Monday 3/7/2022 5pm - 7pm	Student Poster Session Day 1	Chair: Raghu Srinivasan Vice Chair: Saba Navabzadeh Esmaeely The Student Poster Session at the AMPP Annual Conference + Expo encourages students to become active in AMPP and present the results of their work to membership. Each student who wishes to participate must submit a 300-400 word abstract (maximum of 10,000 characters). Please keep in mind that student attendance is required at the conference to participate. There can also only be one student per poster.	Henry B. Gonzalez Convention Center	Exhibit Hall		Other

Tuesday - 3/8/2022

Date & Time*	Name	Description	Location	Location Detail	Committee(s)	Type
Tuesday 3/8/2022 7am - 8:30am	Speakers Breakfast		Henry B. Gonzalez Convention Center	HemisFair C3		Other
Tuesday 3/8/2022 7:30am - 9:30am	Guest Breakfast	Guest Breakfast is for individuals that purchase the Guest Program Registration only and are not for attendees to the conference.	Grand Hyatt San Antonio	Bowie AB		Other
Tuesday 3/8/2022 8am - 9:30am	Advanced Protective Coating Technology - Day 2	Chair: Benjamin Chang Vice Chair: Matt Dabiri This symposium features technical papers that cover the following themes: (1) Rust Creepage Mechanism, (2) Cathodic Disbondment Mechanism, (3) Coating Blister Mechanism, (4) CUI Coatings, (5) Salt Decontamination Chemicals, (6) Offshore Coating Evaluation Methods, (7) Offshore Windmill Coatings, (8) Nanotechnology, and (9) Passive Fire Protection.	Henry B. Gonzalez Convention Center	Room 210		Symposia

Tuesday 3/8/2022 8am - 11am	Flow Assurance in Oil and Gas Productions - Day 2	Chair: Qiwei Wang Vice Chair: Zhengwei Liu This symposium features technical papers on flow assurance which is critical for the safe, economic and efficient oil and gas recovery and processing. This symposium will present the new advancements in understanding and technical solutions related to corrosion, scale and other oilfield chemistry issues in hydrocarbon production and transportation, covering modeling, laboratory investigations and field case studies.	Henry B. Gonzalez Convention Center	Room 301 BC	Symposia
Tuesday 3/8/2022 8am - 11:30am	Geothermal Scaling and Corrosion	Chair: Sigrun Karlsdottir Vice Chair: Keith Lichti This symposium features technical papers on geothermal system scaling and corrosion. The aim is to promote discussion of scaling and corrosion in geothermal energy systems. Papers are sought that provide insight on the impact of production, process and reinjection conditions on materials and process efficiency. Descriptions of research activities, failure analysis and successful implementation of new technologies are welcome.	Henry B. Gonzalez Convention Center	Room 221 D	Symposia
Tuesday 3/8/2022 8am - 12pm	Coating Application	Chair: Ahmad RK Rana Vice Chair: Mohamed Ahmida This symposium features technical papers on various application methods that include coating concrete, electrostatic spray, pipeline coatings, plural components, powder coatings, thermal spray and waterjetting.	Henry B. Gonzalez Convention Center	Room 213	Symposia

Tuesday 3/8/2022 8am - 12pm	Career Fair	Job seekers— No pre-registration required! This is an open opportunity to connect with registered employers in the industry and establish professional relationships. Take advantage of one-on-one conversations to gain a better perspective of what the industry has to offer you, and what entry requirements employers are looking for. Career Fair exhibitors may also take the time to set up 30-minute private interviews onsite! Employers— Interact face to face with job seekers to establish candid relationships and gauge compatibility. Recruit someone who is actively seeking the industry and is eager to grow with your company.	Henry B. Gonzalez Convention Center	HemisFair C2	Other

Tuesday 3/8/2022 8am - 12pm	Digital Asset Transformation - Driving Value for Corrosion & Asset Integrity Forum	Presented by Jason Moral, Kinder Morgan; Bob Adey, Beasy; Floyd Baker, Antea North America: Ellie Lynch EN Engineering and Cecilie A Haarseth, ExxonMobil This forum will discuss recent developments and industry trends in digital technologies for corrosion and integrity management. Many industry sectors are seeking to increase efficiency and reduce costs through the application of digitalization and technologies such as 3D visualization and the Internet of Things. The transforming potential in data capture, information management and analytics, and the possibilities for implementing artificial intelligence, can reduce risk and facilitate better decision making. They are fully applicable to the management of corrosion and asset integrity regardless of industry type. Approaches from different industries covering a broad range of topics on these new developments from both technology providers and end users will be discussed. The forum includes presentations from EN Enginering, Kinder Morgan, Antea North America, Beasy & ExxonMobil. The discussion will be facilitated by probing with key questions to understand have we can remove barriers and create more value. E.g. What do you actually need to make timely decision and is your digitalization targeting that? Does your digital view match reality? How do you verify collected/inputted data? What are the weaknesses of the current data capture tools that are available?	Henry B. Gonzalez Convention Center	Room 207 AB	Forum
Tuesday 3/8/2022 8am - 12pm	SC 09 - Nonmetallic		Henry B. Gonzalez Convention Center	Room 301 A	Standards

Tuesday 3/8/2022 8am - 12pm	SC 11 - Electric Power		Henry B. Gonzalez Convention Center	Room 221 B	Standards
Tuesday 3/8/2022 8am - 12:30pm	RIP - Environmentally Assisted Cracking	Chair: Sebastian Thomas Vice Chair: Rebecca Schaller This Research in Progress session seeks papers that focus on all aspects of environment assisted cracking, with a specific focus on, but not limited to, cracking of stainless steels, magnesium, aluminum and nickel alloys. Studies related to the resistance of materials to the initiation and growth of cracks during stress corrosion cracking and corrosion fatigue are encouraged. In addition, studies related to the development of novel techniques to monitor crack initiation and growth, including, pit-to-crack transition, testing protocols/environments and life prediction models are welcomed. Focus should be on the most current results and research in progress	Henry B. Gonzalez Convention Center	Room 214 A	RIP

Tuesday 3/8/2022 8am - 12:30pm	RIP- Advanced Analytical Techniques	Chair: Rajeev Gupta Vice Chair: Joey Kish This RIP symposium is seeking abstracts that cover recent advances made in understanding corrosion using state-of-the-art electroanalytical techniques and also other “real time” or in-situ characterization techniques. The topics of interest include corrosion studies using electroanalytical methods such as Scanning electrochemical microscopy (SECM), Scanning vibrating electrode technique (SVET), Scanning Kelvin Probe Force Microscopy (SKPFM), Scanning droplet cell microscopy (SDCM) and Local electrochemical impedance spectroscopy (LEIS). This session will also cover “real time” spectroscopic methods used in corrosion monitoring such as online inductively coupled plasma-atomic emission spectroscopy (ICP-OES) and in-situ corrosion investigations using either optical, X-ray or electron based methods.	Henry B. Gonzalez Convention Center	Room 214 C	RIP
Tuesday 3/8/2022 8am - 12:30pm	Military Coatings and Corrosion	Chair: Patrick Cassidy Vice Chair: Charles White This symposium includes technical papers and research on identification, causes, and control of corrosion and materials degradation for military air, ground, and ship systems, as well as electronic systems, support equipment, and infrastructure.	Henry B. Gonzalez Convention Center	Room 221 C	Symposia
Tuesday 3/8/2022 8am - 12:30pm	AC Interference, AC Induced Corrosion, AC Risk Assessment, Monitoring and Mitigation Details	Chair: Shane Finneran Vice Chair: Casey Heinrich This symposium features technical papers on AC interference on buried pipeline, AC induced corrosion, AC risk assessment, monitoring, and mitigation.	Henry B. Gonzalez Convention Center	Room 302 BC	Symposia

Tuesday 3/8/2022 8am - 3:30pm	Advances in Materials for Oil and Gas Production Day 2	Chair: Filippo Cappuccini Vice Chair: Julio G. Maldonado This symposium features technical papers on present advances in materials technology and research for oil and gas. Focus is on new and improved metallic materials and applications. This includes consideration and evaluation of the material's performance in its envisaged exposure environment. Submission of Papers on field experiences, failure analysis and mitigation through metallurgical innovative solutions are also encouraged.	Henry B. Gonzalez Convention Center	005 Juan O'Gorman	Symposia
Tuesday 3/8/2022 8am - 5pm	Microbiologically Influenced Corrosion - Day 1	Chair: Jason Lee Vice Chair: Torben Lund Skovhus This symposium features technical papers on corrosion in the natural world is concomitant with biological processes due to the ubiquity of microorganisms. Advances in metagenomics has provided unprecedented exploration of microbial fauna where previous investigations were constrained by challenges of culturing or enigmatic relationships between microbe function to the overall corrosion influencing community processes. Papers presented during this symposium will explore and explain hard-won learnings in this realm of study.	Henry B. Gonzalez Convention Center	Room 217 A	Symposia
Tuesday 3/8/2022 8am - 5pm	Refining Industry Corrosion	Chair: Abbey Wing Vice Chair: Joe Yin This symposium features technical papers on corrosion and material issues within the refining industry. Topics will explore case histories, materials/coatings performance, corrosion mechanisms, failure analysis, etc.	Henry B. Gonzalez Convention Center	Room 303 ABC	Symposia

Tuesday 3/8/2022 8am - 5pm	RIP - Corrosion of Reinforced Concrete Structures (in Memoriam of Prof. Jose Antonio Gonzalez)	Chair: David Bastidas Vice Chair: Nick Birbilis This RIP symposium is seeking abstracts that cover the overall aspects of corrosion of steel in concrete as regard to building, construction, architecture and infrastructure including reinforced concrete structures, off-shore an on-shore infrastructure, bridges and concrete pipelines. Different aspects of corrosion of steel in concrete will be covered including pitting corrosion, uniform corrosion, chloride corrosion threshold, carbonation influenced corrosion, new cementitious materials, new geopolymer concrete, fly ash concrete corrosion, stress corrosion cracking, fatigue corrosion, weld joints corrosion, corrosion inhibitors, electrochemical chloride removal, electrochemical realkalinization, new corrosion monitoring techniques, modeling and simulation. Communications including experimental, modeling and simulation are highly recommended and emphasized. Including electrochemical and surface characterization techniques. New transformational concepts that revolution the next century buildings and infrastructure will be very welcome. Submissions should focus on recent results or currently ongoing research.	Henry B. Gonzalez Convention Center	Room 214 B	RIP
Tuesday 3/8/2022 8am - 5pm	SC 02 - External Coatings - Atmospheric		Henry B. Gonzalez Convention Center	Room 212	Standards

Tuesday 3/8/2022 8am - 5pm	Headshot Station	Did you know that LinkedIn profiles with headshots get 21 times more views than profiles without a photo? A professional headshot doubles your chances of getting noticed or hired! Stop by the Headshot Station to update your look and professional profile. This is your opportunity to update your LinkedIn profile or web page bio (personal, corporate, non-profit) and make a lasting first impression! Sponsored by Tinker and Rasor Located on Level 2 across from Room 217 A	Henry B. Gonzalez Convention Center	Level 2 Tower View Foyer	Networking
Tuesday 3/8/2022 8am - 5:30pm	Pipeline Integrity - Day 2	Chair: Tod Barker Vice Chair: Matt Ellinger This symposium features technical papers on all aspects of pipeline integrity that can include pipeline integrity management, inspection, assessment, mitigation, operational aspects, regulatory issues, present and upcoming technologies, methods, experiences, and case studies, be it new technologies, new inspection methodologies, or new analyses.	Henry B. Gonzalez Convention Center	Room 304 ABC	Symposia

Tuesday 3/8/2022 8:10am - 8:35am	Laboratory Testing To Investigate If Coated Pipelines Are Safe For Transportation Of Hydrogen Gas	Amal Al-Borno, Jeffrey Rogozinski, Jigar Mistry, Moavin Islam, Yuan Li - Hydrogen is gaining momentum as the centerpiece of clean energy initiatives in many countries and may hold the key to the inevitable and needed transition from fossil fuels to renewable energy. It is estimated by various sources that the global economic impact would be about $1T (one trillion dollars) by the year 2035. Hydrogen can be extracted from natural gas and other fossil fuels commonly known as “blue” hydrogen, or from renewable energy sources or from water by electrolysis, termed “green” hydrogen. The US Department of Energy has consistently supported pipelines as safe and efficient means for the transportation of energy resources. However, the known deleterious effects of H2 on high strength pipeline steel (embrittlement, decrease in ductility, acceleration of fatigue crack growth, etc.) makes it a potential challenge for economic and safe transportation of hydrogen gas from the production source to th	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 8:10am - 8:35am	Wide range of buffering capasity of HLP solution for long term HIC testing under mildly sour conditi	Daichi Izumi, Junji Shimamura, Kyono Yasuda, Nobuyuki Ishikawa, Taishi Fujishiro, Takuya Hara, Eiji Tada, Mitsuo Kimura - High Strength Line Pipe (HLP) Committee of The Iron and Steel Institute of Japan proposed 5% NaCl + 0.93N (CH3COOH + CH3COONa) solution (HLP solution) as a strongly buffered solution, and excellent pH stability was verified in comparison with the Solution C under the condition of pH 4.5 and 0.01bar H2S partial pressure. In this study, pH stubility of the HLP solution was investigated using Grade X70 steels under the wide range of sour invironment with pH 3.5 to 5.5 and H2S partial pressure of 0.001 to 0.01 bar. The effect of solution volume to achive higher pH stability was also investigated. It was confirmed that the HLP solution can be applicable for the wide range of pH and H2S partial pressure conditions and requires no pH adjustment during 30 day HIC test. Test procedures for the preparation of the HLP solution and the detailed conditions to achieve pH stubil	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 8:10am - 8:35am	Characterizing Corrosion On AA-7075 Through Alternative Cleaning Methods And Optical Profilometry	Steven Kopitzke, Karla De Jesus Santiago, Rachel Black - Internal experimentation and work from external institutions have highlighted a potential issue in the currently accepted ASTM G-1 mass loss standard as an effective means for evaluating corrosion damage on aluminum alloy 7075-T6. It has been found that the use of the current standard can result in users reporting mass loss values that are inconsistent with the visual corrosion assessment, including mass gain instead of loss on obviously corroded samples. It is hypothesized that the current method of repeated immersion in acidic solution followed by mechanical cleaning is not effective at dislodging corrosion product from the pits formed on a corroded aluminum surface. To address this, research has been completed to evaluate a two-step method for corrosion analysis. First, based on the work by R. Kelly (Corrosion, 57(2), (2001), 110-117), ultrasonic cleaning of coupons in nitric acid more effectively removes corrosion from the	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 8:10am - 8:35am	Corrosion Testing Of Graphene-Oxide-Polymer Coatings For Geothermal Drilling Applications	Erlend Straume, Gifty Oppong Boakye, Baldur Gunnarsson, Arna Ormsdottir, Beatriz Rodríguez, Sigrun Karlsdottir - Through improvement of drilling methods and equipment, the Geo-Drill project aims to save time, increase service life of equipment and instrumentation, and reduce costs during drilling of geothermal wells. To reduce corrosion damage of materials operating in the harsh geothermal environment, novel corrosion resistant coatings and materials for drilling applications have been developed, fabricated, and tested in the Geo-Drill project at pressure, temperature, and chemical conditions equivalent to those of a geothermal well. High pressure and high temperature (HPHT) corrosion tests were performed in a newly installed 3 L autoclave in the corrosion laboratory at the University of Iceland. The materials fabricated for the novel drilling equipment and sensors developed in the Geo-Drill project, include Graphene Oxide (GO) containing PTFE based coatings, high entropy alloy and c	Henry B. Gonzalez Convention Center	Symposia
Tuesday 3/8/2022 8:10am - 8:35am	Guideline To Determine Erosional Velocity For Liquid Hydrocarbon Transmission Pipelines	Jose Vera, Guanlan Liu, Francois Ayello, Richard Eckert, Prabhas Bhat - Many operators use the general form of the API RP 14E equation to determine erosional velocity, but it does not properly address the effect of the key parameters affecting erosion in liquid pipelines and could give erroneous results in some cases. This paper presents a guideline to determine erosional velocity limits for liquid hydrocarbon transmission pipelines, developed based on a multi-analytical probabilistic approach that integrated results from two industry-recognized erosional models: DNV RP-O501 and University of Tulsa SPPS v5.3.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 8:10am - 8:35am	Corrosivity Laboratory Investigations Of Streams Associated With Gas Compression Plants And Liquid S	Yahya Al-Janabi - The purpose of this laboratory study is to assess the corrosivity of fluids transported through a huge network of gas transmission lines associated with nine (9) Gas Compression Plants (GCPs) and six (6) Liquid Separation Stations (LSSs). The CO2 content ranges from 0.94 mol% to 3.9 mol%, while the H2S content varies from 0 to 1.9 mol%. The lines range in diameter from 16 to 40 inches. The highest gas flow rate in these lines is 757 MMscfd, and the highest estimated temperature and pressure are 140°F (60°C) and 1050 psig (72 bar), respectively. The study consisted of three parts: 1) uniform corrosion in liquid and gas phases; 2) pitting corrosion in liquid and gas phases; and 3) gas phase corrosion. The absence of dissolved solids and bacteria eliminated the need to study for scaling and microbiologically-influenced-corrosion (MIC). The study was conducted using low alloy carbon steel test coupons and distilled water with 0, 150, and 1000 mg/L chloride. The obtain	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 8:10am - 8:35am	Impact Of Preservation Method, Storage Temperature, And Processing Time On Microbiological Community	Lisa Gieg, Mohita Sharma, Yin Shen, Jennifer Sargent, Trevor Place, Nicole Taylor - Microbiological monitoring of samples collected from oilfield operations is crucial for understanding microbial impacts on metal infrastructure. As many oilfields and related infrastructure are in remote locations, the time between sample collection, shipping to laboratory and sample processing for microbiological analysis can vary from days to weeks. Hence, robust sample handling and preservation methodology to arrest microbiological activity at the time of sample collection is needed. To identify the best preservation methodologies that can be adopted for solids, oily sludge samples were collected twice from the nose of the same pig trap during a routine pipeline pigging operation of a crude oil transmission pipeline over a span of two years. Samples were chemically preserved at the time of sample collection (with different alcohols or commercially available nucleic acid preservation reagents) or	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 8:10am - 8:35am	Case Analysis Of Electromagnetic Interference Of AC Substation On Pipeline	Jin Su - The single-phase ground fault of the AC substation will cause electromagnetic interference to the adjacent pipeline and the valve chamber, mainly reflected in the touch voltage, step voltage and coating withstand voltage of the pipeline exceed the safety threshold. In order to evaluate the electromagnetic interference effect of an AC substation on adjacent pipeline and the valve chamber, the numerical simulation method is used to calculate the relevant safety parameters of the pipeline during the single-phase ground fault of the substation. For the case of touch voltage of the pipeline exceeding the safety threshold, the mitigation methods have been obtained by the software calculation. The specific mitigation method is to connect the pipeline to the grounding of the valve chamber through the solid state decoupler, and then set the gradient mitigation line in parallel with the pipeline near the substation.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 8:10am - 8:35am	Corrosion Under Insulation And Atmospheric Corrosion In The Refinery Industry. An Accurate Approach	Bernardo Cuervo, Mark McQueen - Corrosion under insulation (CUI) and atmospheric corrosion are costly problems in refineries. In a Texas refinery, CUI caused approximately 60% of all pipe leaks and was particularly aggressive in some difficult-to-reach areas. In this paper, a case study will be presented that addresses three different methods to calculate the corrosion growth rate, remaining life, and reinspection interval. The traditional approach includes an initial inspection and the estimation of aggressive corrosion growth rates that will require frequent costly re-inspection intervals. This paper details a novel methodology to address the damage caused by CUI so that it can be easily detected and its growth rate accurately estimated. This method will save time and money by decreasing expensive shutdowns. In addition, the paper shows typical examples of CUI and points out some of the major impacts of CUI on in-line inspection (ILI) technologies like magnetic flux leakage (MFL)	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 8:10am - 8:35am	Accelerated Methods To Evaluate Environmentally Assisted Cracking Using The Rising Step Load Method	Joshua Jackson, Louis Raymond, Craig Tod - The Rising Step Load (RSL) test method has been used extensively for evaluating hydrogen embrittlement, and is increasingly being used for other modes of environmentally assisted cracking. Recent and ongoing research in evaluating other cracking modes will be discussed, including assessment of stress corrosion cracking and sour corrosion by the RSL practice. In the RSL method, the load is incrementally increased followed by a holding period which allows hydrogen diffusion and crack growth. Use of environmental chambers, temperature control, and applied voltage can be used to rapidly evaluate many common environmental cracking modes. The rapid nature of the test allows for determination of temperature thresholds, detailed stress analyses, comparison of alloys/coatings, and failure analysis in an accelerated manner.	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 8:10am - 8:35am	Novel Strategies On Magnesium Phosphate Cements Applications To Prevent Corrosion Of Steel In Concre	David Bastidas, Ulises Martin, Jose Bastidas, Digby Macdonald, Nick Birbilis - Novel strategies to address the challenge on resilient infrastructure solutions are required to be adopted in a growing circular economy, towards achieving net-zero emissions and reducing carbon footprint. In this regard, “closing the loop” by maximizing materials recovery and optimizing construction engineering processes will minimize the mining of natural resources and environmental impact, thus resulting in an increased sustainability. To approach this initiative, the reutilization of industrial by-products and recycled materials such magnesium phosphates cements (MPC) can strongly benefit sustainable construction and circular economy. MPC develop a rapid strength, forming a compact interface layer presenting high bonding to the steel reinforcements. The outstanding protection of MPC is due to the formation of insoluble iron phosphate film, which prevents corrosion failure, thus expanding service lifeti	Henry B. Gonzalez Convention Center		RIP

Tuesday 3/8/2022 8:10am - 8:35am	A One Dimensional Crevice Experiment For Determining The Critical Factors Contributing To Crevice Co	Robert Lillard, Shirin mehrazi, DIANA MUÑOZ SALGADO, Yousef Shorrab - Previouosly, we introduce a method for measuring both the depth of the active front in crevice corrosion and the active area which in turn allows the investigator to quantify the crevice current density. The method is similar to that which Pickering introduced years ago,[4] we record video of a propagating crevice in the optical microscope. In this technique the crevice is formed by a set of washers, a piece of acrylic that acts as a crevice former and the metal specimen, nickel alloy 625. The potential of the assembly is controlled potentiostatically using a traditional three electrode set up and the current recorded as afunciton of time. A stereo microscope equipped with a digital camera is used to record images of the initiation and propagation of crevice corrosion. Image processing software is used to quantify the area of the active front. In this presentation we will discuss the method and present results fro	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 8:10am - 8:35am	Corrosion Resistance Of FBE Internal Coating Pipe In High Temperature And High CO2-H2S-Cl- Environme	Xuehua Fan, Yunan Zhang, Jinyang Zhu, Yong Yu, Chang Liu, Gu Feng, Lei Zhang, Kun Fang - Fused epoxy powder (FBE) internal coating pipe is a kind of internal coating technology for pipes, which has good corrosion resistance, and had become one of the important measures of corrosion control for pipes of oil & gas fields. A high temperature resistant fusion bonded epoxy (FBE) coating was chosen as the experimental object, and conducted long period (30 days) immersion tests and electrochemical (impedance spectroscopy EIS) tests of the FBE coatings under various temperatures with high content of CO2-H2S-Cl-, and combined morphology observation & adhesion performance test to study the corrosion resistance and corrosion mechanism of the FBE internal coating under various temperatures. The results showed that no visible corrosion damage was found on FBE coating surface at high temperature with high content of CO2-H2S-Cl- condition. However, there had been obvious local damages such as small	Henry B. Gonzalez Convention Center		Symposia
Tuesday 3/8/2022 8:30am - 11:30am	WCO - Board of Directors		Grand Hyatt San Antonio	Bowie C	Other

Tuesday 3/8/2022 8:35am - 9am	Combining FEM And Fracture Mechanics For A Materials Selection Framework To Mitigate Hydrogen Embrit	Rebecca Skelton, Zachary Harris, James Burns, Robert Kelly - Aerospace structures often include dissimilar materials in complex geometries, such as a stainless steel bolt used to join aluminum alloy panels. The cylindrical geometry of the fastener hole acts as a stress concentrator, enhancing the external stress by three times [1]. With the addition of any conducting electrolyte, localized corrosion may occur within the fastener hole, further complicating the system. The fracture mechanics can be impacted by localized corrosion, through both pits acting as crack nucleation sites and the formation of hydrogen during the anodic dissolution contributing to hydrogen embrittlement [2]. In this work, linear elastic fracture mechanics (LEFM), electrochemical testing, and finite element method (FEM) modeling are combined to determine an optimized selection of materials and coatings to minimize localized corrosion and hydrogen embrittlement in a fastener hole geometry involving dissimilar met	Henry B. Gonzalez Convention Center		RIP

Tuesday 3/8/2022 8:35am - 9am	Bulk And Nano-Scale Characterization Of Additively Manufactured Ti-6Al-4V: Effect Of Composition And	Olivia Maryon, Paul Davis, Michael Hurley, Jake Benzing - The manufacturing of metal parts has been revolutionized by 3D printing. 3D printed metals can be produced through a variety of additive processes, and the resulting parts possess very different microstructures compared to conventionally processed metals. Depending on the method, printed microstructures have nano-scale features that can only be resolved using certain characterization techniques. Scanning probe microscopy (SPM) is a technique that enables nano-level resolution of surface features and properties under various modes of operation. Scanning Kelvin Probe Force Microscopy (SKPFM) measures surface electronic properties and, when co-localized with elemental mapping via energy dispersive spectroscopy (EDS) and electron backscatter diffraction (EBSD), can be used to help understand and predict initiation and propagation of corrosion at microstructural features in metal alloys. In the current work, Electrochemical and sca	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 8:35am - 9am	Corrosion Rates Of Prerusted Steel In Concrete Without Admixtures	Carmen Andrade, Andres Bonilla, Amparo Moragues - Concrete is a material which passivates the steel because of the high alkalinity of its pore solution. This is assumed to happen also if the steel is prerusted. In present work steels removed from an old concrete suffering corrosion by carbonation were embedded in new mortar in order to study their performance. The steels presented different degree of prerusting. The results of corrosion rates measured through linear polarization and electrochemical impedance indicated that some bars with rust did not passivate in fresh mortar even exhibiting very high corrosion rate values. When the specimen was broken it was found some active corrosion spots in the specimens showing high corrosion rates, while in the cases with low corrosion rates the steel was found without any sign of active corrosion. It was observed that the spots were corrosion develops show rust very bonded to the parent steel although it happens not in all bonded rests of rus	Henry B. Gonzalez Convention Center		RIP

Tuesday 3/8/2022 8:35am - 9am	A Machine Vision Case Study Of U-Net Networks For Superficial Corrosion And Dirt Image Segmentation	Wesley Kaizer, Otavio Correa, Eduardo Amaro - Corrosion detection in industrial assets and components is an important broad problem in the industries, since it allows the temporal tracking of possible issues and the execution of preventive maintenance actions, such as protective coating. However, solving this problem using modern machine learning methods usually demands a careful design of artificial intelligence tools, such as neural networks, high computational resources for training and inference, and a large and adequate dataset. In this work we investigate the application of deep convolutional neural networks to the problem of image semantic segmentation of superficial corrosion and dirt present in mining industrial assets, using a set of images collected in place by corrosion inspectors and manually labeled by a data team. We compare two networks based on the popular U-Net model, in which one of them uses the transferred features from a pre-trained VGG-16 image classification m	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 8:35am - 9am	Naphthenic Acid Corrosion And Sulfidic Corrosion In Crude Oil Fractions	Yuhchae Yoon, Kwei Meng Yap, Hui Li - Crude Corrosivity issues manifest themselves at locations where fluid flow rates and velocities are relatively high in atmospheric distillation units, vacuum distillation units, transfer lines, valves, baffles, heat exchangers, and side cut piping in refinery systems. The heavy vacuum gas oil (HVGO) fraction of the vacuum distillation plant is the crude fraction which usually has the highest total acid number (TAN) due to high concentration of naphthenic acids close to their boiling points. This mechanism of non-aqueous corrosion in the presence of crude oil or oil fractions with high quantities of organic acids and sulfur compounds is termed as high-temperature naphthenic acid and sulfidic corrosion. This paper will describe naphthenic acid corrosion behavior and corrosion rates of multiple alloys (C1018 carbon steel, A182-F5 5Cr-0.5Mo low alloy steel, A182-F9 9Cr-1Mo alloy steel, AISI 410 stainless steel, and AISI 304L stainless steel) stemm	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 8:35am - 9am	Case Study - Sharing An AC Mitigation System	Hycem Bahgat, Sorin Segall, Daniel Hebb, Ernesto Gudino, Karl Shen, Shan Jiang - An AC interference study was conducted in 2019 following a utility development project which included the construction of a new substation and upgrading of approximately 24 km of new AC transmission powerline sections in Alberta, Canada. The study comprised of five transmission powerlines owned by one utility and nine pipelines owned by two different operators. In the unmitigated state, the modelling results showed touch voltage hazards under steady-state and fault conditions and susceptibility to AC corrosion and coating stress that were above the established limits. A shared AC mitigation system was designed to eliminate the hazards caused by AC interference on all nine pipelines, which in the end resulted in overall less mitigation requirements, smaller number of site visits, reduced construction footprint and environmental impact, and reduction in the overall project cost. This paper describes the	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 8:35am - 9am	Molecular Deep Dive Into Oilfield Microbiologically Influenced Corrosion: A Detailed Case Study Of M	David Leach, Wei Wang, Chao Yan, Wei Wei, Ron MacLeod, Dillon Mattis - This work details a MIC failure analysis case study for a produced water pipeline. A water dumpline in a shale and tight asset experienced heavy corrosion and ultimate failure within only a 7-month period (estimated MPY = 160). Upon removal by the inspection team, heavy white deposit buildup (a microbial biofilm) was observed directly associated with the corrosion failure on top of a black scale underlayer. Detailed scale and microbial analyses were performed, using ATP photometry, qPCR speciation, and DNA sequencing to profile the microbial population present, which was dominated by high-risk microbial strains such as sulfate-reducing bacteria and methanogens. Scale analysis confirmed iron carbonate and iron sulfides associated with microbial iron metabolism and corrosion, and microscopy and spectral analyses explored elemental composition and biofilm morphology. This study will lay out detailed root cause analys	Henry B. Gonzalez Convention Center		Symposia

Tuesday 3/8/2022 8:35am - 9am	Dual Functional Corrosion Inhibitor Design And Testing For Top-Of-Line And Bottom Of Line Corrosion	Larry Chen, Nihal Obeyesekere, Jonathon Wylde, Michael Sim - Preventing top-of-Line (TOL) corrosion with inhibitors is very challenging, and even more challenging when pursuing a dual functional corrosion inhibitor that serves for both BOL (bottom-of-line) and TOL in the same time. Some of the difficult issues are: how to estimate the treating weight between the topline and bottom line, how to make the products perform effectively for both top and bottom lines, how to make the low and high volatile molecules for mitigating BOL and TOL corrosions to be compatible and homogenous in a single blend. More than 100 active components were blended to develop more than 40 formulated products. These products were screened using TOL rig, RCE and RCA methods to select few products. Finally, two products were selected that satisfied all desired chemical characteristics and performance for both BOL and TOL applications under sweet and sour conditions with or without the presence of acetic acid.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 8:35am - 9am	ILI Validation – Overview And Case Studies	Ana Benz, Laurence Kuan, Kurtis Bell, Cameron Sjerve - The pipeline industry strives to keep pipelines running safely and reliably. The process involves many steps, including selecting the lines/segments to be inspected with in-line inspection (ILI); performing the ILI run; maintenance, repair, extraction digs; ILI validation; and growth predictions and risk-based programs to establish maintenance and repair practices. Most operators' programs start with in-line inspections, which generate large data sets and provide interpretations about the pipeline integrity without a validation process. Although ILI information is thorough, it is generated by non-destructive and/or indirect measurements. As with any non-destructive examination (NDE) technique, comparisons must be made to direct observations and measurements to ensure accuracy. This paper overviews validation of the ILI data through three case studies: determining whether the tool is functioning per its listed specification, discu	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 8:35am - 9am	Advanced Materials For Condensing Heat Transfer	Imran Bhamji, Shiladitya Paul, Garima Mittal, Alan Taylor, Anna Wojdyla-Cieslak - The wetting of solids by liquids is an important consideration for heat exchangers and is particularly relevant for condensation heat transfer, as it can have a dramatic impact on its efficiency. Promotion of dropwise condensation, rather than film-forming, through the use of superhygrophobic materials, surfaces or coatings is expected to be give rise to next generation high efficiency designs. Here, a material-by-design approach has been adopted, where nanoscale metal oxides have been designed and fabricated to provide the enhancement of properties of conventional hygrophobic coatings. Novel superhygrophobic coatings were developed, consisting of a polysiloxane matrix, which provides an inherently water repellent film, and functionalized silica nanoparticles, providing bottom-up roughness. Coatings were applied to aluminum, copper, carbon steel and stainless steel substrates, which had top-down engine	Henry B. Gonzalez Convention Center		Symposia

Tuesday 3/8/2022 8:35am - 9am	Use Of The Corrosion Prognostic Health Management (CPHM) System On The Mi-24 Helicopter	Patryk Ciężak, Piotr Synaszko, Andrzej Leski - The following article presents “Corrosion Prognostic Health Management" (CPHM) System used on helicopter Mi-24. Polish army spends millions of dollars annually on inspection, identification and repair of damage resulting from aircraft corrosion. That is why it is so important to reduce maintenance time and costs. CPHM System helps in this process by reduce maintenance costs and helps in improving the CPCP program. In order to increase aircraft safety, availability, and operational efficiency, Polish army use an on-platform monitoring system. Corrosion prediction requires inputs, models, and actionable outputs that can be used by maintainers. Aircraft corrosion monitoring systems quantify: Environmental parameters (environmental severity) and Corrosion rate of surrogate materials (corrosivity). Conversion equations from signals from sensors to the rate of loss of current to mass are also very important part of the system. The article sh	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 8:35am - 9am	Corrosion Fatigue Of X80 Weld In Mild Sour Environment	Laurent Ladeuille, Yifei Zeng, Chih-Hsiang Kuo, Richard Jones, Gregory Toguyeni, Florian Thebault, Xin Yue - High Pressure High Temperature (HPHT) wells usually require the application of heavy wall pipes for steel risers in conventional grade. The utilization of higher-strength grade such as X80 reduces the constraints related to the manufacturing and the installation by saving line pipe weight. Seamless X80 pipes were manufactured in 323.9 x 25.4 mm and characterized. Girth welding was made using the Pulsed Gas Metal Arc Welding (PGMAW) process on these seamless line pipes. Four-point-bend tests were conducted as per NACE TM0316 to evaluate the Sulfide Stress Cracking resistance of X80 pipes and welds. There are only limited results about the fatigue behavior of high-strength steel welded joints and a fortiori in sour environments. Therefore, the performance of X80 mechanized girth weld was assessed in air and in mild sour environment. Fatigue endurance tests were performed in ai	Henry B. Gonzalez Convention Center	Symposia
Tuesday 3/8/2022 8:35am - 9am	Effect Of Steel Surface Profile Peak Density On Rust Creepage	Russell Draper, Michael Beamish - Rust creepage or undercutting from a discontinuity in a coating film, such as scribe or holiday, is an important mode of coating degradation. The mechanism of rust creepage is attributed to cathodic delamination. This paper describes an experimental study of the influence of steel substrate topography, measured with a digital replica tape reader, on rust creepage. For the coating systems that were studied it was found that rust creepage was strongly correlated with peak density and creepage decreased as peak density increased.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 9am - 9:25am	The Long Term Effects Of Surface Preparation: Evaluating ISO 12944 In Offshore Coating Application W	Alexander Petkas, Jerry Woodson - The team assembled by the major oil company designed a test program to assess the difference in coating performance between dry abrasive blasting and Waterjetting as surface preparation methods. One goal was to both design and document the process according to the highest possible technical standards. They were also interested in determining whether using a cleaning additive in conjuction with various applications had any affect on coating performance. A method was developed to test the different applications with a glass flake epoxy. The panels were treated variably with 38,000 PSI Waterjetting, Dry Garnet blast + Power wash, and cleaning additive. One set of panels was immediately coated after surface preparation, while another set was sprayed with ASTM D1141 seawater salt spray and left to sit a number of additional days before coating. The panels were then cut in two, one set of sections was subjected to ISO 20340 (now ISO 12944) cycl	Henry B. Gonzalez Convention Center		Symposia

Tuesday 3/8/2022 9am - 9:25am	Sensitivity Study Of Typical Pipelines And Station Pipes In Hydrogen Environment	Zhiwen Yang, Fan Fei, Shun Zhou, Ke Shen, Chong Wang, Yanjun Wang, Na Zhao, Min Feng, Yingfeng Chen - This article selects a certain gas pipeline system, the director of the line on material X60 steel and typical process pipeline structure of 20 # steel elbow, yard by the metallurgical structure observation of the typical sampling position and hardness tests, hydrogen permeation test compared the hydrogen and hydrogen content of X60 steel base, girth weld and hydrogen embrittlement sensitivity of 20 # steel elbow position size. The risk of hydrogen embrittlement at sensitive sites in hydrogen environment was studied by notch tensile test. The results show that the hydrogen diffusion coefficient of base metal and weld of X60 steel is higher, and the hydrogen concentration adsorbed on the surface is lower. The hydrogen diffusion coefficient of 20# steel is low, and the concentration of hydrogen adsorbed on the surface is high, which indicates that the hydrogen trap content in 20# steel	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 9am - 9:25am	Efficacy Of MIL-DTL-5541 Compliant Non-Chromate Conversion Coating Repair Materials	David Enos, Derek Wichhart - Non-chromate conversion coatings compliant with MIL-DTL-5541 Type 2, Class 3 have been demonstrated to provide protection comparable to their Type 1 (chromate) counterparts. Repair materials are available from most manufacturers, though with significant variations in their application methodology and efficacy. In this work, chemistries from three different vendors were evaluated, working towardsa a single application method that can be used independent of the selected chemistry. Each coating was then benchmarked against an industry standard chromate conversion coating in terms of both the corrosion performance as well as the capability of each coating to maintain the ability to make low resistance electrical contact to the surface.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 9am - 9:25am	Development Of High Velocity Oxygen Fuel (HVOF) Corrosion Resistant Coatings; A Comparison Between N	Gifty Oppong Boakye, Erlend Straume, Arna Ormsdottir, Baldur Gunnarsson, Feifei Zhang, Andrew Tabecki, Sigrun Karlsdottir - High Velocity Oxygen Fuel (HVOF) thermal spraying process has proven to be one of the most effective techniques for deposition of conventional cermet-carbide composite coatings improving their high-temperature oxidation corrosion, erosion, and wear resistance. As such, the objective of this work focuses on the fabrication of CoCrFeMo0.85Ni HEA coating by HVOF technique developed in the Geo-Drill project. Here we report the comparative analysis of corrosion resistance for the developed CoCrFeMo0.85Ni and CrC–NiCr, WC–Co carbide systems. The HEA and Cermets were immersed for 14 days in a simulated alkaline geothermal drilling environment at 120 °C and 50 bar. In addition, an electrochemical-accelerated corrosion test in a 3.5wt% NaCl was carried out at ambient temperature to investigate the behavior of the coatings in the presence of Cl ions. The compositional eff	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 9am - 9:25am	Impact Of Maintenance Activities On Future Integrity Of Transmission Pipelines	Haralampos Tsaprailis, Mike Hill, Jiajun Liang - Transmission pipeline operators regularly inspect their assets using in-line inspection (ILI) tools to monitor for potential internal and external threats to the system. When these tools identify features that meet excavation criteria, the operators will complete mitigation activities to reduce or remove the threat. Typically, these mitigation activities include excavation of the pipeline, removal of the coating, and non-destructive examination at the targeted feature. Upon completion of the maintenance activities, the pipeline is then re-coated and backfill restored. During the maintenance work, the pipeline’s coating at the ends of the excavation is exposed to atmospheric conditions (e.g., sun light, humidity, etc.). Moreover, the pipeline is then exposed to disturbed soil with varying moisture content after being backfilled. Depending on the coating type, these conditions may increase the corrosivity of the localized environment at	Henry B. Gonzalez Convention Center		Symposia

Tuesday 3/8/2022 9am - 9:25am	Failure On Heater Treater Tubes - Case Study	Roxanna Alvarez, Jose Vera, Carlos Palacios - Heater Treaters are designed for the removal of emulsified water and unwanted salts from crude oil. This paper will discuss a case study completed on two Heater Treaters that exhibited premature failure after 8 months in service, involving an extensive fire with a subsequent loss of production. Multiple cracking on the mitrated elbow welds, on the flanges to shell circumferential weld and a collapsed tube were observed in the heating section, after the treater went out of service. Visual inspection, metallurgical analysis, physicochemical analysis of the formation water, corrosion deposits analysis and stress analysis were completed to identify the root cause of the failure. Results indicated that the accumulation of deposits from the reservoir water and a low level of crude oil due to the reduction in production caused high thermal cyclic stresses on critical welded areas in addition to a localized overheating on the collapsed tube.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 9am - 9:25am	Evaluation of A Rapid Solution For SRB Monitoring In Industrial Water System	KHLOUD ALRAMADAN, SALMAN AlMUTIRY, Joseph Puthuvelil, Mohammed Tolaihy - Sulfate-reducing bacteria (SRB) have been found to be the most troublesome group of microorganisms involved in microbial induced corrosion (MIC) of carbon steel and other metals used in the oil and gas industry. Uncontrolled growth of microorganisms in the oil field production systems has a major negative impact on the productivity and asset integrity. For monitoring microbial SRB populations, the conventional NACE-TM0194 method; based on the most probable number theory and serial dilution technique, is still followed where it can take up to 28 days to be completed. Thus, there is an interest in having a rapid and inexpensive method to assess the presence of SRB in different environments for the control of MIC and also for taking mitigation measures like the biocide injection. In this study, 3M technique as a novel strategy was applied on water samples produced by Saudi Aramco’s Southern Area Oil Operations (SAO	Henry B. Gonzalez Convention Center		Symposia

Tuesday 3/8/2022 9am - 9:25am	Challenges Of Mitigating AC Interference Risks In A 107 Km Multi-Pipeline Corridor	Wolfgang Fieltsch, Paul Murray - An initial AC interference study and mitigation design was performed prior to construction, on the subject 107 km long pipeline installed in 2016. The subject pipeline is collocated with another pipeline constructed in 1999, for the entire route, and several other pipelines in some areas, all owned by the same operator and with shared cathodic protection systems. Five areas of powerline collocation were identified and modeled in the AC Interference study. During the commissioning survey, elevated AC voltages were recorded in areas with no identified powerlines. Furthermore, it was discovered that some pipeline bonds, existing mitigation systems and other pipelines were not modeled as per the final “as-built” installation or incorporated into the AC mitigation system. Subsequent site investigations were performed to confirm bonding, assess AC interference corrosion risks, and identify additional AC interference sources. The pipelines were remodeled to	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 9am - 9:25am	Evaluation Of Reactive Sulfur For Improved Corrosion Predictions In Oil Refineries	Ishan Patel, Gheorghe Bota, David Young - Refinery operators rely on total sulfur (TS) content (wt.% S) and total acid number (TAN), reported in crude oil assays, to predict high temperature corrosion rates by organosulfur species and naphthenic acids. The sulfur exists in a variety of forms in crude oil, associated with particular molecular moieties; from the standpoint of corrosion, these are grouped into reactive (sulfide and mercaptan) and non-reactive (thiophenic) species. According to an industrial rule-of-thumb, only 1/3 of the TS is considered as reactive sulfur (RS) and, hence, this value, together with TAN, is typically used as input in corrosion models for prediction of corrosion rates. It was hypothesized in this research work that the prediction of a corrosion model should improve if experimentally measured reactive sulfur values are used as an input in modeling instead of employing the 1/3 rule-of-thumb. To measure the percentage of reactive sulfur in a given crude oil,	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 9am - 9:25am	Case Study Based On Failure And Application Of Surface Coating (Powder Coating)	Syed Umair Niaz Bukhari, Ahmad Raza Khan Rana, Ahmad Raza Khan Rana - Surface coating is a cost-effective method for protecting the metals surface and is well known for versatility, ease of maintenance, and various compositions specific to service involved. It is also needed for achieving specific surface properties such as corrosion, erosion, and wear resistance. Individuals and industry tend to focus on the wearing surface that has the greatest impact on their own economic situation. Various epoxy coating systems are known for hydrocarbon applications till date, which includes but are not limited to inorganic Zn epoxy, glass flake epoxy, coal tar epoxy, phenolic epoxy etc. Also, various techniques for coatings are known such as Thermal Spraying (TS), Fiction-Surfacing (SF), electroplating, and electrodes. In this paper an attempt has been made to review a case study based on the failure of powder coating applied on the external surfaces of the bolted fire water tank.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 9am - 9:25am	Modelling The Performance Of Reinforced Concrete Exposed To Marine Environments: DURACON Project 10-	Oladis de Rincon, Valentina Millano Gonzalez, Andres Torres-Acosta, Miguel Sanchez Gomez, Pedro Castro Borges, Rosa Vera, Manuela Salta, Miguel Pedron - This research evaluation consisted on a detailed statistical analysis of the recorded data in 72 specimens from the marine atmospheres (12 exposing sites), during a natural exposure period of 10 years in 09 countries. The parameters evaluated included the concrete physical-mechanical characteristics, meteorochemical information, natural reinforcing steel´s corrosion rate and accumulated corrosion rate, concrete chloride concentration, surface crack width and rebar cross section loss correlations. This statistical analysis resulted in empirical corrosion rate predictions as a function of the exposure microclimates, through linear multiple regressions. These models showed a high linear dependence of the corrosion rate with the concrete capillary absorption as well as with the meteorochemical parameters. Results obtained in this investi	Henry B. Gonzalez Convention Center		RIP

Tuesday 3/8/2022 9am - 9:25am	Detection Of Corrosion Using Millimeter Waves	Yshai Gabai, Amir Eliezer - Corrosion leads not only to a loss of metal, but also to changes in physical properties leading to a degradation of its mechanical strength. In occasions where the metallic structure is covered, It is necessary to employ nondestructive testing (NDT) methods for the detection of the degree of the developed corrosion. A technique for the detection of the corrosion degree using millimeter and sub-millimeter waves is presented. It is based on the electromagnetic wave reflection properties of the metallic structure. Illumination the structure by millimeter waves, the power reflection is measured for several different incident angles. The dielectric and magnetic properties of the material are evaluated using the Fresnel equations, revealing the electrical conductivity of the metal in the presence of corrosion. Based on a theoretical study, a computational solver is developed for the analysis of different metallic structures. We demonstrate the technique using	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 9am - 9:25am	Effect Of Size And Size Distribution Of Nb-Bearing Precipitates On Hydrogen Trapping Capacity Of Mod	Sara Filice, Dmitrij Zagidulin, James Noel, Joseph McDermid, Joseph Kish - Supporting the development of HIC-resistant linepipe steel is crucial as pipelines are extensively used in the transportation of oil/gas that may contain high amounts of H2S [1]. In order to improve the reliability and safety of pipelines, a fundamental understanding of the HIC damage mechanism is necessary so that control measures can be implemented. Hydrogen absorption is well known to degrade mechanical properties and increase susceptibility to cracking and associated brittle fracture failure at stresses below the yield stress of linepipe grade steels [2], [3]. The steel microstructure is widely recognized as a critical factor affecting HIC susceptibility, as microstructural features can affect the mobility of absorbed hydrogen by acting as traps [2]. Many features within the microstructure can act as hydrogen traps, however, this study focuses on strengthening precipitate particles, specifically the relati	Henry B. Gonzalez Convention Center		RIP

Tuesday 3/8/2022 9am - 12pm	Zinc Coatings for Asset Protection by Land and Sea Forum	Presented by Bernardo Duran, International Zinc Association; Alana Fossa, American Galvanizers Association; Mike Stroia, Commercial Metals Company; and Chad Martin, Great Western Joint Venture Specifiers and asset owners have used zinc coatings for corrosion protection for structures, vessels, and infrastructure on land and marine applications for many decades due to their proven performance and cost-effectiveness. This presentation will discuss the different coating technologies from application and performance perspectives. This forum is designed for both beginners and seasoned AMPP members. Professionals new to the protective coatings world will learn about proven technologies, including the basics of electrochemical corrosion and how corrosion engineers utilize zinc to protect against it. Experienced industry professionals will learn the breadth of applications and new developments in the zinc coatings world and how to specify and inspect them. The speakers, who have more than 60 years of combined experience in zinc coatings, will discuss steel and concrete substrates and reinforcement steel in concrete. The presentations will demonstrate the versatility of the application methods and provide new coating options for these structures.	Henry B. Gonzalez Convention Center	Room 208	Forum
Tuesday 3/8/2022 9am - 12pm	International Licensee & Partner Meeting		Henry B. Gonzalez Convention Center	Room 225 B	Other
Tuesday 3/8/2022 9am - 12pm	SC 25 - Accreditation Standards		Henry B. Gonzalez Convention Center	Room 211	Standards

Tuesday 3/8/2022 9:25am - 9:50am	Evaluating The Role Of Possible HEAC In Humidity-Dependent Small-Scale Cracking In Austenitic Stainl	Jayendran Srinivasan, Rebecca Schaller, Eric Schindelholz, Jenifer Locke - Experiments are ongoing to examine, from an electrochemical and microstructural standpoint, the hypothesis that small-scale cracking can originate on ground stainless steel exposed to low-RH atmospheres. Cathodic kinetics of 304 stainless steel will be recorded in seawater simulant brines equilibrated to 76% RH and 40% RH to evaluate any differences in HER rate. Solutionized sampled to remove any strain-induced martensite and residual stress will be immersed in sea salt simulant brines to evaluate resulting pit morphology. Finally, U-bend samples will be tested in simulant brines to observe whether one solution promotes failure faster in the presence of externally applied stress. (Sandia National Laboratories, one of the originators of this work, is managed and operated by NTESS under DOE NNSA contract DE-NA0003525. This document is SAND2021-xxxx-A.)	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 9:25am - 9:50am	Evaluation Of Structural Changes In Pipeline And Pressure Vessels Steels By NDT Method Measuring Ste	Svitlana Savluk, Roman Solomakha - There are Coercivity method essence, results of research on Fracture toughness of ferromagnetic metal assessment by Coercivity and other Magnetometric methods based on Fracture Toughness test of Low carbon steel S355J0 samples, result of research of Radiation Embrittlement assessment by Coercivity and other Magnetometric methods on nuclear reactor witness sample, case studies of Coercivity assessment of fatigue in real-time and in-situ presented at the work. Basing on 40-years' experience of Coercimetry application the method's capabilities for: monitoring effectiveness of technologies in manufacture of new metal products and final acceptance control of mechanical properties in mechanical engineering and metallurgy; tasks of a metal fatigue assessment during operation, including scope of repairing and forecast of a residual service life for cast irons and ferromagnetic steels structures; austenitic steels fatigue assessment during operation are	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 9:25am - 9:50am	Upper Bound Estimate Of Corrosion Rate Of Steel In Concrete From Incomplete Impedance Data.	Alberto Sagues, Christopher Alexander - Estimates of the corrosion rate (CR) of steel in concrete from impedance measurements are often highly imprecise because due to time constraints the necessary low frequency (e.g., <0.01 Hz) data are outside a practical test frequency range. The resulting truncated spectrum becomes nearly unsuitable for identifying a polarization resistance (Rp) from which CR could be obtained. However, when certain working assumptions are justified, the data might still yield an upper bound of CR useful for engineering decisions. Two strategies are presented for systems where prior evidence indicated that interfacial impedance approximates a parallel Rp –Constant Phase Element combination, and CR a 1/Rp. In one, a crude, highly conservative lower bound of Rp is obtained by the largest solution-resistance compensated impedance modulus measured. The other, more refined approach proceeds by analysis of the maximum allowable model fit error compatible with the data	Henry B. Gonzalez Convention Center		RIP

Tuesday 3/8/2022 9:25am - 9:50am	Defining High Performance At Low VOC: Waterborne Acrylic Dtms Under 25 G/L	Kathleen Auld, Matthew Padaon - Waterborne coatings have been used to protect steel and concrete infrastructure for decades, and recent technical developments have led to materials with lower VOC content and higher performance. One-component waterborne acrylics in particular are often considered for light to medium duty service environments, but what level of performance can be expected from these systems? This paper will describe recent efforts to formulate waterborne acrylic coatings for steel protection below 25 g/L VOC, and define what high performance over steel looks like. The very low VOC levels are facilitated by an innovative acrylic latex polymer that can be formulated at low coalescent levels and still demonstrate the highest standards of corrosion resistance and exterior durability. A comparison to currently available low VOC resins and DTM coatings will be described to highlight the advantages of the new binder and to demonstrate the high level of performance possible wi	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 9:25am - 9:50am	An Enhanced Prediction Model For Simultaneous Naphthenic Acid And Sulfidic Corrosion Quantification	Sridhar Srinivasan, Winston Robbins, Abbey Wing, Gerrit Buchheim - Refinery operators face increasingly complex challenges in managing integrity of process units and assets – driven by the goal to achieve operational excellence and maximize asset performance while minimizing costs and maintaining the highest safety standards. Achieving reduction in crude costs entails procurement and processing of lower quality, lower cost opportunity crudes with higher concentrations of naphthenic acid and reactive sulfur species. Such crudes carry the potential for increased corrosion of piping metallurgy in process units operating in the range 200-400 C. A prediction model for naphthenic acid and sulfidic corrosion can alleviate corrosion concerns in planning for opportunity crude utilization and development of appropriate mitigation strategies. A mechanistic model, CorrExpert®-Crude, that accurately quantifies naphthenic acid and sulfidic corrosion, was introduced in a paper by the authors in Co	Henry B. Gonzalez Convention Center	Symposia
Tuesday 3/8/2022 9:25am - 9:50am	Comparing AC Study Techniques In Addressing AC Corrosion Risk	Perry Ross - An AC study and mitigation design was performed and installed to address corrosion risks. After a few years of operation, the site was revisited due to changing conditions and increasing AC current densities. For the second evaluation, new modeling software was used to evaluate the risk. This paper is a case study comparing the two modeling software techniques, an evaluation on the impact of field data quality, and a lessons learned on addressing AC corrosion risk.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 9:25am - 9:50am	A Case Study On Microbiologically Influenced Corrosion In Oil Producing Well Flowlines	Akhil Jaithlya, Sandip Kuthe, Amer Jaragh, Sharad Londhe, Abeer Rashed - Microbiologically Influenced Corrosion (MIC) has been known for the impact of bacterial presence in the internal corrosion of carbon steel material. In Oil and Gas industry bacteria are normally introduced in the surface production facilities during crude washing process as part of desalting process. Similarly, secondary recovery by water injection can contaminate the produced fluids typically with sulfate reducing bacteria (SRB). The sudden change in H2S levels in the produced fluids can be one of the indications of such SRB contamination. Under low flow conditions bacteria can rapidly proliferate and cause MIC to the carbon steel flowlines/pipelines. Few such observations on flowlines have been discussed here. The fluid analysis data along with the flowline inspection results were used to generate flowline corrosion risk matrix. This matrix was used to establish a baseline for sorting other flowlines in the s	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 9:25am - 9:50am	Improving Scale Management Using ESEM Bulk Scale Analysis	Steve Heath, Marius Stamnes, Ole Dronnen - The performance of continuous injection and scale squeeze treatments is traditionally monitored by the analysis of scaling ion and residual inhibitor concentrations (RSI) in collected produced water samples in conjunction with other parameters such as productivity index (PI) and temperatures and pressures throughout the whole production system. However, these methods are not always sufficient to identify the onset of scale formation and there can be some uncertainty as to whether the produced water is fully protected. It is therefore desirable to have an alternative to more conventional monitoring methods to assess the actual scaling regime of produced brine samples in combination with the scaling ions and RSI. This can be achieved by analyzing suspended bulk scale solids using Environmental Scanning Electron Microscopy and Energy Dispersive X-Ray Analysis (ESEM/EDX). ESEM bulk scale analysis can measure particle size, identify morpholog	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 9:25am - 9:50am	Inline Cathodic Protection Current Mapping - Applications	Dennis Janda - Inline cathodic protection current mapping is a unique method of assessing a pipeline’s CP. This is accomplished by measuring the actual current received by the pipeline inch by inch along the entire pipeline length. Unlike pipe to soil potentials, which can have a great deal of error in them due to forces often beyond our control, the CP mapping tool uses the physical properties of the pipe itself to measure the CP current. The pipe is a very stable part of the circuit, unlike the soil surrounding it. In a CP mapping inspection, there is no need to interrupt current sources and drains in order to eliminate IR drops that cause potentials to be erroneous. CP mapping inspections are conducted with all current sources and bonds in their normal day to day operating mode. Since this type of mapping is done from inside the pipe, it is an excellent choice for assessing pipelines that have access issues. Whether access is limited due to swamps, marshes, pavement, or terrain	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 9:25am - 9:50am	Integrated Coating System For Corrosion Protection Of Carbon Steel In Artificial Geothermal Brine	Ralph Baessler, Gabriela Aristia, Hoa Le - Corrosive geothermal brines are a major challenge to geothermal power-plants. For cost reasons, plant designers favorize low alloyed steels, e.g., carbon steel, which are susceptible to uniform and localized corrosion when exposed to geothermal brines having acidic and saline properties. To solve such problem, coatings or inhibitors would be a protective solution as an alternative to the use of high alloyed materials. This study investigated a coating system consisting of polyaniline/silicon dioxide basing on locally available resources. Protection against corrosion of carbon steel is shown by long-term exposure and electrochemical tests of coated carbon steels, performed in an artificial acidic and saline geothermal brine, comparable to real conditions at a site in Indonesia. Therefore an integrated coating system is presented for corrosion protection, combining the electrochemical functionality of polyaniline and the physical advantages	Henry B. Gonzalez Convention Center		Symposia

Tuesday 3/8/2022 9:25am - 9:50am	Salt Deposition On F-5 Aircraft In Various Service Environments	Christina Stewart, Christine Sanders - Conductivity testing, via Bresle patch analysis, was performed on F-5 aircraft in Key West, FL, Fallon, NV, and Yuma, AZ (Yuma results are currently being analyzed) to compare the level of salt contamination present at each location. The inspection locations were selected based on the observations of the pilots and maintenance staff of VFC-111, the squadron stationed in Key West, FL. The selected locations represented the areas of highest concern and recurring problem areas noticed by maintenance staff. Testing was performed at several points during the flight schedule: before the first flight of the day, following a flight, and prior to and following a scheduled clear water rinse event. The results obtained from Key West, FL and Fallon, NV indicate a large discrepancy in the amount of salt contamination present in the two locations, with Key West yielding much higher readings. It is anticipated that results obtained from Yuma, AZ will be simila	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 9:25am - 9:50am	Alloying Effect Of Mo In Martensitic Stainless Steel On Passive Film In H2S-CO2 Environment	Kyohei KANKI, Hideki Takabe, Masayuki Sagara, katsuhiro nishihara, Hisashi Amaya - 13Cr martensitic stainless steel is widely used in oil and gas industry. It is well known that addition of molybdenum increases the passivity of steel. However, the role of molybdenum in passive film has not been clarified completely. The subjects of the present research were 0.01C-12Cr-6Ni steels with different Mo contents (0, 1, and 2.5 mass%). The Mott–Schottky plot, obtained via impedance spectroscopy, revealed the effect of molybdenum addition on the semiconducting property of a passive film under an H2S environment in a pH 4.0 solution at 25 °C. The results revealed that Cr-O of the inner film and sulfide of the outer film exhibited semiconductor p-type and n-type characteristics, respectively. The number of defects in the film on 2.5 mass% Mo-added steel was approximately half of that in the film on Mo-less steel. The role of molybdenum will be discussed through investigation using synchrotron r	Henry B. Gonzalez Convention Center		Symposia
Tuesday 3/8/2022 10am - 12pm	Control of Corrosion in Oil and Gas with Inhibitors Day 2	Chair: Zineb Belarbi Vice Chair: Pierre Mékarbané This symposium features technical papers on the study of the application of corrosion inhibitors and/or scale/deposit inhibitors and their mechanisms of inhibition.	Henry B. Gonzalez Convention Center	Room 217 C	Symposia

Tuesday 3/8/2022 10am - 5pm	Protective Coatings Workshop	Want to stay current on the latest coatings developments and technologies available? AMPP is excited to announce the return of the Protective Coatings Workshop. This interactive workshop, designed for coatings applicators, inspectors, and contractors of all experience levels, will feature engaging discussion and presentations from coatings industry leaders, an introduction to new emerging technologies and techniques, and highlight best practices from experts. 10:15 – 11:15 Panel discussion on future of the protective coatings industry 11:15 - 11:45 The Importance of Performance Standards and Quality Programs in the Architectural and Commercial Painting Industry, Presented by John Whalen, Master Painters Institute 11:45 - 1:00 Lunch 1 - 1:30 Corrosion Under Insulation (CUI), Presented by David Hunter, Hempel 1:30 - 2 Inspection of Intumescent Fireproofing, Presented by Russell Norris, Sherwin Williams 2 - 2:30 Inspection of Steel Substrate, Presented by Tony Serdenes, GPI 2:30 - 3 Break 3 - 3:30 Personal Protective Equipment – Protecting Employees from Workplace Hazards, Presented by Charles Brown, GPI 3:30 - 4:00 Concrete, Presented by Steven Reinstandler, Covestro 4:00 - 4:30 Labor Shortages, Presented by Ken Seal and Anton Ruesing, IUPAT 4:30 - 5 Aerospace, Presented by Terry Gabbert	Henry B. Gonzalez Convention Center	Exhibit Hall	Workshop

Tuesday 3/8/2022 10:10am - 10:35am	Influence Of Passive Film Breakdown On SCC Of AISI 316LN In Chloride Contaminated Alkaline Solution	Ulises Martin, Jacob Ress, David Bastidas - In this work, the influence of the potentially induced passive film on the SCC susceptibility of AISI 316LN stainless steel rebar is studied in simulated concrete pore solution contaminated with 4 wt.% Cl–. The passive film composition is changed by means of applied potential, being able to relate the SCC susceptibility with the semiconductive properties of the oxide products. The applied potentials of –100 and +100 mVOCP are not enough to develop SCC due to the Cr rich passive film. While the +400 mVOCP increased the dissolution kinetics, inducing a decrease of the mechanical properties, in addition of developing TG–SCC seen as torn grains. Finally, the +600 mVOCP (potential over the oxygen equilibrium line) promoted a pure brittle fracture with TG–SCC and IG–SCC, as the Cr cationic fraction depletion was severe lowering the corrosion protection and accelerating the pit initiation.	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 10:10am - 10:35am	Hydrogen Trapping Capacity Of Nb Precipitates As Revealed By Atom Probe Tomography	Joseph Kish, Caroline Wojnas, Darren Feenstra, Brian Langelier, Nicholas Senior, Joseph McDermid - The purpose of this work is to determine the H trapping capacity of the Nb carbonitride precipitates in terms of the trap location (interface versus bulk) and trap H concentration using a model Fe-C-Mn-Nb steels with controlled precipitate distribution. This is being achieved by subjecting the model steel to heat treatments to control the size (volume fraction) of the NbC, NbN and Nb(C,N) particles and atom probe tomography (APT) examination of tip samples (prepared by electropolishing) before and after H charging. Transmission electron microscopy (TEM) is being used to characterize the composition and size distribution of the Nb-containing precipitates within the heat-treated microstructures. Electrochemical (cathodic) galvanostatic polarization (−10 mA/cm2) in an aqueous alkaline deuterium (D)-containing solution (0.1 M NaOD) is being used to charge the APT tips. The latter required d	Henry B. Gonzalez Convention Center		RIP

Tuesday 3/8/2022 10:10am - 10:35am	Investigating The Effect Of Applied Polarization During Stress Corrosion Cracking Of AA6111 And Star	Katrina Catledge, Jenifer Locke, Saba Navabzadeh Esmaeely, Gabriella Montiel - This research investigates the effects of polarization on the SCC resistance of AA6111 and moves to understand the effect of applied polarization through crack tip pH changes. Results of fracture mechanics-based testing show that externally applied anodic polarization severely reduces the SCC resistance of this aluminum alloy. Testing in 0.6 M NaCl conducted at the freely corroding potential showed a threshold stress intensity (KTH) of 14.5-18.7 MPa√m, while a 100-mV anodic polarization resulted in a KTH of less than 6 MPa√m. Additionally, a trend of increasing da/dtII with increasingly anodic applied potentials was observed. Work is underway to measure changes in crack tip pH during SCC experiments as a function of applied potential to facilitate understanding of the effect of applied potential on SCC resistance. Part of this work was supported by the Department of Energy under award number DE-EE0007760	Henry B. Gonzalez Convention Center		RIP
Tuesday 3/8/2022 10:10am - 10:35am	Finish Standards For Intumescent Cellulosic Fire Protection	Max Tritremmel - There are various resinous materials used in the formulation of intumescent coatings (acrylics, various epoxies, MMA). The paper would examine the uses and features of these materials and also compare their starting point for appearance. It would then examine the means and methods and effort required to change (improve) that appearance to align with an expectation. It would do this in the context of comparing to other specified standards (Drywall finishing standards, AISC AESS Standards) and propose the development of an industry standard methodology for specifying finishes.	Henry B. Gonzalez Convention Center		Symposia

Tuesday 3/8/2022 10:10am - 10:35am	Performing Coating And Corrosion Assessments To Maintain Military Fuel Piping	Adam Beers - The US Military has and maintains several thousand bases; several hundred of those are outside the United States. The Air National Guard has several hundred installations across the United States. One commonality at each of these facilities is a Fuels Management System, that is, a collection of pipelines, storage tanks, containment dikes, pumping stations, fuel islands, and canopies. Maintaining all the above ground and underground assets is no small task. One important step is a robust preventative maintenance plan that includes a regular coating condition and corrosion assessment/survey. This paper describes the benefits of a well-planned assessment/survey that includes numerous steps. The steps include visually examining all painted assets across the total surface; estimating the total surface area and the percent and type of corrosion (which is invaluable when discussing scope with potential contractors); highlighting areas of concern and coating defects using digit	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:10am - 10:35am	The Change Of Corrosion Inhibition Behavior Of Tetradecyl Phosphate Ester At Elevated Temperatures	Shuai Ren, Yi He, Xi Wang, David Young, Marc Singer, Maalek Mohamed-Saïd, Sheyla Camperos - Organic corrosion inhibitors (CIs) are widely employed in the oil and gas industry to protect carbon steel pipelines against internal corrosion. However, using such inhibitors for corrosion mitigation in high-temperature environments has particular challenges: corrosion rates are largely accelerated, and inhibitor performance can be dramatically affected. Consequently, To have a better understanding of the effect of temperature on organic CIs inhibition behavior is beneficial for their usage. In the present work, the inhibition behavior of an in-house synthesized model compound, tetradecyl phosphate ester (PE-C14), was investigated in a simulated exploration production environment at 25, 55, & 80°C. Surface saturation concentrations at these temperatures are identified resorting to corrosion rates over time measurements obtained by linear polarization resistance (LPR). Surface analysis techniq	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:10am - 10:35am	Corrosion And Stress Corrosion Cracking Behavior Of Super 13Cr Martensite Stainless Steel In CO2-Sat	Zezhou Wen, Jiong Qian, Qiang Zhong, Chun Wang, Richard Barker, Anne Neville, Yong Hua - The service environment of downhole materials in deep/ultra-deep oilfields are particularly corrosive due to the extremely high chloride content, temperature and CO2 pressure, which pose significant challenges to the integrity of tubing materials. In this research, we investigate the corrosion and stress corrosion cracking behavior of Super 13Cr martensite stainless steel (S13Cr MSS) exposed to formation brine at 200°C with a 5.2 MPa CO2 partial pressure through immersion test, in situ HTHP electrochemical tests and slow strain rate tensile (SSRT) tests. S13Cr MSS was shown to be in an active dissolution state at 200°C, with a corrosion product film composed of amorphous Cr(OH)3 with a small amounts of undissolved austenite. The general corrosion rate of S13Cr MSS in simulated downhole environment was 0.75 mm/y in the first 5 hours and increased to 0.99 mm/y after 48 hours immersion, then dropped	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:10am - 10:35am	Simulating Corrosion And Scale Interactions In Autoclave Experiments: A Sensitivity Study	Robert Jacklin, Richard Barker, Anne Neville, Joshua Owen, Daniel Burkle, Richard Woollam - Corrosion experiments were conducted with 3 brines containing 0, 1000 and 5000 mg/L of Ca2+. Iron flux into the brine was also varied by selecting 2 separate combinations of X65 carbon steels specimens to provide a high and low area to volume (A/V) ratio. Tests were conducted at 80°C and 5 bar gauge pressure. Initial results from mass loss tests revealed that corrosion rates were much higher at lower a/v ratio due to the slow formation of a protective corrosion product layer. SEM images revealed that surface coverage at low a/v was further supressed by addition of calcium. At high a/v ratio a full coverage of corrosion product was observed across all calcium concentrations despite noticeable changes in morphology. The mass loss results at high a/v indicated an increase in corrosion rate with increasing calcium concentration which can be linked to the delay in the formation of a full corrosion	Henry B. Gonzalez Convention Center	Symposia
Tuesday 3/8/2022 10:10am - 10:35am	Internal Corrosion Direct Assessment (ICDA) For Dry Gas Transmission Pipelines	Nze Osuagwu - Internal Corrosion is very insidious because we won't know what is happening inside the pipe by looking at it. Internal Corrosion Direct Assessment becomes an effective method for nonpiggable transmission pipelines. ICDA involves 4 steps and during the second step (Indirect Inspection) data assembled during pre-assessment and field workdown are used to calculate the critical angles and inclination angles within pipeline region. Errors or wrong assumptions during this stage will lead to missing the locations where electrolytes will accumulate and digging at the wrong place. This will not only lead to economic waste but also, not achieving the aim for the project which is to determine if IC occurs in the pipeline.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:10am - 10:35am	A Further Look At The Impacts Of Corrosion Inhibitor On Scale Prevention	Qiwei Wang, Tao Chen - In the previous work (paper C2021-16504), we presented the results on calcium carbonate deposition and inhibition in the presence of 50 ppm of corrosion inhibitors. Further studies were performed to investigate the influence of three corrosion inhibitors at high concentrations on calcium carbonate formation and the performance of phosphonates and polymeric scale inhibitors, to simulate the conditions where high corrosion inhibitor dosages are applied or during the early flow back stage after batch treatment. The active ingredients are, respectively, quaternary ammonium, phosphate ester and fatty acid; imidazoline acetate and ethoxylated fatty amine; and quaternary ammonium compounds, in the three corrosion inhibitors. Scale inhibitors are based on polyacrylate, ATMP phosphonate, and DETPMP phosphonate. Tests were conducted at 85 oC using the dynamic tube blocking method and test brine was characterized with high TDS (~ 65,000 mg/L) and high calcium (~ 4,000	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:10am - 10:35am	A Road Map For Innovation In Microbiologically Influenced Corrosion (MIC) In The Gas Pipeline	AMERICA PADILLA, Rigoberto Arroyo Cortez - A bibliometric analysis demonstrated that MIC research has yet to become a fully interdisciplinary field, despite the multiple disciplines involved. We conducted a bibliometric analysis using Scopus and WoS databases. On the other hand, we used patentometrics to make the systematic analysis based on Derwent Patent Database. In this sense, we conducted a transdisciplinary approach, practical to identify MIC knowledge and technology gaps and accelerate the development for practical solutions on MIC detection, control, and mitigation. The big challenge is connecting the technical problems on the field, with the forefront of knowledge generation, and available technological solutions on MIC through a transdisciplinary approach.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:10am - 10:35am	Comprehensive Laboratory Analysis Of AC Coupon Test Stations	Mehrooz Zamanzadeh, Anil Chikkam, Martin Latona, Kristi Hoffmann, George Bayer - In this paper, a test protocol for the laboratory analysis of the coupon test stations (CTSs) exposed to alternating current (AC) interference from the adjacent power lines was discussed in detail. Corrosion of coupons from the CTSs are mainly due to AC interference, corrosive soil, or microbiological induced corrosion (MIC). This paper provides an overview of corrosion issues commonly experienced by coupons and presents specific case histories involving AC interference, corrosive soil, and MIC. During the laboratory analysis, coupons were examined visually and photographed, studied under stereoscope, and the coupons were also examined in detail using scanning electron microscope (SEM) and energy dispersive spectroscopy (EDS) in the as received condition and correspondingly after ultrasonic cleaning. The findings of the laboratory analysis are correlated with CTS historical data and relevant field inspec	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:10am - 10:35am	A Review Of Chloride Stress Corrosion Cracking Factors For Austenitic Stainless Steel	Sangeetha Rao - Chloride-SCC of austenitic stainless steels has been one of the biggest challenges in the refining industry and one of the main reasons where upgrading to stainless steel may not be the miracle solution for battling corrosion problems. Even with all that we know about this mechanism, the industry still faces failures from this problem, mainly because chlorides show up when they are not expected and accounted for, leading to economic or worse, catastrophic failures. API 581 considers factors like pH, operating temperature and chloride ion concentration to designate a Severity Index. Then the number of inspections, the effectiveness of the inspections and time since the last effective inspection etc. are considered to determine the Damage Factor. However, factors like presence of oxygen, effects of extreme pH and temperatures or stress relieving is not considered. A proposed Risk Assessment Tool to API RP 581 Task Group was presented in November 2016 and is awaiting ap	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:35am - 11am	Resistance of U-bend and Integral Finned Duplex Stainless Steel UNS-S32205 and UNS-S32750 to Sulfide	Karen Picker, Kim Yong, Luiza Esteves - Strain calculations, pitting resistance, and chloride stress corrosion cracking testing are currently used as the key indicators to delimit the minimum bend radius for 22% chrome duplex stainless steels without heat treatment to be 3.3 times the tube diameter for u-bend heat exchanger tubing. However, existing data does not address the limit of this alloy, in the as cold worked condition, for sour services in the refining industry. This study evaluates the sulfide stress corrosion cracking resistance of as-bent and integrally finned 22% Cr duplex stainless steel UNS-S32205 tubing for refinery sour services by presenting hardness data and corrosion testing per ASTM G48 and NACE TM0177 of tight u-bend specimens with bend radius up to 1.5 times the tube diameter as well as integrally finned tubes. As a follow up from a previous study, the corrosion resistance of as finned 25% Cr super duplex stainless steel will also be presented.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:35am - 11am	DC Decoupler Modelling To Predict The Effects Of Capacitance On CP Potential Surveys	Alexander Ristow, Michael Tachick - DC decouplers mitigate AC interference caused by the collocation of powerlines and buried coated utilities without causing an increase in cathodic protection DC current requirements. The devices are AC-continuous but DC isolating and are installed in series between the structure and the grounding electrode. To assess the effectiveness of cathodic protection systems, CP current sources are periodically interrupted and structure to electrolyte potentials are measured, which are compared to industry criteria DC decoupling devices function using a capacitor and store electrical charge. When CP current sources are interrupted, the capacitors discharge over a period of time. If structure to electrolyte potentials are taken prior to the full capacitive discharge, measurement error resulting in more electronegative potentials may be observed. The magnitude of the observed effect is a function of surface area, coating quality, soil resistivity, number of de	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:35am - 11am	Selection, Screening and Field Trial of Calcium Hypochlorite to reduce bacteria population in freshw	James Fajt, Alyn Jenkins, Stephanie Iwuala Iwuala, Jarrod Hastie - Fresh river water is used to flush production lines to control halite deposits in unconventional oil wells for a field near Williston, North Dakota, USA. Raw river water is stored in 400 bbl fiberglass tanks and is treated with oxygen scavenger. However, quarterly testing showed total living bacteria per milliliter exceeded 6 log in the tanks. The remote location, cold seasonal temperatures, tank design and restricted tank access prevented application of the lowest cost treatment option which was to apply biocide in solid form via the tank tops. Consequently, a study was conducted where a range of both liquid and solid biocides were screened and tested on site to determine the most effective formulation and treatment regime. Biocide efficacy was assessed using a bacteria metabolism-based assay technique utilising fluorescence spectroscopy. Biocide selection was based on multiple factors including effect on bacteria, c	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:35am - 11am	Laying the Foundation for an Engineered and Integrated Approach to Pipeline External Corrosion Prote	Keith Parker, Alfonso Garcia Rojas, Dale Lindemuth, johnston James, Stephen Gibson, Christophe Baete - With a growing and aging asset base covering over 17,000 pipeline miles as well as Enbridge's move to a High-Reliability Organization (HRO), the Enbridge External Corrosion Prevention (ECP) team is working on a shift from a compliance-driven routine maintenance program to a predictive forecasting strategy that, with advanced diagnostics and modeling, can provide useful information for Long-Range Forecasting (LRF). Utilizing a comprehensive ILI and direct examination program along with state-of-the-art technologies, sound engineering, and risk management practices, the Enbridge Pipeline Integrity External Corrosion Prevention team is developing a unification of corrosion monitoring and mitigation strategies that will minimize and effectively manage external corrosion risks. The expected outcomes of such an approach are increased safety and reliability of the pipeline system along wit	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:35am - 11am	Corrosion Inhibition Under Stressful Geothermal Application Conditions	Sathees Kesavan, Sarat Shanmukh, Seethalakshmi Suresh, Shateesh Battu, pradeep L - In recent years, geothermal power has become a dependable and significant alternative energy source, with installed capacity of ~16 Gigawatt (GW) in 2020 and production capacity projected to touch ~25 GW by 2025. The service conditions in geothermal facilities are usually ideal for corrosion (high temperature; chlorides, microbial) and deposition which extrapolates into a challenge for materials selection and application of corrosion inhibitors. Corrosive chemical species typically found in geothermal fluids are hydrogen ion (pH), acid gases like carbon dioxide and hydrogen sulfide, ammonia, chloride, and sulfate ions. We studied uniform/general corrosion of low carbon steel (C1010/C1018) under real field conditions from Europe & South East Asia (surface, wellhead and subsurface/bottom hole) by multiple laboratory test methods applied in industry. Application conditions vary from 60 – 250 deg C, from	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:35am - 11am	On The Performance Of UNS S32100 vs N08825 Expansion Compensator Materials In Geothermal Application	Keith Lichti, Soroor Ghaziof - Stressed bellows compensators heated by the transmission of two-phase geothermal fluid were exposed to atmospheric contaminants to simulate worst case external conditions. The tests aimed to determine time to failure under increasing severity of the external environment. Failure was not observed in the time period of the tests while the bellows were operated at temperatures of 150 °C regardless of the external contaminants. Cycling from low (ambient) temperature to high (105 °C achieved by steam heating internally) temperature gave accelerated damage mechanisms and failure from the external surfaces of both materials in a similar time period through pitting and Chloride SCC of the S32100 material and pitting of the N08825 material. Internal corrosion was also observed and attributed to the ambient standby conditions with no steam flow.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:35am - 11am	Atmospheric Plasma Coating Removal For Naval Engineering And Maintenance Applications	Glenn Astolfi, Pete Yancey, Arthur Wood, Levi Snowden, Robert Ross - Presented in this work will be the results of tests evaluating the efficacy of non-thermal atmospheric plasma coating removal (APCR) for Naval Engineering and Maintenance applications. Results from laboratory testing as well as on-site testing at a partnering Naval Shipyard will be presented in which coating removal performance on multiple coating systems and substrate configurations commonly found in the Naval industry were evaluated as well as comparative testing performed between APCR and the widely used needle-gunning removal process. The results of these tests will be used to demonstrate the immediate and long-term advantages of the adoption of the APCR process, including improvements in coating removal times, overall productivity, worker safety, reduced waste streams, coating adhesion, and fleet readiness.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:35am - 11am	Environmentally-Assisted Cracking (SSC And SCC) Of Martensitic Stainless Steel OCTG Material In Sour	Yuichi Kamo, Yasuhide Ishiguro, Yusuke Mizuno - The report concluded that martensitic stainless steel does not have any SCC-susceptible temperature range at around 80 to 100 degree C (175 to 210 degree F) that is a well-known phenomenon in duplex stainless steel. In this paper, Modified-13Cr (13Cr-5Ni-2Mo: generic classification of Super- or Mod-13Cr), (2)15Cr (15Cr-6Ni-3Mo-Cu: UNS No.S42625) and (3)17Cr (17Cr-4.5Ni-3Mo-Cu-W: UNS No.S42825) were tested at the border conditions whether the materials are free from crack or suffered from crack in 20%NaCl solution. Those results clearly show that the martensite-based steels did not show a cracking-susceptible temperature region at around 80 to 100 degree C (175 to 210 degree F), unlike duplex stainless steels. And newly added data on 5%NaCl solution support the conclusion in 20%NaCl. Fractographs of Modified-13Cr tested at 24 degree C (at ambient temperature) and 50 degree C (higher temperature) show quasi-cleavage, indicating the crack	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:35am - 11am	The Development Of Environmentally Acceptable Corrosion Inhibitors For Sour Applications	Jody Hoshowski, Alyn Jenkins, Rolando Perez Pineiro - Production chemical regulations in the North Sea oil and gas sector restrict the use of environmentally harmful substances and require chemical providers to replace such products with environmentally acceptable alternatives. Environmentally acceptable corrosion inhibitors that are used in oil and gas production are non-toxic, biodegradable, and have a low impact on the marine environment. Such inhibitors are designed to protect mild steel from the effects of corrosion in systems containing acid gas, organic acids, and the influence of temperature. In this work, two oilfields in the North Sea required the development of environmentally acceptable corrosion inhibitors, to replace environmentally harmful products. The new products were required to offer similar or improved efficacy to the incumbent inhibitors in a sour environment and to be cost-effective. Laboratory tests were performed to represent field conditions and ranged in te	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 10:35am - 11am	Oxidation Studies Of Ni-Cr-Al Model Alloys And The Effect Of Third Element At Low-To-Intermediate Ho	Yasaman Ghaffari, Kevin Daub, Suraj Persaud - Oxidation of model Ni-based alloys was studied in a hydrogenated steam environment at 480 °C to better understand possible embrittlement and the validity of the ‘third element effect’ in this low-temperature regime, where lattice diffusion is negligible. For this purpose, model alloys of Ni-12Cr, Ni-16Cr, Ni-4Al, Ni-8Al, Ni-8Cr-4Al, Ni-12Cr-3Al, and Ni-16Cr-2Al (in at.%) were made with an induction melter. After confirming homogeneity of the alloys, the samples were exposed to a temperature of 480 ˚C in a hydrogenated steam environment, where the partial pressure of oxygen is maintained below the dissociation pressure of NiO. With Ni-metal being thermodynamically stable, the oxidation of Cr and Al, their interaction, as well as the ‘third element effect’ at relatively low temperatures were exclusively studied by using advanced characterization techniques. Ni nodules were observed on the surfaces of all alloys, confirming stress relief due	Henry B. Gonzalez Convention Center		RIP

Tuesday 3/8/2022 10:35am - 11am	Investigation Of Localized Corrosion Phenomena In Al Alloys Using Characterization Techniques	Jijo Christudasjustus, Chathuranga Witharamage, Ahmed Darwish, Wenpei Gao, Rajeev Gupta, Javier Esquivel, Javier Esquivel - Supersaturated nanocrystalline Al alloy was produced using high-energy ball milling (HEBM). The corrosion behavior was investigated using analytical tools: XPS to obtain change in oxidation state of alloying element at oxide film with the immersion in chloride environment, ToF-SIMS to examine the elemental modification within oxide film and at oxide/metal interface, S/TEM to observe the role of alloying element during pitting corrosion at nanoscale, SEM and XRD for preliminary investigation of microstructure, phase identification, grain size and solid solubility after HEBM. The main highlights of this study are following observations and understanding of corrosion mechanisms: 1) the solute enrichment at the oxide/metal interface that provides passive film stability, 2) doping of passive film with solute ion having oxidation state higher than that for Al and 3) d	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 10:35am - 11am	Corrosion-Resistant Stainless Steel Strands For Prestressed Bridge Piles In Marine Atmospheric Envir	Brendy Rincon Troconis, Stephen Sharp, H. CELIK OZYILDIRIM, Charles Demarest, Jacob Wright, John Scully - This study included laboratory and field experiments. In the laboratory, the relative corrosion susceptibility was determined for stranded cold worked AISI 1080 carbon steel; cold worked austenitic stainless-steel Type 201; and stranded heavily cold worked Type 2205 duplex stainless steel (SCW2205). The techniques included salt droplet exposure, cyclic potentiodynamic polarization, four-point bend SCC testing. SSRT were also conducted in a pitted and unpitted condition. The field experiments included the fabrication and placement of several prestressed piles reinforced with SCW2205 steel, which are now part of Virginia bridge structures. Some of the samples for field exposure included, U-bend SCC environmental exposure, four-point bend SCC test semi covered with mortar. Moreover, field evaluations were performed and the material was characterized using SEM, XRD, and TEM.	Henry B. Gonzalez Convention Center		RIP

Tuesday 3/8/2022 11am - 11:25am	Durability Of Underground Concrete Pipes In Chloride Environment	Arnaud Castel - For bridge and building structures, it is assumed that corrosion damage (concrete cracking) will occur relatively quickly as soon as corrosion propagation starts, when the chloride threshold is reached at reinforcement depth, which is the main justification of the traditional service life design approach. However, field observations seem to show that this assumption is not appropriate for underground pipes. Despite high chloride levels, corrosion of reinforcement is only marginal after a very long period without leading to any concrete cracking. The lack of oxygen is suspected to be the governing factor of steel corrosion limitation suggesting that the propagation phase of steel corrosion should be considered as part of the 100 years design service life of underground pipes. In this study, five reinforced concrete pipes with different concrete covers located in tidal zones in Queensland have been assessed by sampling concrete cores at different depths from the outlet	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 11am - 11:25am	Investigation Of Preferential Weld Corrosion Of A Medium-Carbon-Steel Tube Exposed To CO2 By Immersi	Zehbour Panossian, Bruno Andrade, Ilson Palmieri Baptista, Juliana Cardoso, Marcos Henrique, Petronio Zumpano Junior, Rodrigo da Silva Marques, Thales Rosa Gomes - Two different longitudinal welded joints (WJ1 and WJ2) were tested in simulated condensed (CW) and dragged (DW) water. The former was deionized water saturated with CO2 (pH = 3.9, 44.6 µS/cm) and, the latter, with Fe2+ and CO2 (pH = 5.0, 190 µS/cm). In immersion tests, the base metal (BM) presented a slightly higher corrosion rate (CR) in CW for both joints. In DW, the heat affected zone (HAZ) presented the highest CR and a groove was formed at fused zone (FZ) in both joints. Galvanic tests indicated that the galvanic current was clearly increased in DW for WJ1 and presented a slight increase in WJ2 with the FZ acting as a cathode in WJ1 and as an anode in WJ2. SVET results indicated that HAZ was a localized anode in both joints. The overall analysis of results will indicate whether chemical composition and microstructure	Henry B. Gonzalez Convention Center		RIP

Tuesday 3/8/2022 11am - 11:25am	Permeation And Thermal Desorption Spectroscopy Of Two Carbon Steel Grades	Bernd Loder, Gregor Mori - In the future, decarbonization will be the most important topic to reduce climate change. One way to reduce emission is the use of hydrogen and hydrogen storage. This work deals with the resistance of carbon steels to hydrogen embrittlement. Therefore hydrogen trapping in two steel grades is characterized by electrochemical permeation by use of a Devanathan-Stachurski cell and thermal desorption spectroscopy with a coupled mass spectrometer. Investigated carbon steels are P110 and mild sour grade VA-S-110 with 110 ksi specified minimum yield strength. After characterization of microstructure, permeation tests were done. Charging was done galvanostatically in a salt solution with addition of thiourea as recombination poison. At the Pd plated oxidation side a sodium hydroxide electrolyte was used at anodic potential. Results show a lower effective diffusion coefficient for mild sour gas grade VA-S-110 compared to conventional P110. Multiple loading cycles wer	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 11am - 11:25am	Influence Of Ternary Additives On Electrochemical And Mechanical Behaviors Of Electroless Ni-P Coati	Omar Chaar, Ahmad Raza Khan Rana, George Jarjoura - Hydrocarbon processing facilities and pipelines are prone to degradations from corrosion and mechanical damages. Electroless Ni-P coating is known for decades for their excellent corrosion resistance which comes from its amorphousness. The downside of Ni-P coatings is its degradation from mechanical loading and wear that deteriorates the coatings and allows corrosive electrolyte to seep underneath the coating, thereby defeating the purpose of surface protection. This research work is focused on improving the mechanical behavior of electroless Ni-P coating by adding various candidate ternary additives, namely Carbon Nanotubes (CNT), Alumina (Al2O3), and Titanium. Resulting coating matrix were characterized for wear performance in a test setup against sliding Tungsten carbide ball followed by wear rates determination via weight loss measurements. Candidate coatings were further characterized for co-efficient of friction (COF) behavior	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 11am - 11:25am	The Effect Of Sulfur Components Of Corrosion Inhibitors On Chemical Qualification	Hunter Thomson, Rodney Madjitey, Paul Hammonds, Caroline Simpson, Gordon Graham -	Henry B. Gonzalez Convention Center	Symposia

The process of successfully qualifying a corrosion inhibitor is an important process and it is imperative that a thorough and representative assessment. This involves laboratory tests, including screening tests and more complex field representative tests.
Screening tests can however misrepresent the field performance of an inhibitor which would otherwise be deselected. This can be for a variety of reasons if test conditions are not selected effectively. One potential cause of this is the presence of minor or low concentration components in corrosion inhibitor formulations, and the function of which are critical to performance in a given system and may be synergistic with major formulation components.
To demonstrate this, a matrix of tests with a range of standard corrosion inhibitor components will be shown, including typical standard screening tests. These works will show the impact additives compone

Tuesday 3/8/2022 11am - 11:25am	Rethinking Sulfide Stress Cracking (SSC) Resistance Super Martensitic Stainless Steel (SMSS-13Cr) Ba	Karthik Krishnan, Chad Glaesman - 13Cr-5Ni-2Mo type Super Martensitic stainless steels (SMSS-13Cr) are often chosen for the manufacture of downhole completion equipment within the oil and gas production environment. SMSS-13Cr is primarily used in CO2 rich production environments where carbon/low-alloy steels are subject to high corrosion rates. Currently different UNS grades of SMSS-13Cr with varying maximum hardness, yield strengths, and heat treatment requirements are listed for use in limited sour service per NACE MR0175/ISO 15156-3 guidelines. The hardness limits of the listed grades mainly pertain to the 95 ksi (655 MPa) Minimum Yield (MY) strength level. The limits listed for the 95ksi MY grade have similar maximum H2S partial pressure limits and minimum environment pH limits, but with vastly different chloride limits. While chloride ions can pit SMSS-13Cr type materials, it is not clear historically why the current limits reflect a difference between the UNS grades within the	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 11am - 11:25am	15.5-Year Inspection Reveals the Effectiveness of a Single-Coat Epoxy	Guy Zanti - In 2000, the US Naval Research Laboratory (NRL) for Corrosion Science & Engineering began work on the Office of Naval Research Future Naval Capabilities Single Coat Program. The program’s goal was to reduce maintenance time and provide cost savings by introducing rapid-cure coatings technology to the fleet. A single-coat epoxy was selected and applied to a ballast tank (SWB-3-121-1-W) in the USS Oak Hill LSD-51. In 2005, an existing coating applied in 1996 was removed due to its poor condition. The one-coat epoxy product was applied in its place, and the tank was put back in service and filled by the saltwater fire main system. Follow-up inspections were conducted 15 months, 7.5 years, and 15.5 years later. The 15-month inspection revealed the tank was in excellent condition, with far less than 1/10 of 1% corrosion noted. Most corrosion observed was running rust originating from the interior surface of the ferrous pipe brackets that were not disassembled for preservatio	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 11am - 11:25am	Measuring Chemical Composition Of Pipeline Steel Using Laser Induced Breakdown Spectroscopy (LIBS) T	Brian Wilson - Recent PHMSA safety rules governing the operation of gas pipelines require operators to ensure material records are 100% traceable, verifiable, and complete (TVC) within the guidelines for the Pipeline Material Verification process defined under 192.607. Testing for chemical composition is a critical input where records are incomplete and while performing grade estimations for MAOP reconfirmation. Emerging non-destructive technology using portable handheld laser induced breakdown spectroscopy (LIBS) for in-situ analyses offers one NDE methodology for assessing pipeline steel composition. We will present the LIBS technology including performance for carbon, carbon equivalency in addition to the concentrations of microalloying elements that may be present in the sample.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 11am - 11:25am	Microbiologically Influenced Corrosion In Drinking Water Pipelines – Old Deposits Or Active Process?	Elsemiek Croese, Eelco Trietsch, Jentina Schuurman, Sabine Doddema - In the Netherlands, a large part of the drinking water distribution system consists of cast iron pipelines of which some have been installed and are used since the beginning of the last century. Previous investigations showed that corrosion deposits are present in many of those pipes and that microbial processes have been involved in the corrosion damage. Due to the increase in water quality over the decades, the question was raised whether or not the MIC processes were still active. To investigate this, RNA qPCR and RNA metagenomics by Next Generation Sequencing was used to investigate corrosion defected areas. RNA is the genetic material which occurs in biological cells only when they are active. With those techniques we could confirm that, despite the good water quality, MIC processes were still active and form a direct risk in cast iron water pipes. Interestingly there seemed to be no relation between the water	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 11am - 11:25am	Is Your CIS Data Accurate?	Phil Eggen, Jay Warner, Randy Hilgart - Obtaining accurate polarized potentials (a.k.a. Instant-OFF potential) during an interrupted survey can be complicated by the introduction of a capacitance effect from DC decouplers in the circuit. Methods to obtain accurate polarized potentials in these scenarios exist, but there is some level of risk introduced to the pipeline and operating personnel. This paper will explain these existing methods, evaluate the level of risk associated with each and introduce a new technology that offers improved data by providing accurate polarized potentials and avoids the risks or inaccuracies that other methods introduce. Field data will be presented to represent the performance of the new technology and compare it to having traditional decouplers in place. The new technology significantly reduces the time required for decoupler voltage to dissipate without having to disconnect the decouplers during an interrupted survey, thus providing all the same safe	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 11am - 11:25am	Chemical Mitigation Of Alkaline Carbonate Stress Corrosion Cracking	Oussama Zenasni, Philip Thornthwaite, John Scholz, Maria Marquez - In the crude oil refining industry, alkaline carbonate stress corrosion cracking (ACSCC) has been a well-documented corrosion mechanism found in the overheads of fluid catalytic cracking units (FCCU), sour water strippers (SWS), and associated gas separations units (GSU). Typically, ACSCC occurs in non-stress relieved carbon steels with high levels of residual stresses and in the presence of both condensed alkaline sour water where the pH is equal to or greater than 8.5 and carbonate concentrations greater than 1000 ppm. The equipment most likely to be exposed to these conditions are the overheads of the FCCU and GSU main fractionators, overhead accumulators, wet gas compressor knock drums, condensers, and associated piping around these areas. Traditional methods used to mitigate this type of corrosion include the use of post-weld treatments or costly metallurgy upgrades. With a limited number of examples highlighting	Henry B. Gonzalez Convention Center		Symposia
Tuesday 3/8/2022 11am - 12pm	Titanium Grade Selection and Design Considerations for Chemical Process Equipment	Presented by Chris Wilson, Uniti Titanium | Presentation on the design criteria to be considered when utilizing various grades of titanium and titanium alloys for use in the chemical processing industry for pressure vessels, heat exchangers, tanks, piping systems or other ancillary equipment.	Henry B. Gonzalez Convention Center	AMPPiTheater 2	Theater

Tuesday 3/8/2022 11:25am - 11:50am	Chemical Treatment To Mitigate Polythionic Acid SCC Without A Soda-Ash Wash: Laboratory And Plant Ex	Nathaniel Sutton, Brandon Rollins, Kenneth Evans, James Esteban - A novel oxidative chemical treatment method is already being used to neutralize pyrophoric metal sulfides present in Hydroprocessing reactor systems. It is hypothesized that this treatment will similarly neutralize the iron sulfides which contribute to the formation of polythionic acids. A simple laboratory test has been developed to test the effectiveness of the chemical treatment. Previous experimental studies into PTASCC have typically immersed stainless steel specimens in Saman's solution, made by bubbling gaseous SO2 and H2S through the cell at controlled rates to produce a mixture of di-thionic through hexa-thionic acids along with sulfuric and sulfurous acids. Even in Saman's solution, it can be difficult to obtain cracking even with the standard sensitizing heat treatments suggested in ASTM A262. To circumvent these challenges, the current work uses standard U-bends (ASTM G30), coated with an air-sprayed suspen	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 11:25am - 11:50am	Obtaining The Polarized Potential Under AC Interference	Andreas Junker Olesen, Lars Nielsen - Obtaining the polarized potential (off potential / instant-off potential / IR compensated potential) of a pipeline is considered extremely difficult, if not impossible, when the pipeline is interfered by an alternating voltage, and particularly if the pipeline is fitted with capacitive AC mitigation devices. Yet, a number of procedures exists to obtain information on the polarized potential, due to it’s importance in cathodic protection operation. Two distinct approaches are measurements on the structure/pipeline itself, and measurements on coupons. While it can be agreed that the structure measurement is challenging, some beleive that the coupon method is error-free, as the AC interference is not present on a disconnected coupon. This paper will illustrate that this is not entirely true. Some of the present challenges and some of the approaches to get meaningful measurements are presented.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 11:25am - 11:50am	Effect Of Antimicrobial Halophilic Plant Extracts On Microbiologically Influenced Corrosion (MIC)	Tanmay Chaturvedi, Torben Lund Skovhus, Mette Thomsen, Jakob Stein - Effects of halophyte extracts on MIC was studied on carbon steel coupons inoculated with sediment from the Wadden Sea or produced water from oil wells, to mimic MIC from oil production facilities in the North Sea. The coupons were treated with extracts from selected halophytes. Using H2S as activity indicator for , sulfate-reducing bacteria (SRBs) and ATP for general microbial activity in the liquid phase, results show a significant reduction in H2S production and decrease in ATP concentrations in experiments treated with extracts compared to untreated controls, indicating a reduction of SRB species. Biofilm formation on carbon steel coupons from a bioreactor was reduced by two-thirds with the addition of extracts. Furthermore, next generation 16S rRNA amplicon sequencing of DNA from Bacteria and Archaea, proved a significant shift in the microbial composition when compared to samples not treated with extracts. Last	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 11:25am - 11:50am	Moisture Management In Thermal Insulations For In-Service And Out Of Service Pipelines	Ahmad Raza Khan Rana, Graham Brigham - CUI (Corrosion Under Insulation) is a key degradation in facilities and pipelines and known to drive 40% - 60% failures in the piping systems. CUI is known to trigger from the soaked insulations that are held in contact with the metal(s). Although high operating temperatures are perceived to reduce CUI risks, integrity issues happen due to condensation or sweating once the pipe/ equipment is brought through cyclic temperatures or transient conditions. With lower or even ambient temperatures, the content of liquid moisture within the insulation increases which ends up exploiting CUI risk. This issue of soaking becomes more pronounced in mothballed equipment/ pipes as there is no moth-balling method known that can keep the insulation dry once the pipeline is out of service. This article addresses the case study where the soaked insulations on pre-existing operational and out-of-service multi-kilometer pipelines were trialed for moisture retention	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 11:25am - 11:50am	Novel Heat-Conducting “Metallic” Coatings Against Biofouling And Biocorrosion	Tingyue Gu, Di Wang, Timothy Hall - NiMo and NiMo/CeO2 coatings were created on Ti surfaces using an electrochemical process for heat exchanger applications. Static biofouling and biocorrosion assessments were carried out in glass vessels using Desulfovibrio vulgaris, a sulfate reducing bacterium (SRB), and an alga (Chlorella vulgaris) mixed with generate heterotrophic bacteria (GHB). It was found that NiMo/CeO2 was much more effective than NiMo in preventing SRB biofilm formation with an efficacy of 99% reduction in sessile cells after 21-day incubation. The NiMo/CeO2 coating also exhibited a 50% lower corrosion current density compared to the uncoated Ti in the SRB culture. Both NiMo and NiMo/CeO2 coatings achieved 99% reduction in sessile algal cells. Confocal laser scanning microscopy (CLSM) indicated a large reduction of sessile GHB cells. CLSM images also confirmed the biocidal effects of the two coatings. Unlike polymer coatings, the “metallic” costings are heat conductive, th	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 11:25am - 11:50am	Evaluation Of Titanium 475 Alloy For Use In Oil And Gas Environments	William MacDonald, Michael Gram, Dennis Dunlap, Mike Hogan - A new titanium alloy, TIMETAL 475, which was developed for use in aggressive geothermal fields as a casing material, has been tested for use in typical oil and gas environments. The 475 alloy composition, Ti-0.4Ni-3.75Mo-0.75Zr, provides excellent corrosion resistance in geothermal brines which are low pH and high in chlorides. For oil and gas applications, the additional effects of H2S and CO2 on the alloy must be considered. To this end, the alloy was subjected to the NACE TM-0177 Level VII exposure test. For the geothermal application, the alloy is prepared in the Solution Treated and Aged (STA) condition with a typical titanium bimodal microstructure. For use in oil and gas, the alloy is prepared in the Beta Annealed condition resulting in a Widmanstätten microstructure typical of titanium alloys with slow diffusion beta-stabilizing components. The beta annealed condition is required for large components such as titaniu	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 11:25am - 11:50am	The Performance Of HPHT Corrosion Inhibitor At Offshore Downhole Sour Conditions	Youngil Choi, Bang Cha Rang Song, Youngsun Yim, George Economopoulos - High pressure, high temperature (HPHT) corrosion in sour conditions is a major concern in oil and gas production. Here, the selection of corrosion inhibitor is a significant challenge in oil and gas industry. This paper presents the results using HPHT Hastelloy RC autoclave for the performance study of corrosion inhibitor with high H2S/CO2 environments and high shear stress of 25 Pa in 80% water cut. The sour corrosion testing conditions were the combination of 16.8 bar H2S concentration and 12 bar CO2 concentration with the temperature of 121 oC. Triplicate API 5L X65 weight-loss coupons were used in the test. Some important standard tests (e.g. thermal stability, emulsification tendency, forming tendency, and solubility) with material compatibility test (Alloy 825) were also presented. The test results showed that the average corrosion rates using weight-loss coupons were less than 0.1 mm/yr with low corrosion i	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 11:25am - 11:50am	Mitigation Of CRU Heater Tube Carburization By Modified High Heat Transfer Ceramic Cladding Material	Natalie Frank, Iain Hall, Paolo Brunello - Carburization is a failure mechanism common to the petrochemical industry in Catalytic Reforming Units (CRU's) where atmospheres containing hydrocarbons and/or carbon monoxide are prominent. Elevated fuel prices cause refineries to run with low excess oxygen to generate cost savings. The resulting atmosphere at elevated temperatures creates an environment where carbon is favorably transferred to iron and low alloy steels, forming a hardened layer of carbides that reduce the life of the steel vessels. Ceramic coatings have previously been applied in CRU's to increase radiant efficiency. A dual functionality was hypothesized for select materials to aid in the prevention of carburization. To evaluate this potential, ceramic coatings were applied to a commonly used low-alloy steel tube material and exposed to a low-oxygen, high-temperature, carbon-rich environment. Chemical etching, optical microscopy, and microhardness evaluations were complet	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 11:25am - 11:50am	Stress Corrosion Cracking Of Austenitic Stainless Steels In Concentrated Chloride Environments	Ryan Katona, Jason Taylor, Erin Karasz, Brendan Nation, Andrew Knight, Charles Bryan, Rebecca Schaller - Localized corrosion and stress corrosion cracking (SCC) are potential degradation mechanisms for Stainless steels (SS) during exposure to corrosive environments. When localized corrosion features are subject to stresses (either external or residual), it is possible that a crack can nucleate from the corrosion feature and potentially propagate to a through-wall crack. One potential scenario under which chloride induced SCC may pose a risk is the interim storage and the eventual transport of spent nuclear fuel (SNF) in SS canisters. In order to inform upon potential materials degradation in corrosive environments for SS alloys utilized in SNF storage, we present initial efforts in determining in-situ crack growth rates geared toward understanding chloride-induced SCC. Initial efforts will be focused on accelerated conditions; concentrated salt brines at elevated temperatures. Ack	Henry B. Gonzalez Convention Center		RIP

Tuesday 3/8/2022 11:25am - 11:50am	Measurement Of Adsorption Kinetics Of Quaternary Ammonium Type Model Inhibitor Compound On Gold Subs	Kushal Singla - In the present study, an oscillatory circuit based, Quartz Crystal Microbalance (QCM) equipment equipped with a flow cell was used to investigate the adsorption of tetradecyldimethylbenzylammonium (BDA-C14) inhibitor model compound for two inhibitor concentrations (50 ppm and 100 ppm) on gold coated quartz crystal resonator. Langmuir adsorption isotherm was used to analyze the experimental data to evaluate kinetic adsorption/desorption constants, equilibrium surface coverage and free energy of adsorption. Analyzing the normalized frequency response with respect to time indicate that the adsorption process is rapid and there exists an equilibrium for the adsorption/desorption process. From these measurements, free energy of adsorption was estimated to be -21.5 kJ/mol for adsorption of BDA-C14 onto gold substrate.	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 11:25am - 11:50am	Durability In Design Of Light Rail Reinforced Concrete Structures.	William Nash - Recently a number of light rail systems have been built or extended in North America. Typical design lives of structures are required to exceed 75 years, with exposure to de-icing salts, freeze/thaw and the potential for stray currents. Measures to mitigate the risks of reinforcement corrosion to rail structures have progressed over the last century, with some diversion between the preferred practices in Europe and North America. One significant difference with large cost impacts on projects is the means and methods to achieve continuity of the reinforcing steel within rail structures. Herein we review the available standards and literature on reinforced concrete structure design for rail. Field measurements of steel resistivity taken during construction of rail structures is presented to clarify the as-built condition. Taking into account the effect of stray currents on the chloride threshold for corrosion initiation, methods are recommended to achieve durability requ	Henry B. Gonzalez Convention Center		RIP
Tuesday 3/8/2022 11:30am - 1pm	CEPC Symposium Officer Training		Henry B. Gonzalez Convention Center	Room 225 C	Administrative

Tuesday 3/8/2022 11:50am - 12:15pm	Water Based Flame Retardant Coating	Sachin Chavhan - Rapidly growing trends in flame retardant coatings demand environmentally sustainable advancements in coating compositions. Non-halogenated water based flame retardant coatings can address these concerns. These coatings allow for low flammability, low smoke density and low toxicity. Life Cycle Analysis suggests that these coatings can improve environmental impact by reducing global warming potential while showing superior performance and durability. This coating solution can offer significant application, safety and environmental advantages that reduce total ownership costs and increase structural protection during fire events.	Henry B. Gonzalez Convention Center	Symposia
Tuesday 3/8/2022 11:50am - 12:15pm	On-Site Parameter Measurements And Corrosion Coupon Tests Of Buried Pipeline Subject To AC Interfere	Le Chen, Du Yanxia, Jianjun Li, Jia Liu, Yi Liang, Nianpei Tian - The parallel length of a buried pipeline and high-speed railway is about 40 km, and the parallel distance between the two is less than 500 m. There are three intersections along the way, and the pipeline is subject to dynamic AC interference. The AC and DC parameters are tested for 24 hours, and the dynamic interference characteristics are obtained by analyzing the test data. In addition, corrosion coupons were embedded in three locations along the pipeline. Through 12 months of test, the corrosion morphology and corrosion rate data of corrosion coupons under dynamic AC interference were obtained, and the correlation between dynamic interference parameters and corrosion behavior was analyzed, which provided a reference for corrosion evaluation under dynamic AC interference.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 11:50am - 12:15pm	The Spontaneous Passivation Of Multi-Principal Element Alloys: Real-Time Kinetic Measurements With E	Kevin Ogle, Xuejie Li - The corrosion resistance of an alloy in most environments will depend on its ability to spontaneously passivate at the corrosion potential. In the laboratory however, the kinetics of passivation are mainly investigated using electrochemical methods that require a polarization of the material. Recently we have developed the AESEC method (atomic emission spectroelechemistry) to determine the kinetics of passivation under spontaneous conditions. In this work we will demonstrate the method as applied to both Ni-Cr-Mo alloys and the high entropy cantor alloy, equiatomic NiCrFeMnCo. We will demonstrate that the element-resolved electrochemical method provides insight into the specific role of alloying elements such as Mo in the Ni alloy series and Mn in the high entropy alloy. Further, the role of the oxidizing agent in the electrolyte (oxygen or hydrogen ion) will be examined.	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 11:50am - 12:15pm	Understanding The Role Of Temperature On The Corrosion Fatigue Of AA7085-T7451 In Full Immersion And	Brandon Free, Jason Niebuhr, Sarah Galyon Dorman, Jenifer Locke - 7xxx series aluminum alloys are frequently used in aerospace environments where temperatures may vary considerably. Surface salts are expected to deliquesce when exposed to moist air at temperatures greater than -21.1 °C, which can provide the electrolyte needed for corrosion fatigue (CF) to take place. In this work, the effect of temperature ranging between -50 °C and 25 °C on the CF of AA7085-T7451 is examined with particular emphasis on comparing dry, full immersion, and wet atmospheric environments. To date, findings have not showed a strong effect of temperature on the crack growth rate (da/dN) when no surface salt present. Tests completed in a full immersion environment of 23.1 wt% NaCl and loaded at 0.3 Hz have shown a greater than 2x decrease in da/dN when temperature was decreased from 25 °C to -10 °C. Experiments on samples with surface salt applied and exposed to air of varied humidity at low temperature are	Henry B. Gonzalez Convention Center		RIP
Tuesday 3/8/2022 12pm - 2pm	Student Poster Session Day 2	Chair: Raghu Srinivasan Vice Chair: Saba Navabzadeh Esmaeely The Student Poster Session at the AMPP Annual Conference + Expo encourages students to become active in AMPP and present the results of their work to membership. Each student who wishes to participate must submit a 300-400 word abstract (maximum of 10,000 characters). Please keep in mind that student attendance is required at the conference to participate. There can also only be one student per poster.	Henry B. Gonzalez Convention Center	Exhibit Hall	Other

Tuesday 3/8/2022 1:30pm - 2pm	Novel Developments in <100 g/L Exempt-Solvent Free Polyaspartic Corrosion Topcoat...	Novel Developments in <100 g/L Exempt-Solvent Free Polyaspartic Corrosion Topcoat to Address Future Regulations | Presented by Covestro | With continued environmental concerns of VOCs and the growing health concerns of certain exempt solvents, development of higher solids coatings are important for safely reducing the environmental impact of Architectural and Industrial Maintenance (AIM) coatings. This presentation covers the development of a new high solids polyaspartic topcoat for corrosion protection systems <100 g/L VOC (>89% volume solids) without exempt solvents in anticipation of tighter future VOC and exempt solvent regulations. The new coating provides similar corrosion and weathering performance to current polyaspartic systems while retaining the applicator's desire for a sprayable pot life and enhanced productivity at high solids. Results for pot life, dry time, salt fog exposure, and QUV weathering will be shared to show comparable performance of the new coating to current polyaspartic corrosion coatings.	Henry B. Gonzalez Convention Center	AMPPiTheater 2	Theater

Tuesday 3/8/2022 2pm - 2:25pm	Effect Of A Nitrate-Based Corrosion Inhibitor On Carbonation Induced Corrosion	Marco Ormellese, Andrea Brenna, Fabio Bolzoni, Silvia Beretta, Maria Diamanti, Mariapia Pedeferri - Corrosion of reinforcements is one of the most important phenomena affecting the durability of reinforced concrete structures. Corrosion inhibitors are additives that can work both as a preventative technique to delay the onset of corrosion or a protection system to reduce corrosion rate, once corrosion is initiated. Several substances have been evaluated as possible candidates, both organic and inorganic in nature. Recently, a nitrate-based compound has been proposed, as nitrates are still used in concrete as set accelerators. Moreover, some studies have shown that nitrates inhibiting mechanism is similar to nitrites, the latter being the most efficient compound nowadays available. This work evaluates the effect of a nitrate-based corrosion inhibitor on carbonated-induced corrosion in concrete. Results show that nitrates are able to delay concrete carbonation but they do not have any	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 2pm - 2:25pm	Converting Hydroprocessing Equipment To Produce Renewable Diesel From Soybean And Corn Oil: Corrosio	Nathaniel Sutton, Phillip Prueter, Kenneth Kirkham - The authors recently were tasked with identifying applicable corrosion damage mechanisms and specifying appropriate materials of construction for multiple renewable units, including two styles of RDU as well as a pretreatment unit for distillers' corn oil (DCO) upstream of one of these RDUs. In light of the pressures to bring the units online quickly, materials engineers must identify creative solutions for materials selection. In some cases, pre-emptive integrity operating windows (IOWs) can be established to allow a lower-cost and readily available material such as carbon steel to be utilized. In other cases, it may be economically practical to over-alloy a component or system if the higher cost material comes with a lower lead-time than a lower-cost more appropriate material of suitable corrosion resistance. Conventional crude oil refinery process knowledge and damage mechanism experience can be leveraged for the unique challeng	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 2pm - 2:25pm	Upset Conditions In Anaerobic Digesters In Wastewater Treatment Plants Cause Degradation Of Protecti	Randy Nixon - Both mesophilic and thermophilic anaerobic digesters are currently being utilized to treat sludge derived from more than typical municipal sewerage sources. Wastewater treatment plants are accepting septage and sludge from food waste and industrial contributors routinely today. Receiving these other sources of waste which are extremely high in volatile solids is a source of significant income for the utilities. However, high volatile solids loading into the digesters can cause out-of-balance bio-chemical conditions in the digesters. High volatile fatty acid to alkalinity ratios and low methane production are but a few of the repercussions of these imbalanced conditions. These process upsets result in high acetic and propionic acid exposure for protective linings. These exposures, when sufficiently prolonged, can cause degradation to the polymers in some protective coating systems commonly used successfully in the past. This paper will present evidence of this type of a	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 2pm - 2:25pm	Novel Solution For Corrosion Coupon Access Fitting Abandonment	Monica Fernandez, Badar Habsi, Malik Shereiqi, Samuel Jarratt - Increase in incidents related to intrusive corrosion monitoring retrieval, has led to many Pipeline Operating Companies to suspend, or significantly reduced the use of corrosion coupons and probes, decrease the frequency of retrieval, and eliminate its use in new projects. In the case of Petroleum Development Oman (PDO), 91% decrease of corrosion coupon was carried to reduce the risk to ALARP. Therefore, more than 300 access fittings / locations were no longer required. Un-attended access fittings could result in creating dead legs (corrosion threat) which could have a possible leak path in the pipeline systems. In that sense, this project was initiated to search for a safe and efficient permanent solution for abandonment of the existing access fittings. The Company reviewed several options, considering technical aspects as well as costs. The first option was to use a high-pressure retaining cover with a solid plug assem	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 2pm - 2:25pm	Development Of The Multipurpose High Strength Super Austenitic Stainless Steel UNS N08034 By Cold Wo	Julia Botinha, Helmuth Sarmiento Klapper, Clara Herrera, Merlin Seifert, Bodo Gehrmann, Helena Alves - Corrosion resistant alloys (CRAs) are used in oilfield applications where carbon and low alloyed steels are expected to be considerably affected by corrosion, and they represent a cost-effective alternative to chemical treatment, or where specific application driven requirements are needed. Several alloys from 13% chromium stainless steel all the way to highly alloyed nickel and cobalt alloys have been successfully used in drilling, completion, production as well as offshore oilfield equipment, where corrosion resistance is of concern. Non-magnetic austenitic stainless steels (CrMn), for instance, have been consistently used for many years in drilling technology components. In demanding production environments involving very corrosive streams at elevated temperatures, on the other hand, nickel alloys are preferred. While one of the large disadvantages of stainless steels concerns th	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 2pm - 3pm	Stop Data Corrosion Before It Happens	Presented by Becky Gibbs Murray, American Innovations | Data corrodes, just like pipelines do. The first step to combatting bad data is to identify its source. This short course explores common causes and sources of poor data, and best practices on how to fight back against bad data. The Cathodic Protection (CP) industry lags behind the technology curve driving so much innovation and growth in other industries. As pipeline operators adopt relevant technology for gathering and storing CP data, workflow efficiency has increased. But those technologies are not always fully leveraged to improve data quality. Our data corrodes just like pipelines. Internal and external forces can create pinholes within our data without us ever seeing a problem. This severely reduces data quality and ultimately leads to failures in analysis. Bad data comes from a number of sources: manual data entry errors, misalignment errors, lack of completeness and over-completion, data conversions, limitations of software applications, limitations of data models, and loading large batches of data and integration with other systems. There are several ways to combat the negatives associated with bad data: leveraging data capture technology, data validation at the point of capture, data normalization, application, data quality auditing, metadata, data provenance, and choosing the correct application.	Henry B. Gonzalez Convention Center	AMPPiTheater 2	Theater
Tuesday 3/8/2022 2pm - 3:30pm	Area Workshop		Henry B. Gonzalez Convention Center	Room 224	Other
Tuesday 3/8/2022 2pm - 4pm	Certification Program Committee		Henry B. Gonzalez Convention Center	Room 225 B	Administrative

Tuesday 3/8/2022 2pm - 4pm	Hydrogen Embrittlement and Stress Corrosion Cracking in Subsea Materials	Chair: Sai Venkateswaran Vice Chair: Mohammed Muaisub The symposium features technical papers on the research and development of novel oil and gas or subsea applications involving the evaluation of materials for their susceptibility to hydrogen embrittlement by cathodic protection, and galvanic interactions or from other contributory sources of hydrogen where H2S is not believed to be the primary contributor to the mechanism damage and cracking.	Henry B. Gonzalez Convention Center	Room 301 BC	Symposia
Tuesday 3/8/2022 2pm - 4pm	Materials and Cost of Corrosion	Chair: Barinder Ghai Vice Chair: Sandra Le Manchet This symposium features technical papers concerning the economic impact of corrosion and its implications on the global economy. Topics may include life cycle cost analysis, the cost of corrosion failure and case studies that address a project's return on investment (ROI) as a performance measurement.	Henry B. Gonzalez Convention Center	Room 217 C	Symposia

Tuesday 3/8/2022 2pm - 5pm	Galvanizing, Metalizing, and Duplex Coatings for Bridge Preservation Forum	Presented by Kevin Irving, International Zinc Association; Sudhir Palle, University of Kentucky; Dr. Tom Langell, American Galvanizing Association; and Derrick Castle, Sherwin Williams Corrosion of steel is a worldwide problem. This workshop will discuss the corrosion protection measures of galvanizing, metallizing, and duplex coatings that describe both DOT's and paint manufacturers' experiences in dealing with them. This will include hands-on demonstrations of adhesion tests of duplex coating on galvanized and metallized panels. There will be discussions from three different paint manufactures on using duplex coating for new steel. They will discuss measures on what needs to be taken into consideration for coating the galvanized/metallized steel. Slip and creep of faying surfaces will also be discussed. We will be able to show current case studies of galvanized bridges over 50 years old with no maintenance to date, meaning the first cost is still the same cost. We have case studies of metallized bridges over 20 years old with no maintenance. Duplex bridges will also be highlighted, with a current case study as well. If allowed, we could also do a live small outside demo of the metallizing process. This workshop will educate the beginner as well as the experienced AMPP members. They will learn of the cathodic protection of zinc and how it protects the steel substrate. These presentations will be very informal so the audience will be able to ask questions directly to the presenters.	Henry B. Gonzalez Convention Center	Room 208	Forum

Tuesday 3/8/2022 2pm - 5pm	PHMSA Pipeline Safety Forum	Presented by Kevin Garrity, MEARS; and Alan Mayberry, PHMSA The Pipeline and Hazardous Materials Safety Administration (PHMSA) and AMPP members play a critical role in protecting the public from potential catastrophic failures of liquid/gas pipelines. Join policymakers, regulators, and industry experts for a discussion on how PHMSA and other agencies address corrosion in pipeline safety. The forum will provide both a regulator and industry perspective on best pipeline safety practices and the latest developments. The PHMSA Forum is your chance to hear an annual update from key PHMSA officials and discuss proposed rules that may be considered in 2022. Additionally, you'll have the opportunity to hear from fellow members and stakeholders on the latest trends in pipeline safety.	Henry B. Gonzalez Convention Center	004 Mayor Cockrell	Forum
Tuesday 3/8/2022 2pm - 5pm	Materials Protection and Performance – Latin-America Experience in the Life Cycle	Presented by Annelise Zeeman, TECMETAL Soluções Tecnológicas em Materiais; Dannisa Chalfoun, YPF Tecnología, CONICET, Instituto Sabato; Fabián Sanchez, SLOM—Sociedad Latinoamericana de Operadores de Terminales Marítimos y Monoboyas; Mauricio Herrera, BLASTING EXPERTS; and Teresa Perez, TEP Consulting This forum will share knowledge and best practices to reinforce AMPP's position as a global leader in the protection and performance of materials, bringing together some of the Latin American leading experts. The lectures will address topics related to the materials life cycle such as design, manufacturing, failure investigation, and inspection. At the end, a panel session will be opened so that the public can interact with the speakers and other participants, providing a differentiated networking experience.	Henry B. Gonzalez Convention Center	Room 206 AB	Forum

Tuesday 3/8/2022 2pm - 5pm	SC 19 - Maritime		Henry B. Gonzalez Convention Center	Room 211	Standards
Tuesday 3/8/2022 2pm - 5pm	SC 13 - Corrosion Monitoring & Measurement		Henry B. Gonzalez Convention Center	Room 221 B	Standards
Tuesday 3/8/2022 2pm - 6pm	Recent Experiences with Nickel, Titanium, Zirconium and Other Corrosion Resistant Alloys	Chair: Ralph Bäßler Vice Chair: Ajit Mishra This symposium features technical papers related to the practical use and experience with corrosion resistant alloys including nickel base, titanium, zirconium and other corrosion resistant alloys.	Henry B. Gonzalez Convention Center	Room 217 D	Symposia
Tuesday 3/8/2022 2:10pm - 2:35pm	Comments On Standards Development For Selection And Specification Of Subsea Materials	Russell Kane - In the oil and gas industry, the major standard for material selection today is ISO 15156 Parts 1-3. While this standard deals extensively with environment cracking and its prevent under exposure to production environments containing H2S, chlorides, and sulfur, it does not include any guidance or material requirements for resistance to environmental cracking under variable subsea conditions that may involve exposure to seawater under cathodic protection. As a result of several incidents involving in-service cracking due to hydrogen embrittlement in subsea equipment, there has been a multi-year effort through a NACE forum, research symposium and STG-32 sponsored symposium to increase awareness of this problem with high strength steels and nickel-based alloys. As originally anticipated, the next step in this effort was envisioned to be the assembly of standard documents (in some form) that take available technical findings, research results and field experience on the se	Henry B. Gonzalez Convention Center		Symposia

Tuesday 3/8/2022 2:10pm - 2:35pm	Material Selection For Storage Tanks – Life Cycle Cost Analyses	Sandra Le Manchet - This paper is dedicated to material selection and Life Cycle Cost (LCC) of storage tanks. There are many materials options for the construction of storage tanks among which coated carbon steels, austenitic stainless steels and duplex stainless steels. Material choice requires the designer to consider several features: material performance, material cost and availability, weight and strength aspects, fabrication and maintenance costs. All are important factors in determining the lowest project and life cycle cost. Duplex stainless steels are today more and more considered for storage tanks projects thanks to their high mechanical properties and good corrosion resistance in many environments. This paper will first provide recent corrosion data for stored chemicals. Duplex stainless steels corrosion curves obtained in nitric, sulfuric, phosphoric acids as well as several kinds of waters will be given. In addition, atmospheric corrosion data obtained after 15+ years	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 2:10pm - 2:35pm	Recent Advances On The Influence Of Microstructural Characteristics On Corrosion Resistance In H2SO4	Marco Ormellese, Mariapia Pedeferri, Gianluigi Botton, Luca Casanova - Commercially pure titanium has been anodized with the use of a pulsed signal in unipolar regime, with 25% of anodic contribution at low frequency (20 Hz). This anodizing regime can effectively enhance thickness and crystallinity of the barrier region directly in contact with the metallic substrate. The latter condition will be particularly advantageous for corrosion resistance enhancement in strong reducing acidic environment, as concentrated hot sulfuric acid (10% v/v at 60 °C). Corrosion response has been investigated through the use of Electrochemical Impedance Spectroscopy (EIS) and results compared with weight loss tests and Linear Polarization Resistance (LPR). The higher degree of crystallinity of the coating, in the interfacial region, will be found to provide an effective barrier against proton diffusion thus retarding debonding of the oxide promoted by hydrogen evolution reaction (HER).	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 2:25pm - 2:50pm	Significance of Π–Electrons In the Inhibition Performance of Organic Corrosion Inhibitors for Carbon	Ahmed Mohamed, David Bastidas, Donald Visco - The significance of π–bond electrons was illustrated by electrochemical testing and a quantitative structure-property relationship using atomic Signatures for different organic corrosion inhibitors. Amines, alkanolamines, and polycarboxylates were tested using a cyclic potentiodynamic polarization to find the pitting potential for carbon steel rebars in 0.1 M Cl– contaminated deaerated simulated concrete pore solution. According to electrochemical testing, it was found that poly–carboxylate performed best in increasing the pitting potential compared to amines and alkanol amines. This was attributed to the presence of π–bond electrons in the carboxyl group, increasing the molecule's tendency to donate electrons to the surface of the carbon steel rebar; this phenomenon was corroborated with DFT calculation. Furthermore, carboxylates were able to create an adsorption film on the surface of the rebar by complexing with the ferrous ions, thus	Henry B. Gonzalez Convention Center		RIP

Tuesday 3/8/2022 2:25pm - 2:50pm	Development Of An Efficient MIC Mitigation And Control Strategy In Pipelline Pigging Operations	Charles Armstrong, Hejian Sun, Yuxiu Liu, Patrick Powell - Eleven fluid samples in two groups from their pipeline pigging operations in the Texas Gulf Coast region were used in this study. All of the samples contained high amounts of FeS, SRBs, and APBs and were producing varying amounts of H2S. These pipelines had historically been treated with increasing amounts of glutaraldehyde and glut/quat blends, to no avail. Increasing problems associated with microbiological activity (biofilm, corrosion, FeS, H2S) required a novel treatment regime. The first part of this study was undertaken in order to determine a successful biocidal treatment program that would address both the planktonic and, if necessary, the sessile bacterial populations in the pipelines. Due to the perceived induced resistance to glutaraldehyde and the dirty water conditions in the pipelines, alternative dosing regimens and additional biocides were considered including THPS, TTPC, aldehydes, and cocodiamines. The sec	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 2:25pm - 2:50pm	Thinning Of Inlet Piping To Reactor Effluent Air Condenser [REAC] Of Gas Oil Hydrotreating Unit - Ca	Sudharsanan Soundararajan - Druring turn around inspection of a Gasoil Hydrotreater severe metal loss was observed in the Reactor Effluent Product Condenser Inlet piping. The thickness loss was on the straight horizontal piping portion downstream of continuous wash water injection point. The loss is confined to top portion i.e.10 to 2 o'clock position of the piping only. Corrosion rates in excess of 1mm/year were noticed. The unusual observervation was that, there was no significant thickness loss at point of water injection or immediate downstream piping, but loss was predominantly on straight portion after 4 directional change. Process simulation, Ionic Equilibria Modelling and Computational Fluid Dynamic study of the REAC inlet system was performed.This paper explains how the location of wash water injection and type of injection device has influenced the corrosion in the REAC inlet piping. Based on the study, it was identified that stratification of flow and inadequate scrubbing	Henry B. Gonzalez Convention Center		Symposia

Tuesday 3/8/2022 2:25pm - 2:50pm	Opportunistic Compilation Of ECDA, ILI, And Hydrostatic Testing For Successful Pipeline Uprating: Ca	Paul Young - Regulators require minimum federal safety standards for pressure uprating as described in 49 CFR Part 192 Subpart K. Pipeline uprating to a pressure that will produce a hoop stress of 30% or more of SMYS in steel pipelines require a series of documented integrity assessments to ensure the pressure uprating will not adversely affect the safe operation. The objective of this paper is to disseminate a process that operators can use to develop an effective integrity assessment strategy for pressure uprating. This guide exceeds the requirements established in §192.555. The combination of External Corrosion Direct Assessment (ECDA), In-Line Inspection (ILI), and hydrostatic testing is used in conjunction to identify a variety of time dependent and time independent threats. A systematic approach for chronological implementation of assessment types for pressure uprating has been validated through a successful case study.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 2:25pm - 2:50pm	Optimisation Of Hydrogen Stress Cracking Resistance Of High Strength Precipitation Hardened Nickel A	Stephen McCoy, William MacDonald, Brian Baker - The precipitation hardened Nickel alloys are designed for Oil & Gas applications requiring high mechanical strength and toughness combined with high corrosion resistance in sour environments. Over recent years there has been increasing industry demand to improve quality control and categorise the various PH Nickel alloy grades resistance to Hydrogen Stress Cracking (HSC) for critical High Pressure-High Temperature environments. This is a complex corrosion mechanism with many factors including composition, strength, microstructure and grain boundary cleanliness. Evaluation efforts have used multiple techniques to measure the effects of HSC resistance with this paper concentrating on the Slow Strain Rate Test (SSRT) according to TM0198 Appendix C and the quality control of API6ACRA. The purpose of the paper is to present results using the TM0198 slow strain rate test method in a hydrogen charging environment and show the Hydrogen Stress	Henry B. Gonzalez Convention Center		Symposia
Tuesday 3/8/2022 2:30pm - 3:30pm	In-Ground Service Performance of 2-Layer Polyethylene Corrosion Coatings Including Laboratory Aging	Presented by Samuel Thomas, Liberty Coating Company | This presentation will address the performance of 2-Layer Polyethylene coatings for in-service gas distribution pipelines. The presentation will also share results of laboratory aging of 2-Layer Polyethylene coatings for thermal and hydrolytic aging and include documented coating properties that were exposed to UV from 1 year to 21 years.	Henry B. Gonzalez Convention Center	AMPPiTheater 1	Theater

Tuesday 3/8/2022 2:35pm - 3pm	Environmentally Assisted Cracking Of Nickel Based Alloy 955 In Saltwater With Cathodic Protection Fo	Arshad Bajvani Gavanluei, Vipul Shinde, Manuel Marya, Thodla Ramgopal, Alexis Simon - A thorough characterization of nickel-base alloy 955 was performed in saltwater with cathodic protection, SWCP, environment for high pressure high temperature (HPHT) subsea applications. The test environment was deionized water with 3.5% NaCl, pH of 8.2, CP potential of -1050 mV vs saturated calomel electrode, and at -40 °F (-4.4 °C). Environmentally assisted cracking susceptibility of the alloy was evaluated by performing fracture toughness test using a compact tension test specimen and rising displacement method in air and in SWCP as well as fatigue crack growth rate (FCGR) and static crack growth rate (SCGR) in SWCP. Fracture toughness test results indicated a significant reduction in the initiation fracture toughness value of the alloy. FCGR by performing frequency scan at various ΔK values and SCGR of the alloy was studied in SWCP. SCGR was obtained at different load holds of 55, 66, 75, and 9	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 2:35pm - 3pm	Nickel Based Alloy Casting Failure In Potash Production Mill	Newton Peterson, Alireza Kohandehghan, Brian Wilson - ABSTRACT A nickel-based alloy knife gate valve exposed to hot potash brine failed in less than two years in service. Failure was realized when the valve was unable to stop the flow. The valve body was constructed with UNS N30002 cast material, the gates were manufactured from UNS N10276 wrought plate material. Both cast and wrought materials were supplied in the solution annealed condition. Visual examination of the valve internal body parts revealed heavy scaling and corrosion damage in the cast material, the wrought parts were intact. Corrosion scale samples taken from the valve body were subjected to chemical analysis by X-Ray diffraction (XRD) augmented by energy dispersive X-Ray spectroscopy (EDS). The XRD technique was unable to identify approximately 85% of the components in the scale due to lack of crystallinity. The crystalline portion of the scale was found to contain a mixture of molybdenum, chromium, nickel and tun	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 2:35pm - 3pm	Expected Service Life And Cost Considerations For Maintenance And New Construction Protective Coatin	Jayson Helsel, Robert Lanterman - The paper is designed to assist the coatings engineer or specifier in identifying candidate protective coating systems for typical service environments and provides: 1) commonly used generic coating systems; 2) service life for each system and service environment; 3) current material costs; 4) current field and shop painting costs; and 5) guidelines for calculating approximate installed costs of the systems. Guidelines for developing long-term life-cycle costs and number of paintings for the expected life of the structure are also included. The basic elements of economic analysis and justification are addressed together with guidance on the preparation of a Present Value Analysis. Examples are provided to aid the reader in the proper use of the information. Updates in the 2022 version include coating system revisions for atmospheric exposure and immersion service, new discussion related to maintenance painting strategies, and new cost information.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 2:50pm - 3:15pm	Evaluation Of The Organic Compound 1-Benzyl-4-Phenyl-1H-1,2,3-Triazole As A Green Corrosion Inhibito	Loreto Dacio, Oladis de Rincon, Leonardo Alvarez, Homero Castaneda-Lopez, Brendy Rincon Troconis - The organic compound BPT is proposed to be used as a corrosion inhibitor in reinforced concrete to influence the corrosion mechanism at the alkaline/carbon steel interface. BPT was evaluated in a synthetic pore solution (SPS, 8.33 g/L NaOH + 23.3 g/L KOH + 2.0 g/L Ca(OH)2, pH: 13.6) following ASTM G180. Qualitative and quantitative characterization included electrochemical techniques, such as electrochemical impedance spectroscopy (EIS) and anodic cyclic potentiodynamic polarization. Varying concentrations of BPT were tested in SPS with and without the addition of 2 M NaCl. The optimal concentration of BPT was found to be 3 mM (inhibitor efficiency = 85.2%). EIS test results suggest adsorption mechanism of the compound onto the metal substrate and a defined trend in the charge transfer process when BPT is added.	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 2:50pm - 3:15pm	Microbiological Profile and Risk Exposures in Topside Production Systems of FPSOs in West Africa	Kingsley Oparaodu, Ibiba Braide - Microbiological risk evaluation of topside systems of four FPSOs in West Africa was carried out in over four years. Field samples were taken and analyzed using Next-generation DNA isolation and sequencing technique, to identify and classify the microbial population present on the facilities. Several classes of bacteria and archaea were sequenced and identified from the samples, including those that have been shown to play key roles in microbiologically influenced corrosion, biofouling, and biogenic hydrogen sulphide generation in oil and gas production systems. The study found that of the total microbes identified, 35.3% were found to be associated with biofouling, 31.5% were MIC-associated species and 29.1% of the species were associated with a combined, H2S/MIC risk. A few species, representing just 4% of the population, did not have definitive metabolic classes and therefore, with unclear risk classification. Some methanogens of the archaeal group	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 2:50pm - 3:15pm	Modelling Electrolytic Hydrofluoric Acid In The Fractionation Phase Change Corrosion Zone Of HF Alky	Andy Gysbers, Michael Cayard, Tim Korstanje, Peiming Wang, Ezequiel Vicent - Electrolytic hydrofluoric acid (HF containing water) continues to be a significant carbon steel corrosion concern in the industry, particularly in the regime where water/HF undergoes phase changes as it is heated and cooled in the fractionation section of the HF alkylation process. This corrosion may be attributed to formation of a water enriched electrolyte phase. An industry sponsored Joint Industry Project (JIP) was undertaken to better understand this corrosion relationship by developing an electrolyte thermodynamic database and relationships of HF/Water/Hydrocarbon interactions that could be used in process models to evaluate the impact of operating changes on the corrosion potential in these systems. This paper will discuss the creation of the electrolyte thermodynamic model and its application in evaluating the phase transitions that occur in user plants as a function of operating conditions through p	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 2:50pm - 3:15pm	Recent Advances In Depth Assessment Of Stress Corrosion Cracking Using Tangential Eddy Current Array	Michael Sirois, Mathieu Bouchard - The recent developments in the field of eddy current array (ECA) technologies have pushed this non-destructive technique far beyond the nuclear and aerospace industries to which it has been traditionally associated. Advanced ECA tools are now commonly deployed in the oil and gas industry for the rapid detection of hard spots, stress corrosion cracking (SCC), weld cracks and other linear indications on the external surface of gas and liquid pipelines. These inspections take place during the direct assessment phase in pipeline digs in lieu of magnetic particles inspection (MPI). Due to their speed and ease of use, ECA tools have shown great potential for decreasing the duration of dig programs while providing detection performance that compares favorably against MPI. Despite being a method of choice for the detection of SCC on carbon steel surfaces, traditional ECA technologies are still rarely being used for measuring the depth of these cracks. Phas	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 2:50pm - 3:15pm	Environmentally Assisted Cracking Susceptibility Of Nickel Based Alloy 955 In A Sour Wellbore Fluid	Arshad Bajvani Gavanluei, Vipul Shinde, Manuel Marya, Thodla Ramgopal, Alexis Simon - A thorough characterization of nickel-based alloy 955 was performed in a sour production wellbore environment for high pressure high temperature (HPHT) subsea applications. The test environment chemistry was 1.14 mol.% of CO_2, 0.4 psia fugacity of H_2S, 240,000 mg/L chloride, dissolved oxygen less than 10 ppb, pH of 4.2, at 400 °F (204.4 °C) temperature. Environmentally assisted cracking susceptibility of the alloy was evaluated by performing fracture toughness test using compact tension test specimen and rising displacement method. Fatigue crack growth rate (FCGR) and static crack growth rate (SCGR) was studies in the HPHT environment. Fracture toughness testing indicated no significant reduction in the initiation fracture toughness value of the alloy in HPHT condition compared with in-air value. FCGR was obtained by performing frequency scan at various ΔK values and SCGR of the alloy was studied i	Henry B. Gonzalez Convention Center		Symposia

Tuesday 3/8/2022 3pm - 3:25pm	The Susceptibility Of Spheroidal Graphite Cast Iron To Hydrogen Induced Stress Cracking	Roy Johnsen, Ida Westermann, Atle Qvale, Veronika Djupvik, Cathrine Hartung - Due to its attractive combination of cost, mechanical properties and castability, use of Spheroidal Graphite Cast Iron (SGCI) has to an increasing extent replaced steel for use in some structural and mechanical components in subsea applications. Subsea structures are typically protected by use of sacrificial anodes attached to the host structure. Under such conditions nascent hydrogen is generated on the surface of the protected material due to the cathode reaction, hence Hydrogen Induced Stress cracking (HISC) is a constant concern for subsea components subjected to tensile stress. In this work, the SGCI's resistance to Hydrogen Embrittlement has been examined by use of Slow Strain Rate (SSR) Test and Stepwise Constant Load (SCL) Test. Since structural steel is the main competing candidate material for such subsea applications, two grades of SGCI have been compared to two structural steel grades with s	Henry B. Gonzalez Convention Center		Symposia

Tuesday 3/8/2022 3pm - 3:25pm	Corrosion Performance Of Various Types Of Welded And Seamless Tubulars Of Ni-Mo And Ni-Cr-Mo Alloys	Ling Chen, Vinay Deodeshmukh - Ni-base corrosion resistant alloys are known to exhibit high resistance to pure hydrochloric and sulfuric acids over wide ranges of concentration and temperature. Particularly the pipe and tube products are widely used in many industries. The common tubular products include seamless tube, Class I - as welded and solution-annealed, and Class III - welded and fully cold-reduced or welded and bead-worked, according to ASTM B626 and the ASME specifications. Commercial alloys HASTELLOY® B-3® alloy, HASTELLOY® C-276 alloy, HASTELLOY® C-22® alloy, HASTELLOY® C-2000® alloy and HASTELLOY® HYBRID-BC1® alloy in aforementioned tubular product forms were studied in this paper. Notably, in selected test environments, HYBRID-BC1 tubulars showed excellent general corrosion and pitting corrosion resistance in comparison to the C-type alloy tubulars. In addition, the sensitization behavior of welded tubes in ASTM G 28A and G28B solutions will be compared.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 3:10pm - 3:35pm	Long-Term Cost Saving By Using High Alloyed Stainless Steel In Seawater Coolers	Jonas Höwing - A refinery has for decades been using CuNi 90/10 for several seawater cooled heat exchangers, usually a good material choice for this kind of service. Over the years the refinery has been facing a lot of corrosion issues with these heat exchangers though, leading to frequent leakages, plugging of tubes and ultimately regular replacement of the complete tube bundles. Apart from high maintenance costs, this also led to production losses with associated lost earnings. This paper will show the long-term cost of the CuNi heat exchanger solution and compare this to an initially more expensive stainless steel solution having a lower long-term maintenance cost. The cost calculations are based on data supplied from fabricators, material suppliers and end-users.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 3:15pm - 3:40pm	BTA Modified Hybrid Sol Gel Coating For Corrosion Protection Of Steel In Reinforced Concrete	Jacob Ress, Ulises Martin, David Bastidas - Sol gel coatings have been shown to be viable coating methods for various metal substrates including copper and aluminum. However, due to their brittle nature, they fail to provide substantial corrosion protection. A novel sol gel coating containing benzotriazole (BTA) corrosion inhibitor was synthesized and studied on carbon steel. The coating was applied by spin coating method and the optimum curing time was studied. The resulting sol gel film was characterized by Fourier Transform Infrared Spectroscopy (FT-IR) and thermal gravimetric analysis (TGA). The corrosion protection of the sol gel was then studied by potentiodynamic polarization (PDP) and electrochemical impedance spectroscopy (EIS) over time. The FT-IR results indicate successful incorporation of BTA corrosion inhibitor within the sol gel network. EIS and PDP showed the BTA imparts significant improvement in corrosion protection and the development of an organic passive film and	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 3:15pm - 3:40pm	Microbiologically Influenced Corrosion Failure Of Ni-Coated Carbon Steel Fittings In Enhanced Oil Re	Moavin Islam, Amal Al-Borno, Chad Walz - This paper presents the findings of an investigation that was carried out to determine the root cause of the premature failure of Ni-coated carbon steel fittings on the composite water injection piping system installed at an oil production facility in Western Canada, which has been in operation since 2011 without major corrosion issues. The core structure of composite pipe is a high-density polyethylene (HDPE) inner pipe, a middle layer of high-strength dry fiberglass, and a protective thermoplastic outer jacket. The interconnecting fittings are made of carbon steel coated with a thin, ~40 micron (1.5 mil) layer of Nickel. Many of the Ni-coated fittings, which are expected to have a service life of 20 years, started to fail (developed leaks) unexpectedly after about 4 years. The failure investigation results (bacteria, water and corrosion product analyses as well as corrosion damage morphology) provided quite convincing evidence that the prem	Henry B. Gonzalez Convention Center		Symposia

Tuesday 3/8/2022 3:15pm - 3:40pm	A Case Study-Caustic Gouging Of Boiler Tubes	Suresh Divi, Sri Krishna Chimbli - Caustic corrosion also referred to as “Caustic attack” or “Caustic gouging” generally results from the fouled heat transfer surfaces on boiler tubes and due to the presence of an active corrodent in the boiler water. Once the caustic concentrations reached a certain level the caustic attack occurs and results in irregular wall thinning or gouging of the tube waterside surface. The damage progresses into tube wall rupture. Such caustic corrosion failure was observed in one of the tubes from a utility’s boiler section. This paper presents the laboratory failure analysis of the failed tubes including welds and the process fluids and its effects on the caustic corrosion. The laboratory analysis includes deposit analysis, metallography, chemical analysis, and hardness tests.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 3:15pm - 3:40pm	Statistical Analysis Of U.S. Reportable Onshore Hazardous Liquid And Natural Gas Pipeline Accidents/	Alvaro Rodriguez - A statistical analysis of reportable onshore hazardous liquid and natural gas pipeline accidents/incidents in the United States from January 2010 to January 2021 was conducted by evaluating releases reported to be caused by external corrosion. The US Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) Office of Pipeline Safety (OPS) Accident Investigation Division (AID) collected historical records from Form PHMSA F 7000-1 (Hazardous Liquid/CO2 Accident Report) and Form PHMSA F 7100.2 (Gas Transmission and Gathering Systems Incident Report) for the 11-year period. Since January 2010, 358 of the 4,332 (8%) hazardous liquid accidents; and 122 of the 1,364 (9%) natural gas incidents involved failures due to external corrosion. These failures were reported as corrosion failures under section G1: Corrosion, and 29 accidents were reported as environmental cracking-related accidents under section G5: Material Failure of Pipe or We	Henry B. Gonzalez Convention Center		Symposia

Tuesday 3/8/2022 3:25pm - 3:50pm	The History Of Hydrogen Induced Stress Cracking (HISC) Failures Of Duplex & Super Duplex Stainless S	Glenn Byrne, Geoffrey Warburton, Roger Francis - Between 1975 and 1995 roughly 500,000km of DSS pipe had been installed in the North Sea, subsea, with insulation coating and cathodic protection (CP) applied. In contrast to the previous 20 year of good experience, between 1996 and 2004 a cluster of subsea failures of new and relatively newly installed DSS/SDSS assets occurred. These failures were attributed to HISC as a consequence of CP. The paper reviews the available literature detailing a number of case histories and presents some additional anecdotal information not previously reported. Some similarities between these failures and a cluster of HISC failures of martensitic stainless steel pipelines that occurred shortly after the first DSS failures are detailed. Current methods of mitigation such as those detailed in design codes, the use of hot isostatically pressed production methods, surface treatments and modified alloys with improved HISC resistance are discussed. To conclude	Henry B. Gonzalez Convention Center		Symposia

Tuesday 3/8/2022 3:25pm - 3:50pm	Long- And Short Term Laboratory Testing Of UNS N06985 For OCTG In Extreme Sour Environments	Charlotte Ulfvin, Per olsson-artberger, Wenle He - Recently, cold worked Sanicro 48 (UNS N06985) tubes have been developed and produced for OCTG in specified minimum yield strength 110 ksi and 125 ksi and in dimensions 4½² and 7² (OD´WT, mm: 114.3´6.88 and 177.8´10.36). Laboratory testing has provided mechanical properties and corrosion resistance to localized corrosion and SCC. The pitting corrosion resistance has been evaluated per ASTM G150 in 1M NaCl and 3M MgCl2. The SCC resistance has been verified using both short-term SSRT and long-term autoclave exposures using C-ring and mass loss for 90 days. The SSRT was performed in the maximum boundary conditions of environmental limits for 4d type nickel based alloys per ISO15156-3, i.e. 180 000 mg/L chloride, 1 000 psi CO2, 300 psi H2S at 218 °C; whereas 2200 psi H2S, 1g/L elemental sulfur were used at 149°C; strain rate was 4´10-6 /sec. The long-term autoclave exposures were performed in a more severe condition level VI which is outs	Henry B. Gonzalez Convention Center		Symposia
Tuesday 3/8/2022 3:30pm - 4:30pm	Corrosion Is Wide Awake...Dreams or Nightmares for Industrial Hygiene?	Presented by Sylvia Fontes, CIH, Forensic Analytical Consulting | This session will cover some of the basic health hazards associated with the coatings industry. This includes silica, lead, beryllium, and methylene chloride. The basic OSHA regulations regarding health and safety will be reviewed to give the beginner in the coatings industry a basic foundation to ensure a safe and healthy work environment.	Henry B. Gonzalez Convention Center	AMPPiTheater 2	Theater

Tuesday 3/8/2022 3:35pm - 4pm	Life-Cycle Cost Evaluation Of Corrosion Mitigation Strategies In Mining Industry	Masoumeh Naghizadeh, Yuri Savguira, Miqdaad Fatakdawala - Corrosion-related challenges are addressed during the detailed engineering phase to meet the specified service life of the asset, but a comprehensive strategy to lower corrosion costs is rarely implemented. The current work explores the cost of corrosion in the mining industry and attempts to identify pathways for design optimization. The current work examines the corrosion costs associated with the lithium, nickel, and iron processing industries using an LCCA. The direct cost of corrosion was determined by quantifying the cost of all corrosion-related activities and design, and the indirect cost of corrosion was estimated through industry-accepted models. The effectiveness of corrosion mitigation strategies was evaluated by examining the associated return on investment (ROI).	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 4pm - 4:25pm	An Experimental Methodology For Determination Of Chloride Threshold (CT) Of Steel Rebars In Simulate	Yi Lu, Deeparekha Narayanan, Changkyu Kim, Homero Castaneda-Lopez - Steel rebars have been widely applied in reinforced concrete (RC) structures due to their improvements in mechanical properties as composite material. However, exposure to chemical aggressive ions such as chloride ions and oxygen originate a corrosive cell that causes the material loss of the rebar and therefore the loss of capacity required for structural elements. The literature has reported a significant wide range of chloride threshold (CT) based on different laboratory methodologies and theoretical approach. This work aims to provide a quantitative CT for steel rebars with 0, 2, 4, 9 and 23 wt% Cr with expression of free chloride in wt% and [Cl-]/[OH-] by conducting electrochemical testing (EIS and cyclic polarization) and structure characterizations (SEM and XPS). The added chloride ions were controlled by using a titration method to determine the change of mechanism, parameter, mechanism based on electrochemic	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 4pm - 4:25pm	Failure Analysis Of Hydrotested 12-Inch Type 304 SS Pipe Sections	Sudhakar Mahajanam, Scott Harding, Cody Robinson, Christopher Miller, Amilcar Oberto - Hydrostatic testing of pipelines is an important step prior to commissioning. In this paper, we discuss two case studies wherein leaks were detected during hydrotesting of a newly constructed 12-inch pipeline at a client site. The first failure occurred in the body of a pipe segment coated with fusion bonded epoxy. The second failure occurred at a girth weld of a different pipe segment in the same line, but coated with abrasion resistant outer wrap. Visual examination and stereomicroscopy revealed the presence of pits adjacent to the leaks. Scanning electron microscopy, energy dispersive x-ray spectroscopy, MIC V testing and metallography confirmed that the pitting occurred as a result of internal microbiologically induced corrosion.	Henry B. Gonzalez Convention Center	Symposia
Tuesday 3/8/2022 4pm - 4:25pm	Hydrochloric Acid Corrosion Of A Venturi Gas Scrubber In A Continuous Catalyst Regeneration (CCR) Pl	Yousif Al Rabie, Iyad Alburaiki - A venturi gas scrubber (ejector) made of Ni-Cr-Mo alloy C-2000 (UNS N06200) located in a Continuous Catalyst Regeneration (CCR) Platformer failed prematurely after 1.5 years in operation. The scrubber was used to neutralize hydrochloric acid (HCl) and chlorine present in the regeneration tower vent gas by injecting a caustic solution (1% NaOH). In general, many alloys are susceptible to HCl corrosion at different acid concentrations. Originally, the scrubber was made of alloy B-2 (UNS N10665) but was changed to alloy C-2000 after multiple failures. In this paper, a metallurgical failure analysis concluded that the scrubber had failed due to hydrochloric acid (HCl) corrosion. Recommendations are provided to minimize similar damage recurrence.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 4pm - 4:25pm	Statistical Analysis Of U.S. Reportable Onshore Hazardous Liquid And Natural Gas Pipeline Accidents/	Alvaro Rodriguez - A statistical analysis of reportable onshore hazardous liquid and natural gas pipeline accidents/incidents in the United States from January 2010 to January 2021 was conducted by evaluating releases reported to be caused by external corrosion. The US Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) Office of Pipeline Safety (OPS) Accident Investigation Division (AID) collected historical records from Form PHMSA F 7000-1 (Hazardous Liquid/CO2 Accident Report) and Form PHMSA F 7100.2 (Gas Transmission and Gathering Systems Incident Report) for the 11-year period. Since January 2010, 358 of the 4,332 (8%) hazardous liquid accidents; and 122 of the 1,364 (9%) natural gas incidents involved failures due to external corrosion. These failures were reported as corrosion failures under section G1: Corrosion, and 29 accidents were reported as environmental cracking-related accidents under section G5: Material Failure of Pipe or We	Henry B. Gonzalez Convention Center		Symposia

Tuesday 3/8/2022 4:10pm - 4:35pm	New Experiences With Explosion Clad Alloys UNS N06058 And UNS N06059	Philipp Hübner, Helena Alves, Daniela Niespodziany, Jochen König, Olivier Sarrat, Rainer Behrens - Prior work shows that the Ni-Cr-Mo alloys UNS N06058 and UNS N06059 can be reliably explosion clad to carbon steel and are fully compliant with ASME Code. Additionally corrosion tests in hydrochloric and sulfuric acid, in “green death solution” and further mechanical tests according to SA 265 (Nickel and Nickel-Base Alloy-Clad Steel Plate) have been conducted to be shown in this work. To fabricate equipment such as pressure vessels, explosion cladding is followed by shell and head forming. If requested by the codes, a post weld heat treatment may also be mandatory. After this sequence, the cladding layer has been investigated with respect to mechanical properties and corrosion resistance (e.g. in sulfuric acid). Therefore, best practices for explosive cladding and head forming were identified and evidence was provided, that the explosive cladding process does not affect the properties	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 4:25pm - 4:50pm	The Hydrochloric Acid Attack Of Reinforced Concrete In A Gold Refinery	Christian Paglia - The reinforced concrete structures are used in industrial applications. Despite the good mechanical performance and durability of the cementitious material, some chemical agents have a detrimental effect on rebar and concrete. Within a gold refinery build with pre-cast concrete elements, several types of substances are used for the treatments of ore deposits. The goal is to extract the gold component. The main chemical agent consists of hydrochloric acid. After the chemical treatment the liquid passes through a drain system placed in the pavement in the lower level of the refinery. With time the drain sealing capability decreased and a contamination of the surrounding reinforced concrete took place. Furthermore, the acid and chlorides penetrated through the reinforced concrete elements. The rebars were adversely affected by the attack of the acid and the chlorides. Localized corrosion was observed on the rebars until complete disgregation. This was observed in the	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 4:25pm - 4:50pm	Study On Elemental Sulfur Formation From Black Powder Deposits	Yousef Khuraibut - The Black Powder in gas and associated processing equipment is a global phenomenon that many operating companies had and still suffering from. The Black Powder is general term to describe a host of corrosion related contaminants found in pipelines that transport natural gas, condensate, LPG and fuel gas. The composition of Black Powder has been found to vary significantly in chemical composition. However, the constituents mainly consist iron sulfides (FeS) & iron oxides. Black Powder is known to cause serious problems to pipelines, such as flow inefficiency, product contamination, wear, plugging, and under deposit corrosion. Another major concern is the possible formation of elemental Sulfur, which could be produced as a by-product of oxidation of iron Sulfides. It also, can be produced from H2S dissociation at elevated temperatures or by microbiological reactions, involving the reduction of Sulfate. Elemental Sulfur can be produced in sour gas wells and carried b	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 4:25pm - 4:50pm	Wireless UT Sensors For Structural Health Monitoring & Remote Operations In A Post COVID19 World	Steve Strachan - Nothing like a crisis to force people think and act differently. The concept for deployment of installed ultrasonic sensors to either replace or augment manual inspections to improve operational efficiencies and outcomes is by no means a newfangled idea. As with all technology, components get smaller and sensors become more deployable and affordable. The same with wireless UT sensors. Over the last decade the O&G industry has been marked by falling oil prices, reductions in new builds/expansions, declines in CAPEX budgets, and corporate reorganization in efforts to cut costs. Then COVID19 arrived, and the world changed in a matter of weeks. Instead of trying to cut costs, many refining and chemical plants shifted their thinking to working smart versus hard. This presentation will detail how wireless UT sensors combined with new ways of thinking has transformed the industry to save millions of dollars in asset integrity and operating efficiencies.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 4:25pm - 4:50pm	Failure of 24” Common Crude Piping and Formation of Iron Sulfides Due to the Influence of Sulfate &	Yousef Khuraibut - A leak suddenly occurred at the 24-inch common crude piping from the separators heading to the degassing boot inlets and the wet crude tanks at oil gathering center in Kuwait Oil Company. The Initial observations showed the leak was due to a deep isolated pit and localized corrosion. Consequently, the piping spool was opened, deposits were collected for analysis and an action report was issued recommending replacing the leaky spool. Additional inspections (UT/LRUT) for the 24” common crude line showed similar deep isolated pits (up to 70% thickness reduction) scattered across the length of the 1100 meter piping. This was extremely concerning since the facility has just been commissioned and been in service for 1.5-2 years only. Subsequently, an investigation was carried to determine the root causes for the failure concluded that an active Microbiologically Influenced Corrosion (MIC) was taking place due to the influence of Sulfate and Iron Reducing Bacteria strai	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 4:35pm - 5pm	Stress Corrosion Cracking (SCC) and Electrochemical Corrosion Study of Cold Formed Alloy 625 (UNS N	Suresh Divi, Sri Krishna Chimbli - Corrosion-resistant alloy (CRA) such as alloy 625 (UNS N06625) provides excellent corrosion resistance and chloride stress-corrosion cracking (SCC) resistance than stainless steels in many corrosive environments. Literature shows that under annealed condition alloy 625 is immune to chloride stress-corrosion cracking in high chloride environments (boiling 30-40% MgCl2) and provide excellent localized corrosion resistance in >10,000 ppm Chlorides. However, the literature shows that when the alloy is heavily cold worked and/or aged it becomes more sensitive to chloride levels and susceptible to SCC. In order to understand the sensitivity of alloy 625 under cold-worked conditions, a series of electrochemical tests and SCC tests were performed on annealed and cold-worked/cold-worked and aged alloy 625 in various concentrations of chlorides (NaCl) and at low pH levels (1-3). The test results and the threshold chlorides levels and pH values contributing t	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 4:50pm - 5:15pm	New Trends In Research Of Corrosion Of Steel In Concrete – A Critical Review	Burkan Isgor, Ueli Angst - Corrosion of reinforcing and prestressing steel in concrete continues being a corrosion research topic of high societal relevance. On the one hand, there is an ever-increasing need for reliably diagnosing to condition of ageing structures in corrosive environments. On the other hand, the scientific community and industry are undertaking countless efforts towards cement production with low environmental footprint, even towards “net zero”. Thus, the chemistry and microstructure of the porous medium, concrete, surrounding the steel are continuously changing. Fundamental understanding about corrosion of steel in these media is urgently needed to ensure the safe and durable performance of new materials and structures in service conditions. We review different recent emerging trends in corrosion science in general and identifying if they can be useful in addressing the big open questions for steel corrosion in concrete. We discuss the usefulness and limitation	Henry B. Gonzalez Convention Center	RIP

Tuesday 3/8/2022 4:50pm - 5:15pm	Utilizing Corrosion Damage Morphology As An Indicator Of Microbiologically Influenced Corrosion (MIC	Moavin Islam - Microbiologically Influenced Corrosion (MIC) is a major concern in process industries, particularly in the Oil and Gas sector. MIC has been linked to numerous corrosion failures and it is estimated that 25-30% of corrosion related in pipelines and industrial equipment failures can be attributed to MIC. Under anaerobic conditions, such as in oil and gas pipelines or deaerated oil-field waters, sulfate reducing bacteria (SRB) are commonly considered as the main culprits of MIC. However, several different types of other bacterial strains under the classification of general aerobic bacteria (GAB) and general anaerobic bacteria (GAnB) have been implicated in the MIC process. Close examination of extensive sessile bacteria data, water chemistry and the corrosion damage morphologies observed on corresponding corrosion coupons in different oil field waters (brackish, recycled, produced, effluent) over a period of some 10 years, indicated that there was a distinct relationship	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 4:50pm - 5:15pm	Surface And Defect Preparation Using Atmospheric Plasma For Non-Metallic Pipe Repair	Jeffrey Piascik, Jeff Pavelka, Pete Yancey, Glenn Astolfi, Chris Alexander, Ahmed Hassanin - The objective of this study was to prove quantitatively how the APS atmospheric plasma surface preparation can improve the performance of composite repair systems whether on leaking or nonleaking defects. Surfaces treated with atmospheric plasma were compared to industry standard surface preparation (NACE-2) and flash-rusted surfaces on commercially available composite repairs systems. All groups were tested to ASTM and ISO standards for contact angle wettability; lap shear testing; full-scale leak repair cyclic pressure testing; and mechanical testing (tensile and fracture toughness (Charpy V-notch)). Plasma treated surfaces displayed over 65% improvement in lap shear strength and over 300% increase in pressure cyclic performance compared to industry standard solutions. Additionally, utilizing this solution did not affect the bulk material properties of the metal substrates as shown in tensi	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 5pm - 5:25pm	Stress Relaxation Cracking Of Thin Alloy 800/800H Electric Heater Tubular Heating Elements	Iyad Alburaiki, Mohammed Abu Alsaud, Sadiq Al-Ismail - Stress relaxation cracking (SRC) is known to occur in in austenitic stainless steels and nickel alloys operating between 550°C (1020°F) and 750°C (1380°F). Commonly, failures occur in heavy wall welded components. This paper, however, will discuss two SRC failures that occurred in thin unwelded components. Both of these failures occurred in electric heaters and, specifically, in tubular heating elements made of alloy 800 and 800H. Failure analysis of the components indicated intergranular fractures due to SRC as the cause of these failures. Both failures initiated in areas of relatively high hardness due to cold work. This paper provides details related to manufacturing, environmental conditions, metallurgical analysis and provides recommendations to avoid such failures in the future.	Henry B. Gonzalez Convention Center	Symposia

Tuesday 3/8/2022 5:25pm - 5:50pm	Development Of Zinc Coatings In Halide Free Ionic Liquids For Corrosion Mitigation	Kranthi Maniam, Shiladitya Paul - Electrodeposition of zinc (Zn) from ionic liquids (ILs) has been gaining significant attention as a technique to resolving the issues associated with aqueous systems (such as H2 evolution). These coating solutions are employed in a variety of industries, including marine, automotive etc. Amongst the developed ILs, Zn deposition from choline chloride based IL were demonstrated to show promising potential over convention aqueous electrolytes but suffer from drawbacks such as formation of chlorinated compounds and environmental toxicity issues. As a result, research focus has been shifting towards the development of halide-free ILs. While development of halide-free ILs as environmental friendly electrolytes for the electrodeposition of Zn are underway, the studies on the understanding on the modeling, simulation and performing an experimental study of the electrodeposited Zn coatings from these ILs in terms of deposition conditions, electrolyte conditio	Henry B. Gonzalez Convention Center	Symposia
Tuesday 3/8/2022 7pm - 8pm	Scholarship Awards Ceremony	Continuing the traditions of two great organizations, AMPP EMERG Student Outreach supports the future of our industry with an evening of recognition and celebration, acknowledging the accomplishments of our 2022 scholarship and award recipients.	Aztec Theatre	Networking
Tuesday 3/8/2022 8pm - 11pm	EMERGing Leaders Bash	Come for the Awards...Stay for the Celebration. Continuing the traditions of two great organizations, AMPP EMERG Student Outreach supports the future of our industry with an evening of recognition and celebration, acknowledging the accomplishments of our 2022 scholarship and award recipients, followed by an evening of music and dancing, featuring The Grooves Band.	Aztec Theatre	Networking