

Corrosion Control, Prevention and Mitigation in Oil & Gas Industry

T. Nagalakshmi, A. Sivasakthi

Abstract: The impact of corrosion within the refining industry ends up in the failure of components. This failure leads to closing down the plant to scrub the corroded components. Additionally, corrosion normally causes serious environmental issues, namely spills and releases. A vital resource for all those that are concerned within the corrosion management of oil and gas infrastructure, corrosion management within the oil and gas industry provides engineers and designers with the tools and strategies to plan and implement comprehensive corrosion-management programs for oil and gas infrastructures. Control of corrosion is important for continuous production and eradicating the well control losses. Materials to be used in down hole have to meet certain characteristics to avoid corrosion and provide additional mechanical strength. It is potential to determine a logical series of steps for material choice, incorporating analysis of the surroundings, corrosion rate calculations, and final material choice based on established limits. Several developments have taken place in refinement the calculation of CO_2 corrosion rates. Moreover, the definition of bitter examination has been reviewed and a way wider evaluation of the relevance of varied established and new materials for various service conditions has been created.

Keywords: Corrosion, Corrosion Rates, Corrosion Resistance Environmental Issues, Plant Failure and Refining.

I. INTRODUCTION

Corrosion of materials could be a major challenge to maintaining the integrity of equipment within the industry. Mobile and static mechanical facilities like pipelines, vessels, tanks, compressors, turbines, and then forth are intermittently subjected to degradation and failure because of corrosion. The impact of corrosion within the oil and gas industry considerably contributes to the unproductive time (NPT) of 20–30% lost from exploration to production [3].

II. CORROSION PREVENTION

Unprotected pipelines corrode, in spite of wherever the pipeline is. If it's buried underground, higher than ground or in sea water, it's progressing to corrosion. About 60% of nation's transmission lines approach their lifespan of a half century, many industries dealing a lot about pipeline failures. While not implementing safety measures and having corrosion management program, corrosion makes transporting dangerous material unsafe [8]. Here are a number of the ways NACE (National Association of Corrosion

Engineers) recommends as a part of an effective corrosion management program to safeguard oil and gas pipelines. Those corrosion preventive methods are as follows,

- A. Cathodic protection
- B. Coatings and linings
- C. Corrosion Inhibitors
- D. Pipeline material

A. Cathodic Protection

Cathodic protection is a technique to manage corrosion by employing a direct electrical current that neutralizes external corrosion generally related to metal pipe. It is typically used once a pipeline is buried underground or in water. While executed on a new pipeline, cathodic protection will forestall corrosion from the beginning. On associate older pipeline, cathodic protection will impede existing corrosion of the pipeline. Tubing protected by cathode is shown in fig. 1.



Fig. 1. Cathode Protected Tubing

B. Coatings and Linings

These are applied to pipelines whether or not higher than or below ground and sometimes are employed in combination with cathodic protection. Another application that is presently obtaining some attention is that the use of fiber-reinforced polymers to strengthen and repair pipelines. The metal strength with and without coating is shown in fig. 2.



Fig. 2. Coatings at Metal Surface

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Corrosion Control In The Oil And Gas Industry

Yasser Kassem

A decorative graphic consisting of a red circular shape with a white center, partially obscured by a white horizontal bar.

Corrosion Control In The Oil And Gas Industry:

Corrosion Control in the Oil and Gas Industry Sankara Papavinasam, 2013-10-15 The effect of corrosion in the oil industry leads to the failure of parts This failure results in shutting down the plant to clean the facility The annual cost of corrosion to the oil and gas industry in the United States alone is estimated at 27 billion According to NACE International leading some to estimate the global annual cost to the oil and gas industry as exceeding 60 billion In addition corrosion commonly causes serious environmental problems such as spills and releases An essential resource for all those who are involved in the corrosion management of oil and gas infrastructure Corrosion Control in the Oil and Gas Industry provides engineers and designers with the tools and methods to design and implement comprehensive corrosion management programs for oil and gas infrastructures The book addresses all segments of the industry including production transmission storage refining and distribution Selects cost effective methods to control corrosion Quantitatively measures and estimates corrosion rates Treats oil and gas infrastructures as systems in order to avoid the impacts that changes to one segment if a corrosion management program may have on others Provides a gateway to more than 1 000 industry best practices and international standards Corrosion Inhibitors in the Oil and Gas Industry Viswanathan S. Saji, Saviour A.

Umoren, 2020-02-10 Provides comprehensive coverage of corrosion inhibitors in the oil and gas industries Considering the high importance of corrosion inhibitor development for the oil and gas sectors this book provides a thorough overview of the most recent advancements in this field It systematically addresses corrosion inhibitors for various applications in the oil and gas value chain as well as the fundamentals of corrosion inhibition and interference of inhibitors with co additives Corrosion Inhibitors in the Oil and Gas Industries is presented in three parts The first part on Fundamentals and Approaches focuses on principles and processes in the oil and gas industry the types of corrosion encountered and their control methods environmental factors affecting inhibition material selection strategies and economic aspects of corrosion The second part on Choice of Inhibitors examines corrosion inhibitors for acidizing processes inhibitors for sweet and sour corrosion inhibitors in refinery operations high temperature corrosion inhibitors inhibitors for challenging corrosive environments inhibitors for microbiologically influenced corrosion polymeric inhibitors vapor phase inhibitors and smart controlled release inhibitor systems The last part on Interaction with Co additives looks at industrial co additives and their interference with corrosion inhibitors such as antisclalants hydrate inhibitors and sulfide scavengers Presents a well structured and systematic overview of the fundamentals and factors affecting corrosion Acts as a handy reference tool for scientists and engineers working with corrosion inhibitors for the oil and gas industries Collectively presents all the information available on the development and application of corrosion inhibitors for the oil and gas industries Offers a unique and specific focus on the oil and gas industries Corrosion Inhibitors in the Oil and Gas Industries is an excellent resource for scientists in industry as well as in academia working in the field of corrosion protection for the oil and gas sectors and will appeal to materials scientists

electrochemists chemists and chemical engineers Metallurgy and Corrosion Control in Oil and Gas Production Robert Heidrich,2018-09-17 Details the proper methods to assess prevent and reduce corrosion in the oil industry using today s most advanced technologies This book discusses upstream operations with an emphasis on production and pipelines which are closely tied to upstream operations It also examines protective coatings alloy selection chemical treatments and cathodic protection the main means of corrosion control The strength and hardness levels of metals is also discussed as this affects the resistance of metals to hydrogen embrittlement a major concern for high strength steels and some other alloys It is intended for use by personnel with limited backgrounds in chemistry metallurgy and corrosion and will give them a general understanding of how and why corrosion occurs and the practical approaches to how the effects of corrosion can be mitigated Metallurgy and Corrosion Control in Oil and Gas Production Second Edition updates the original chapters while including a new case studies chapter Beginning with an introduction to oilfield metallurgy and corrosion control the book provides in depth coverage of the field with chapters on chemistry of corrosion corrosive environments materials forms of corrosion corrosion control inspection monitoring and testing and oilfield equipment Covers all aspects of upstream oil and gas production from downhole drilling to pipelines and tanker terminal operations Offers an introduction to corrosion for entry level corrosion control specialists Contains detailed photographs to illustrate descriptions in the text Metallurgy and Corrosion Control in Oil and Gas Production Second Edition is an excellent book for engineers and related professionals in the oil and gas production industries It will also be an asset to the entry level corrosion control professional who may have a theoretical background in metallurgy chemistry or a related field but who needs to understand the practical limitations of large scale industrial operations associated with oil and gas production *Basics of Corrosion in Oil and Gas Industry: Corrosion Science, Forms, Monitoring, and Control*. Yasser Kassem,2019-01-08 This book is the starting point for junior corrosion engineers or beginners in corrosion studying The book is also very useful for senior corrosion technicians where it provides the basics of corrosion theory corrosion forms corrosion monitoring and corrosion control methods The book is based on NACE basic corrosion course with many additional explanations and illustrations The book also include the basic of metallurgy necessary for corrosion engineers and technicians *Corrosion Protection in the Oil and Gas Industry* J. M. Leeds,198? Metallurgy and Corrosion Control in Oil and Gas Production Robert Heidrich,2010-12-01 This book is intended for engineers and related professionals in the oil and gas production industries It is intended for use by personnel with limited backgrounds in chemistry metallurgy and corrosion and will give them a general understanding of how and why corrosion occurs and the practical approaches to how the effects of corrosion can be mitigated It is also an asset to the entry level corrosion control professional who may have a theoretical background in metallurgy chemistry or a related field but who needs to understand the practical limitations of large scale industrial operations associated with oil and gas production While the may use by technicians and others with limited formal technical training it will be written on a level intended for

use by engineers having had some exposure to college level chemistry and some familiarity with materials and engineering design

Production Chemicals for the Oil and Gas Industry Malcolm A. Kelland, 2014-03-13 This text discusses a wide variety of production chemicals used by the oil and gas industry for down hole and topside applications both onshore and offshore It reviews all past and present classes of production chemicals providing numerous difficult to obtain references Unlike other texts that focus on how products perform in the field this book focuses on the specific structures of chemicals that are known to deliver the required or desired performance Where known it also details the environmental aspects of the chemicals discussed and their success in the field

Corrosion Protection for the Oil and Gas Industry Mavis Sika Okyere, 2019-02-14 Corrosion Protection for the Oil and Gas Industry Pipelines Subsea Equipment and Structures summarizes the main causes of corrosion and requirements for materials protection selection of corrosion resistant materials and coating materials commonly used for corrosion protection and the limitations to their use application and repair This book focuses on the protection of steels against corrosion in an aqueous environment either immersed in seawater or buried It also includes guidelines for the design of cathodic protection systems and reviews of cathodic protection methods materials installation and monitoring It is concerned primarily with the external and internal corrosion protection of onshore pipelines and subsea pipelines but reference is also made to the protection of other equipment subsea structures risers and shore approaches Two case studies design examples and the author's own experiences as a pipeline integrity engineer are featured in this book Readers will develop a high quality and in depth understanding of the corrosion protection methods available and apply them to solve corrosion engineering problems This book is aimed at students practicing engineers and scientists as an introduction to corrosion protection for the oil and gas industry as well as to overcoming corrosion issues

Combating the Silent Threat Jacks, 2024-06-22 Combating the Silent Threat Internal Corrosion Control in Oil Gas Pipelines delves into the unseen enemy that plagues the oil and gas industry internal corrosion of pipelines This insidious process weakens pipelines from the inside out posing a significant threat to safety the environment and operational efficiency The book equips you with the knowledge to combat this silent threat You'll gain a comprehensive understanding of the different types of internal corrosion the factors that contribute to their development and the most effective strategies for prevention and mitigation Combating the Silent Threat explores various non destructive testing NDT techniques to identify corrosion early before it leads to catastrophic failures Additionally the book provides insights into industry standards and regulations for pipeline integrity management Whether you're a pipeline engineer inspector or technician this book is a critical resource for safeguarding the integrity of oil and gas pipelines

Corrosion in the Petrochemical Industry, Second Edition, 2015-12-01 Originally published in 1994 this second edition of Corrosion in the Petrochemical Industry collects peer reviewed articles written by experts in the field of corrosion that were specifically chosen for this book because of their relevance to the petrochemical industry This edition expands coverage of the different forms of corrosion including the

effects of metallurgical variables on the corrosion of several alloys It discusses protection methods including discussion of corrosion inhibitors and corrosion resistance of aluminum magnesium stainless steels and nickels It also includes a section devoted specifically to petroleum and petrochemical industry related issues **Corrosion Control in Petroleum**

Production Harry G. Byars,1999-01-01 *Oil and Gas Corrosion Prevention* James G. Speight,2014-03-13 According to NACE National Association of Corrosion Engineers the total annual cost of corrosion in petroleum refining takes up 3 7 billion in the US alone Corrosion control is always a challenge for the downstream industry but as the quality of feedstock is declining due to refineries accepting more of the heavy and shale gas and oil resources that are more readily available today refinery managers petroleum and natural gas engineers are unprepared for the new set of corrosion problems that are showing up in their equipment and processing units Oil and Gas Corrosion Prevention From Surface Facilities to Refineries quickly gets the engineer and manager up to speed on the latest types of corrosion common for these lower grade crude oils and gases as well as the best prevention methods for all of the major sections of the refinery especially desalting and sulfur recovery units which are the most common problem areas for unconventional feedstocks Also covering the unique midstream sections or point of entry to the refinery as well as the major critical refinery equipment Oil and Gas Corrosion Prevention From Surface Facilities to Refineries offers the perfect quick cross reference for the oil and gas community Gets engineers and managers up to speed on the latest types of corrosion common for lower grade crude oils and gases Provides the best prevention methods for all of the major sections of the refinery especially desalting and sulfur recovery units Covers additional topics such as unique midstream sections or point of entry to the refinery as well as major critical refinery equipment *Guidance for Corrosion Management in Oil and Gas Production and Processing* ,2019 *Aspects of Co2 Corrosion in Oil and Gas Industry* Migahed Mohamed,Al-Sabagh a M,Attya M M,2015-12-08 Natural gas is most likely contains carbon dioxide as part from reservoir fluid composition on other hand CO2 can be injected for enhanced oil recovery purposes As such corrosion control in carbon dioxide containing media is area of concern for oil field industries Process operating parameters especially temperature pressure and fluid composition are generally contributing to corrosion behavior for such conditions Extensive investigation studies had been carried out to understand and control CO2 corrosion CO2 dissolves in oil wells produced water forming carbonic acid which in turn dissociates and decrease the solution pH The nature of oxide passive film resulted from a corrosion process contributes to the overall behavior of it as well as temperature and chemical composition of the aqueous media Surfactants are most likely corrosion inhibitors employed in the petroleum industry to protect iron and steel equipment used in drilling production transport and refining of hydrocarbons The efficiency of the applied corrosion inhibitor depends on its concentration and stability of the formed inhibition film on metal surface

Trends in Oil and Gas Corrosion Research and Technologies A. M. El-Sherik,2017-06-09 Trends in Oil and Gas Corrosion Research and Technologies Production and Transmission delivers the most up to date and highly multidisciplinary

reference available to identify emerging developments fundamental mechanisms and the technologies necessary in one unified source Starting with a brief explanation on corrosion management that also addresses today s most challenging issues for oil and gas production and transmission operations the book dives into the latest advances in microbiology influenced corrosion and other corrosion threats such as stress corrosion cracking and hydrogen damage just to name a few In addition it covers testing and monitoring techniques such as molecular microbiology and online monitoring for surface and subsurface facilities mitigation tools including coatings nano packaged biocides modeling and prediction cathodic protection and new steels and non metallics Rounding out with an extensive glossary and list of abbreviations the book equips upstream and midstream corrosion professionals in the oil and gas industry with the most advanced collection of topics and solutions to responsibly help solve today s oil and gas corrosion challenges Covers the latest in corrosion mitigation techniques such as corrosion inhibitors biocides non metallics coatings and modeling and prediction Solves knowledge gaps with the most current technology and discoveries on specific corrosion mechanisms highlighting where future research and industry efforts should be concentrated Achieves practical and balanced understanding with a full spectrum of subjects presented from multiple academic and world renowned contributors in the industry **Corrosion Control Handbook** ,1970 *Petroleum Abstracts* ,1997 Corrosion Control in Petroleum Production National Association of Corrosion Engineers,1979-01-01

Corrosion and Materials Selection Alireza Bahadori,2014-08-11 The petroleum and chemical industries contain a wide variety of corrosive environments many of which are unique to these industries Oil and gas production operations consume a tremendous amount of iron and steel pipe tubing pumps valves and sucker rods Metallic corrosion is costly However the cost of corrosion is not just financial Beyond the huge direct outlay of funds to repair or replace corroded structures are the indirect costs natural resources potential hazards and lost opportunity Wasting natural resources is a direct contradiction to the growing need for sustainable development By selecting the correct material and applying proper corrosion protection methods these costs can be reduced or even eliminated This book provides a minimum design requirement for consideration when designing systems in order to prevent or control corrosion damage safely and economically and addresses Corrosion problems in petroleum and chemical industries Requirements for corrosion control Chemical control of corrosive environments Corrosion inhibitors in refineries and petrochemical plants Materials selection and service life of materials Surface preparation protection and maintainability Corrosion monitoring plant inspection techniques and laboratory corrosion testing techniques Intended for engineers and industry personnel working in the petroleum and chemical industries this book is also a valuable resource for research and development teams safety engineers corrosion specialists and researchers in chemical engineering engineering and materials science The Oil and Gas Journal ,1929

Corrosion Control In The Oil And Gas Industry: Bestsellers in 2023 The year 2023 has witnessed a remarkable surge in literary brilliance, with numerous captivating novels captivating the hearts of readers worldwide. Lets delve into the realm of bestselling books, exploring the fascinating narratives that have enthralled audiences this year. The Must-Read : Colleen Hoover "It Ends with Us" This heartfelt tale of love, loss, and resilience has captivated readers with its raw and emotional exploration of domestic abuse. Hoover expertly weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can succeed. Uncover the Best : Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This intriguing historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids captivating storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Discover the Magic : Delia Owens "Where the Crawdads Sing" This captivating coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens weaves a tale of resilience, survival, and the transformative power of nature, entrancing readers with its evocative prose and mesmerizing setting. These top-selling novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of compelling stories waiting to be discovered. The novel begins with Richard Papen, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is a masterful and thrilling novel that will keep you guessing until the very end. The novel is a cautionary tale about the dangers of obsession and the power of evil.

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