the final properties of products due to its higher mass transfer efficiency, together with good mixing properties and large contact area. Specifically, Taylor-Couette flow allows for examining hydrodynamic instabilities while stimulating vortex motion, offering a highly active interface for mass transfer, and phase mixing. Through the use of secondary flow regimes, the TCR provides high mass transfer rates and enhanced mixing properties, including a high surface-to-volume ratio, which makes it desirable for enhancing reactions among multiple phases. In addition, narrow residence time distribution (reaching the behavior of PFR) and homogeneous distribution of mixing intensity in the TCR volume (compared to a CSTR), combined with mild but effective shear rates, make TCR an attractive reactor for a range of chemical reactions. Unlike mixing in typical PFR configuration, which is almost entirely dependent on the reactant-feed flow, micromixing times in the TCR are influenced by the inner cylinder rotation. This offers the possibility of independently controlling the mixing intensity and decoupling it from the feed flow-rate. The intense local mixing combined with the ability to control axial dispersion in the reactor, allows the TCR to offer a breadth of mixing on multiple scales ranging from macro-fluid motion, and mesomixing all the way to mixing on the microscale.

Abstract (#19561)

Title: Investigation of Cobalt Borides as Co-Catalyst for g-C3N4 for Electrocatalytic Water Splitting

Authors: M. A. Suliman, Mohammed Qamar, C. Basheer

King Fahd University of Petrol

Electrocatalytic H2 production using water splitting is a sustainable and attractive solution for energy demands. Graphitic carbon nitride (g-C3N4) is a potential semiconductor catalyst owing to its low-cost, high stability and nontoxicity, and capability of absorbing the broad solar spectrum. However, it is blocked as electrocatalyst due to its poor conductivity and electrochemical activity. Therefore, it can be resolved by increasing the active sites was studied. Here, we report a facile method for incorporation of cobalt boride into bulk g-C3N4 to improve the electronic conductivity and exfoliate the layers. Here, we report a CoB/g-C3N4 composite as a highly efficient oxygen evolution reaction (OER) electrocatalyst. In 1.0 M KOH, a new CoB/g-C3N4 afforded a current density of 10 mA cm-2 at a small overpotential of 360 mV and small Tafel slope of 94 mV/decade. This work also gives a reference for g-C3N4 based catalyst working in a broader field.

Abstract (#19362)

Title: Azobenzene-Functionalized Trainglamine: a Light Responsive Macrocycle for Petrochemical Separation

Authors: Dana M. Al Kelabi, Niveen M. Khashab, Basem A. Moosa.

KAUST

Azobenzene derivatives offer many applications in diverse fields due to the unique photoisomerization property providing a possibility of controlling the trans-cis or cis-trans configurations with light that could be used as molecular switches. Macrocyclic host exhibit molecular recognition platform that can self-assemble with the introduction of complementary aromatic guest molecules. Chiral Schiff base macrocycles containing three azobenzene chromophore was synthesized by the [3+3] cyclocondensation of 1R,2R-diaminocyclohexane with azobenzene-4,4’-dicarbaldehyde and the product was confirmed by different spectroscopic technique. The introduction of Azobenzene group in the cavity periphery can tune the cavity size of the macrocycle with light, which can lead to selective recognition of certain guests over others. The synthesized macrocycle was studied to analyze the host?guest interaction of different important chemical feedstocks in petrochemical industry. Systematic study of different sizes, steric and electronic variation of the guest molecules were performed to understand and to reach to the best performance of trainglamine macrocycle.

Abstract (#19326)

Title: Green Chemistry for Decomposition of Dyes Pollutants: Kinetic Studies

Authors: Abdullahi B. Olabintan, Tawfik A. Saleh.

KFUPM

Fenton's reagent was used for the degradation of an aqueous solution of Methylene Blue (MB) dye without the need of light source. The effects of different parameters like pH of the solution, the initial concentrations of Fe2+, H2O2, and MB dye and temperature on the oxidation of MB dye were investigated. The optimum amounts of Fenton's reagent were 4mM of Fe2+ and 70mM of H2O2 at an initial MB dye concentration of 20mg/L. The optimum ratio of 0.05 of Fe2+/ H2O2 was found to give the best result for decolorization of dye. The Fenton process was effective at pH 3 with maximum dye decolorization efficiency of 98.8% within 30 min of reaction, corresponding to COD removal of 85%. The decolorization process was thermodynamically feasible, spontaneous, and endothermic. The value of the activation energy (Ea) was found to be 33.6 kJ/mol suggesting that the degradation reaction proceeded with a low energy barrier.
Keywords: Intermolecular interactions; Fenton's reagent; Methylene Blue; Thermodynamic parameters, Kinetics.

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 (#19480)

Title: Ultra Violet Light Photocatalytic Degradation of Basic Blue Dye Using Zinc Nanoparticles Decorated

Authors: 20Khaled Alaqad.

KFUPM

Graphene oxide nanosheets were prepared by modified hummer method and decorated with zinc nanoparticles to form nanocomposite (ZnO/GO). The nanostructure surface materials of GO nanosheets are include different organic groups such as carboxyl, carbonyl, hydroxyl groups, which are used for oxidation process. Synthesized nanocomposites were characterized by using various techniques such as scanning electron microscopy (SEM) which was shown good surface morphology of (ZnO/GO) and X-ray diffraction was illustrated high crystal structure of the surface, FTIR technique and XPs were shown the functional groups of nanocomposites (ZnO/GO). The optical band gap characterization of nanocomposite ZnO/GO was achieved good value around 3.29 eV due to the decorated of ZnO on the surface of graphene oxide.
Synthesized photocatalyst was utilized to investigate the photocatalytic degradation of basic blue dye and obtained 98 % of degradation efficiency. Liquid chromatography/mass spectrometry was used to identify the mechanism of dye degradation. The degradation mechanism of basic blue may be proposed by the following steps, (i) cleavage of benzene ring, (ii) cleavage of N-N bond during attack of OH• radicals, (iii) cleavage of aniline and C–C bonds of the benzene group. Fragmentation formed after irradiation time of Basic blue on the surface of ZnO-RGO. In addition, the intermediate of basic blue species 100 m/z and 117 m/z ratios are obtained with higher peak intensities for furfural anhydride and 2,6, dihydroxy 3-pyrane respectively.

Abstract (#19419)

Title: Organic Chloride Speciation: from The Analytical Strategy to a Refinery Case Study

Authors: Frederick M. Adam, Nayef M. Alanazi, Ali S. Al-Hayek, and Muthukumar Nagu.

Saudi Aramco

Refineries are designed to transform crude oil into high value products. To obtain finished products meeting the specifications, the feed and the intermediate products are subjected to successive interdependent processes and chemical treatments. To maintain a steady production, the integrity of the refining tool needs to be maintained. Corrosion related to hydrochloric acid attack is one of the major threats to refineries and is given a particular attention in the Oil & Gas industry. Hydrochloric acid is a result of the hydrolysis of chloride salts at high temperature during the refinery process. The majority of chloride compounds associated with crude are inorganic salts. Inorganic chloride is usually removed from crude during the first processing stage by an electric desalter. Even though inorganic traces can still have adverse effects, desalting is usually sufficient to maintain a safe chloride level. Organic chlorine can also be present in crude or refined products. Unlike inorganic chloride, organic chloride is not removed during electric desalting. It is therefore processed with the hydrocarbon streams where it tends to convert into HCl, which can dissolve in water and result in severe corrosion across the refinery. The chloride monitoring in the feed of the hydrotreating process is essential to prevent hydrochloric acid

attack, related to the presence of organic chloride in side cuts, after passing through the desalination unit. This poster presents the development of the analytical strategy to monitor organochloride compounds in the naphtha feed in a Middle East Refinery Naphtha Hydrotreating (NHT) unit that experienced a leak in air-cooled product condenser tubes due to corrosion. The investigation determined the immediate cause of the corrosion was abnormally high organochlorides in the naphtha feed to the NHT. The investigation results exhibited that the organochloride contamination in the naphtha feed was within the refinery process, where two organochloride compounds, Tetrachloroethylene (Perchloroethylene-PCE) and Trichloroethylene (TCE), were detected in the analyzed sample. These chemicals are an excellent solvent for organic materials and mainly used to maintain catalyst performance.

Abstract (#19450)

Title: SABIC's Plastic Powders for 3D Printing

Authors: Zahir Bashir, Gu, Hao.

SABIC

There are several types of 3D printing methods. The materials for 3D printing also are tailored for the method. Selective Laser Sintering (SLS) is a 3D printing method whereby the material is in powder form and the article is built by fusing selected areas of the powder by the heating action of a laser. While the injection moulding process can be used with any thermoplastic polymer, the SLS process is very demanding and it only works well with some plastic powders. The limited choice of plastic powders has slowed down the advance of SLS. To tackle this, SABIC embarked on a programme to develop new plastic powders for SLS. This presentation will describe the good printing performance of a SABIC thermoplastic powder. The mechanical properties are benchmarked against other thermoplastic powders used for SLS.

Abstract (#19471)

Title: Investigating The Effect of VASBT Paint in The Context of Humidity Resistance for Buildings

Authors: Balqees Alshareef, Shroug alamri.

KAU

Investigating The Effect of titanium dioxide (TiO?) Nano Particles Genitive to Adjustable elastic acrylic And varnish (VASBT) paint in the context of Humidity Resistance for Buildings

Saudi Arabia includes a lot of Archaeological places and all of these places can collapse, smash and fall because of the damage weather factors and Humidity, Rather if it is Air humidity, Rainwater or as a result of condensation.
The aim of this project is to test the effect of Titanium Dioxide (TiO?) Nano Particles Genitive to Adjustable elastic acrylic And Varnish paint in Porous and Permeability of the building's Absorption to increase resistance of humidity conditions.

To test this hypothesis , three sets of building-blocks were under humidity focused, the three sets include: the control group:
natural block
experimental groups:
- Group 1: a block painted with titanuim dioxide (TiO?) nano particles genitive to varnish
-Group2:block painted with titanuim dioxide (TiO?) nano particles genitive to Adjustable elastic acrylic and varnish
The results show that experimental group 2 was the least in terms of water absorption. Moreover, the amount of water it has absorbed 0.5 ml, to prove that this paint can help preserve buildings for periods related to the protection provided ,low costs, best results, way more sustainability can raises from economy and reduced from environmental problems ,thus confirming the hypothesis.

Abstract (#19563)

Title: Thermal Energy Harvesting from Oil and Gas Fluids for Self-Powered Remote Monitoring and Control App

Authors: Muhammad Arsalan.

Saudi Aramco

Objectives/Scope: To demonstrates the concept of thermal energy harvesting from fluids using thermoelectric generators (TEGs) utilizing temperature differences in fluids generated by vortex tubes. Laboratory-based experimental validation of the concept is presented showing the potential of a significant amount of energy harvesting in difficult to access locations and environments such as downhole in multilaterals where no other energy source is available besides the flow to power the monitoring and control of circuits and systems.
Methods, Procedures, Process: In multilateral horizontal wells the capability of real-time monitoring and control within individual laterals can be a key enabler for efficient water management and production optimization. This requires permanent monitoring and control devices to be deployed downhole. Providing power to these devices is challenging. In this paper we describe a novel energy harvesting technique suitable for downhole environments to harvest energy from flow to enable self-powered systems that do not require any external power source to function. The technique involves producing temperature difference using vortex tubes from the flow and use of TEGs to convert the temperature difference into usable electrical power. Details of the lab experiments are provided showing encouraging results and potential for a significant amount of energy harvesting that may be sufficient for self-powered downhole permanent monitoring systems. The technique can be utilized in any environment including surfaces where flow is present. The proposed system is extremely reliable and robust for long-term deployments as it does not have any moving parts.

Results, Observations, Conclusions: Results based on laboratory prototypes are presented as proof of concept. The experimental results show more than 25oC of temperature difference generated by the vortex tubes at 80 psi airflow. A significant amount of electrical power has been generated using TEGs at this thermal separation. The amount of energy is suitable for permanent downhole monitoring and control systems.

Novel/Additive Information: The concept of thermal energy harvesting in fluids using vortex tubes and TEGs is presented for the first time. A lab prototype and experimental results are presented as a proof of concept. The idea will enable a number of self-powered monitoring and control applications in remote hard-to-reach locations.

Abstract (#19328)

Title: Innovative Materials for Sustainable Production of Eco-Friendly Fuels

Authors: Prof. Tamer Ezzat Youssef.

Imam Abdulrhaman bin Faisal

Innovative Materials to convert petroleum and renewable feedstock to fuels efficiently. Different approaches have been reported to develop zeolites via post-synthesis modification by using alkaline, acid treatment or steam. This work aims to develop zeolites for application in sustainable production of eco-friendly fuel production. A by-product in biodiesel production can be converted into numerous valuable chemicals via dehydration, through nanoporous catalytic materials as catalysts. A new class of mixed metal zeolites for fuel synthesis with simple preparation has been developed. Therefore, the production of biodiesel tends to consume less energy and require less expensive equipment.
This research project will enhance the growth of catalyst development for Refining and Petrochemicals.

Abstract (#19603)

Title: Investigation of Boron-Doped Carbon Derived from Rice Husk as a Charged Droplet Catalyst for the Oxi

Authors: Ahmed Abdi Hassan.

KFUPM

This research work investigated the electrocatalytic oxidation of n-pentane using Boron doped carbon (BDC) catalyst derived from rice husk. For the oxidation process, hydroxide radicals (OH.) were produced through the charge droplet chemistry after hydrogen abstraction. Using a pump natural air was used as a carrier gas as well as oxidant and n-pentane as a model compound, the purpose of selecting n-pentane is to understand the functionalization of sp3 C–H bonds via charge droplet chemistry to produce value-added products. Based on the products mass spectra the catalytic pathways were successfully studied. The entire process was conducted under ambient conditions such as room temperature and atmospheric pressure, on the minute time timescale using simply fabricated flow reactor consisting of high voltage power supply and pump. It was noted that the higher positive potential generates OH. This study provides a new strategy for the development of technology for a simple way to produce value-added chemicals by droplet chemistry.

Abstract (#19427)

Title: Oil in Water QA Blind Samples Preparation Technique

Authors: Thamer AbuHulaiqah, Alaa M. Al-Ali.

Saudi Aramco

This abstract shares a preparation technique of oil in water QA blind samples using engine lube oil and cyclohexane
In compliance with ISO 17025 requirements, blind samples are used to support labs quality program by checking impartiality & technicians' competences
Treated produced water from plants is injected in oil reservoir for pressure maintenance and the concentration of oil in water is monitored to ensure safety and environmental compliance

In laboratories, oil in water analysis is performed as per ASTM D7678 to measure the oil concentration by basic extraction technique with cyclohexane using mid-infrared laser spectroscopy

Previously, QA oil in water samples were prepared using crude oil in deionized water which consumes huge amount of DI water and requires an extraction in lab analysis process

Currently, Oil in water blind samples are prepared using mineral oil (diesel oil and lubricating oil without additives) to be dissolved in cyclohexane

This preparation technique doesn't require water and can be analyzed directly without any extraction which helps saving huge amount of water and analysis performance time comparing to the previous preparation technique

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Abstract (#19352)

Title: Spiro Structure: Rational Design of New Porous Organic Cage

Authors: Mram Al-Yami, HsinHua Huang, Niveen M. Khashab.

KAUST

Porous organic cages (POCs) are a unique class of microporous material composed of discrete molecules with intrinsic, guest accessible cavities. Porous organic cages (POCs) recently have become a real alternative to extend framework materials with a high specific surface area and high processability opening up a number of applications would be challenging with insoluble porous materials. The resulting cages are commonly used in gas storage, capture and separations owing to the unique cavity size and distinctive structure. However, developing the cryptand structure within a spiro compound is rare. Herein, we develop new molecular building blocks within a spiro compound to further enrich the organic cage

family. We describe cage synthesis containing spiro-structure by the imine condensation of 6 imine units of 3 tri-amine molecules and 2 dialdehyde molecules. Then, the spiro-cage will be used for gas storage.

Abstract (#NA)

Title: Morphology Mapping of Solution Sheared Halide Perovskite Thin Films for Solar Cell Applications

Authors: Min Kyu Kim, Min Kyu Kim, Hyeon Seok Lee, Esra AlHabshi, Issam Gereige, Steve Park, Byungha Shin.

KAUST

Large area scaling of hybrid perovskite is essential to bring the technology into commercialization. Various large-scale printing techniques have been successfully employed to fabricate high performance perovskite solar cell. In particular, solution shearing is a versatile technique in which many processing parameters can be tuned in order to produce films with desired structure and morphology. In this study, we have examined the impacts of substrate temperature and coating speed (i.e., how fast the blade is moving), two of the most influential process parameters, on morphology of the resultant perovskite films. Four distinct phases are identified in terms of surface morphology and a morphology-phase map is constructed with the aforementioned parameters. Occurrence of different morphology phases was explained by the rate and degree of supersaturation and the supply of solution to the meniscus, both of which dictate the rate of nucleation and crystal growth. An optimal phase window with specific parameters is chosen and the device performance with the solution-sheared perovskite film exhibits power conversion efficiency of 18.48%, which is beyond to that of reference device prepared by the conventional spin-coating process. A large scale perovskite film of an area of 57 cm_2 is prepared with solution shearing and shows high uniformity.

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 (#19261)

Title: A New Approach to Maximize Hole Cleaning Efficiency

Authors: Meshari Alshalan, Abeer Alolayan.

Saudi Aramco

New type of drilling fluid based on a cross-linked synthetic polymer. The developed polymer is a superior hole cleaning product that moves drill cuttings, metal, shaving and other debris out of the well bore. In addition, the new polymer is capable of transporting cuttings when drilling metallic junk or partial losses formation.

The gel is generated by adding the first component (cross-linker) to the drilling fluid and then spotting the second component (PVA) diluted with water at designed percentages. The gel is spotted in the wellbore and then washed out. The strong carrying cpacity of the gel is expected to remove all cuttings and debris from the wellbore. The other conventional hole cleaning pills contain big solids and/or are expensive. The other method to clean excessive junk from wellbore is mechanically by running many hole cleaning trips that consumes a lot of rig time.

This practice has saved time by reducing the clean out trips. Moreover, the POLYSWEEP can provide a potential solution to hole cleaning when milling metallic junk or drilling at partial circulation. POLYSWEEP has underwent to once successful trial test in deviation well (with partial losses). The POLYSWEEP was effectively capable of carrying all the shaving derbies and cuttings out from the wellbore throughout drilling operation with no troubles. Also, POLYSWEEP has proved that compatible for use in drilling fluid. POLYSWEEP is cost effective because it's not consist of several chemicals and it reduce number of wiper trips. Besides that, it is environmentally friendly as the compositions of fluid is not toxic.

Each fluid can be mixed in a short time, and both of them are not toxic and chemically inert. The new composition has potential of producing modified fluid for different application, such as: LCM and fracturing fluid.

Abstract (#19357)

Title: Microbial Influence Corrosion Investigation in Gas Gathering Facilities

Authors: Husam Khanfar, Ammar Alsaqer, Abdulkareem Alqahtani, Nasser Huwaiji.

Saudi Aramco

Microbial influence corrosion (MIC) becoming a worldwide problem in oil and gas industry. The Microbes involve in corrosion have different activities and its mechanisms are varies of deteriorating the facilities. The microbial colonization has negative impact results in environment, and operation. Therefor the requirements to identify and well diagnose the microbes with robust and advanced technology are essential and in highly demands in order to reduce the cost of control, treatment, and overcome the corrosion`s problematic.

A recent field and laboratory study of a failed gas gathering facility in Saudi Aramco revealed that the prematurely failed sweet gas flowlines were colonized with different groups of corrosion-causing microorganisms. The failure was manifested in a through-wall pinholes surrounded by scattered pits on the internal surfaces of the multi-section pipes. Specialized examination confirmed the suitability of the operating environment for the growth of microbes. The overall findings revealed detection of considerable numbers of different microbial groups with potential of MIC in the metallic sections of the flowlines, detection of less numbers and less microbial groups with MIC potential in the water samples, include general bacteria (BA), sulfate reducing archaea (SRA), acid producing bacteria (APB) and sulfate reducing bacteria (SRB), methanogens (MET), iron-oxidizing bacteria (IOB). The water analysis revealed non-corrosive environment, detection of pinholes at 6 o'clock position and localized pitting corrosion resembling MIC, detection of Fe- and S- rich corrosion products on the failed metallic flowlines sections These groups of microorganisms can separately or collectively fail a system with the generation of highly aggressive species such as acids and sulfide. Metallographic examination confirmed the presence of microbial by-products in the through wall pit. The various analysis confirmed that microbially influenced corrosion was the main localized corrosion mechanisms leading to premature failures.

The presentation will discuss the field and laboratory work and used analytical techniques to assess the risk of microbial colonization on the integrity of the system. It will discuss the findings and the practical recommendations to curtail microbial activities and prevent reoccurrence of failure. Work is underway to implement the use of microbial control strategy and to deploy the devised monitoring strategy.

Abstract (#19424)

Title: Emulsion Characterization Study of Blended AH and AL Crude Oil Samples

Authors: Alaa Al-Ali, Norman Mateo.

Saudi Aramco

This abstract shares a study of an emulsion characterization and physical properties of Arab Heavy and Arab Light crude oil samples

In order to increase oil production, newly drilled oil wells from a reservoir that producing Arab Heavy is planning to be connected to GOSP-A which is only processing Arab Light crude oil from two different reservoirs

The objective of lab study is to determine the required process upgrades in GOSP-A to ensure emulsion separation and crude quality production after blending AH crude with AL

Lab study was conducted in the original samples (as collected from the field), blended samples and dried ones. Samples were blended by taking equal volumes and poured in one container and placed in a shaker for 15 minutes under room temperature. Samples were dried by adding demulsifier and placing the samples into water bath at 60 degree Celsius

Sampling campaign was carried out to collect in total of 15 samples from three different reservoirs that producing AH and AL. Lab study includes density measurement, API gravity, viscosity analysis and emulsion separation index (ESI)

From emulsion separation and physical properties study, it can be concluded that Arab heavy crude oil samples were the major contributors in changing the viscosity as well as API gravity. In addition, AH samples were found very tight emulsion and blending them with both AL crude samples from two different reservoir would even tighten the overall emulsion. Therefore, demulsifier type and injection dosage rate and concentration should be considered and evaluated

Lab analysis was performed in accordance to ASTM D 4052, ASTM D 1298, ASTM D 445 and SPE63165

Abstract (#19460)

Title: Utilizing Reclaim Water in Petroleum Industry as a Water Injecting Source

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

Saudi Aramco

Scaling problem is widespread in oil and gas industry and is a major cause of concern to reservoir and operation engineering. 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.
Water injection is the most common practice used to enhance the oil recovery by maintaining a positive reservoir pressure. The technique works by pressure swiping hydrocarbons to the producing well. The present study attempts to demonstrate the possibility of using treated sewage effluent (TSE) or filtered seawater (200-400 ppm of CaSO4) as an alternative source for water injection to maintain well pressure during oil production and preserve irreplaceable groundwater resources for future generations.
A prediction model was used to simulate scale tendency and its formation caused by mixing different water sources (formation and injection), and evaluate the severity of the problem in the field. The geochemical analysis of water sources were fed into the model. The program is designed to predict the amount and type of scale that may be encountered by the mixing of different types of formation and injection. The study revealed that the injection of TSE decreases scale potential in formation water containing high concentrations of calcium ions but there is a slight increase of pH. The results predicted by the simulator was verified by static and dynamic loop tests. The scale precipitates are characterized using X-ray diffraction (XRD), and Environmental scanning electron microscopy (ESEM).
The study demonstrated that the use of treated sewage effluent (TSE) and filtered seawater significantly suppress scaling tendency compared to other sources of water including most common seawater and aquifer water. However, the effect of injecting TSE is pH dependent and scale potential formation increases with a rise in the pH of mixed solution. Additionally, the use of treated sewage effluent or filtered seawater would support the Saudi Arabia initiative for preserving groundwater for future generations.
