Minutes of EFC WP 15
Corrosion in the Refinery and Petrochemical Industry

Hybrid: Lille (France) and Zoom

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Acknowledgement
The EFC WP 15 Refinery Corrosion Group would like to express thanks to Nalco Ecolab Anios for hosting this meeting in Lille with special thanks to Valerie Beucler for organizing the meeting.

Content

1 WELCOME

Valerie Beucler welcomed the participants and Francois Ropital opened the meeting.

64 persons attended this meeting (19 face to face and 45 remote). The list of participants is enclosed in Appendix 1.

2 EFC WP 15 ACTIVITIES

2.1 EFC WP 15 activities And Minutes of Meetings

Information on the activities of EFC WP 15, was presented by Francois Ropital. This information can also be found on the EFC web site where the minutes of previous WP15 meetings can be consulted and downloaded. More information is enclosed in Appendix 2.
https://efcweb.org/WP15.html

EFC hub platform:
EFC launches a web platform to share information and collaborative works. The web link is https://efc.solved.fi/activities/wp/list. 92 WP15 members joined the platform. In this platform news on the activities of WP15 and collaborative works (such as publication of EFC green books) will be shared. Every person interested by WP15 activities are welcome to join this platform.

2.2 Publications from WP15

Available revision of publications:

The third revision of the EFC Guideline 55 “Corrosion under insulation” is achieved and the book is available since August 2020 :
https://www.elsevier.com/books/corrosion-under-insulation-cui-guidelines/de-landtsheer/978-0-12-823332-0.

Revision of the EFC Guideline 46 “Amine units corrosion in refineries”. This revision takes place in the frame of a joint WP13-15 task force. The book is available.
https://www.elsevier.com/books/corrosion-in-amine-treating-units/van-roij/978-0-323-91549-6

Advancement on a new guideline on corrosion in sea water cooling systems:

Valerie Beucler reported on the advancement of the guideline. A draft issue has been sent to the publisher Elsevier mid-March. The table of contents with the chapters contributors is enclosed in Appendix 2. The book is expected to be available at the beginning of 2024. Antoine Surbled is doing an important work to homogenize the guideline and we express all our special thanks for his great contribution.

2.3 EUROCORR 2023

Eurocorr 2023 “Closing the gap between industry and academia in corrosion science and prediction” will take place in Brussels, Belgium from 27 to 31 August.
A session dealing on corrosion in the refinery and petrochemistry will take place on Monday 28 August.
A joint session on “corrosion in biorefineries” with the Task Force “Corrosion in low carbon and green energy technologies” will take place on Thursday 31 August morning.
The conference program will be soon online. More information is available via the web link:
https://www.eurocorr2023.org/

2.4 EUROCORR 2024

Eurocorr 2024 will take place in Paris, France from 1 to 4 September 2024.

2.5 EUROCORR 2025

Eurocorr 2025 will take place in Stavanger, Norway from 7 to 11 September 2025.

2.6 Next 2023 WP15 full meeting

The annual WP15 full meeting will take place during the Eurocorr 2023 on Tuesday 29 August from 10h to 16h in Brussels Square Conference Center. The technical possibility to have an hybrid meeting will be investigated.

3 CORROSION UNDER INSULATION

Chabel Insulation System
Laurent Eckebus presented the flexible thermal insulation material (CTP) developed by Chabel to avoid water penetration in CUI systems. It allows closures around tubs, T pieces, valves and it can be reusable. Examples of application in Shell Pernis, Dalamine plants and results of tests in Sitech facilities have been given. The fire resistance, reuse, adhesion properties have been discussed. More information can be found in Appendix 3.

Potential of distributed fibre optic sensing for corrosion monitoring
The optic fibre technology developed by FLUVES was detailed by Thomas Van Hoestenberghe. It does not evaluate the corrosion rate, but the environmental conditions of CUI (vibrations, temperature) and indicate potential location of active corrosion. The fibre can be placed on the outside of the cladding. More information can be found in Appendix 4.

Copsys Intelligent Digital Skin
The coating with an integrated impressed current cathodic protection (ICCP) developed by Copsys was presented by Michael Maguire (Currach Consulting Ltd). The combination of an advanced polymer, electronic and digital technologies can detect and locate coating barrier damages. ICCP can prevent corrosion even after barrier system failures. Field trials were launched in Holyrood Marine Base (Canada) including thermal cycling. More information can be found in Appendix 5.

CUI monitoring of a Heat Exchanger: Case Study
Philip Enegela (Ineos) presented the application of Corrosion Radar® moisture and corrosion sensing device in an Ineos heat exchanger. A trial tests campaign was performed and water had been detected and localized in the heat exchanger insulation. More information can be found in Appendix 6.

Sirris Joint Industrial Project on CUI
The progress and the objectives of this JIP have been presented by Jeroen Tacq. In order to evaluate coating, insulation and sensors, Sirris developed tests equipment. Monitoring techniques such as Fluves optic fibres and I-Senspro electrical capacitance are tested. Some results of the influence of thermal cycling, location of water retention are reported in Appendix 7.

Recent development of CUI management
Geert Henk Wijnants detailed the World Class Maintenance roadmap for CUI management: best practises, tools for implementation, gap analysis for optimisation. Actions are ongoing to develop decision tool based on inspection costs, built a database with CUI related incidents, establish a coating monitoring program, develop a cost-effective moisture monitoring program, extend the application of the CINI standard. The development of a CUI ecosystem was also discussed. More information can be found in Appendix 8.

Revision of the EFC 55 CUI guideline
Gino de Landtsheer gave some information about the current status of the draft version of the EFC publication 55 about CUI.

A new collaboration platform (via Google drive) has been established since August 2022, to allow to work together on the different chapters of the CUI publication.

At the moment of this meeting, only some reviews and comments were implemented by Henk Wijnants.
People who were interested to collaborate in this publication (since Eurocorr 2022) have all received the applicable access links to the chapters of their interest.

A second request for participation was raised during this meeting, and in the meantime also the access links were provided to Fluves.

It is also highlighted that a new specific chapter regarding sensor techniques will be created (chapter 9 – or maybe we need to re-number the chapters for a better integration). All sensor developers should participate in this to have a full coverage of the current technology available on the market.

4 COATING

Phencote® protective coating for heat exchanger internal tubes protection from corrosion and fouling
Lorenzo Comel (GMA) presented the Phencote epoxy coating that can protect heat exchangers internal tubes (diameter > 13 mm and tube length < 25 m) for temperatures up to 180°C. The coating has a positive effect on thermal exchanges. Examples of condensers protection against corrosion, erosion, fouling were discussed. More information can be found in Appendix 9.

HVTS solution to upgrade existing metallurgy to higher alloys against corrosion and/or erosion
Some application of high velocity thermal spray (HVTS) coating developed by IGS were presented by Ghalem Roguieg: protection of a de-ethanizer column (against sulfide stress corrosion cracking SSC), DGA amine stripper column, delayed coker fractionation column. More information can be found in Appendix 10.

5 HIGH TEMPERATURE HYDROGEN ATTACK

Effect of temperature instability on Nelson curves
Henke Helle presented some calculation on the effect of temperature drops on the fugacity of hydrogen and methane and their effect on high temperature hydrogen attack (HTHA). A 30°K drop from 580°K and 0,00045 w% hydrogen leads to the methane void pressure increase from ~300 MPa to ~500 MPa. This phenomenon can be a cause of the Anacores Tesoro explosion. Temperature instabilities could probably reduce the incubation time of HTHA and lower the incubation threshold. A program of tests would be welcome to confirm this phenomenon. More information can be found in Appendix 11.

6 CORROSION IN BIOREFINERY PROCESSES

Corrosion case histories in biorefinery plants: from feedstock to reaction section
After an overview of the corrosive issues, corrosion cases were presented by Carlo Casu (IIS). A first case concerned an epoxy coating exfoliation in a used cooked oil tank that should be kept at 70°C. An epoxy phenolic coating is recommended. In a carbon steel pipeline transporting rapeseed/soybean oil at 50°C, pitting due to MIC was observed. A third failure case mentioned a chloride SCC of a 304L piping from HPO_3-NaOH pre-treatment plant. Another chloride SCC failure was reported on a heat exchanger tube in the stripper section of a hydro-processing plant. In another hydroprocessing plant, the use of a 304 instead of 316L filler materials, lead to the selective corrosion of a weld in a pipe between the furnace and the reactor. More information can be found in Appendix 12.

Solutions to renewable processing challenges
Alberto Ribès presented Nalco mitigation strategy based on inhibitor and metallurgy selections to avoid ammonium chloride salts corrosion and alkaline stress corrosion cracking in HVO coprocessing FCC units. More information can be found in Appendix 13.

Bio oils / vegetable oils hydroprocessing, possible impacts on corrosion
Joan de la Paz (Baker Hughes) gave an overview of the corrosion challenges in hydroprocessing units of renewable diesel plants: organic fouling, high TAN and acid corrosion, carbonate stress corrosion cracking, organic acids in waste waters. More information can be found in Appendix 14.

Update on RISE member program: MRC Corrosion in Biorefinery Production
Rikard Norling gave information on the advancement of RISE member program on corrosion in biorefinery. A first Work Package concerns the influence of ammonium chloride on the corrosion resistance of large panel of alloys. More information can be found in Appendix 15.

Discussion on published data on corrosion rate processing biofuels
From the discussion it appeared that at the present time, very few information is available. API 581 on RBI does not face the question and it seems that this topic is not part of the MTI project on corrosion in bio-oils. The topic could be integrated in an European project and will be further discussed during the next WP15 meeting or in side lines of Eurocorr 2023 in Brussels. Also, as plastic recycling will issue new corrosive environments and challenge, this topic could be included in the round table.

7 CO_2 SPECIFICATION

After an overview of the corrosion issues by Ludovic Gaillot (TotalEnergies) a discussion on CO_2 specification for storage took place by sharing feedbacks for refinery companies' representatives. More information can be found in Appendix 16.

8 CORROSION MANAGEMENT

To conclude the meeting, Alec Groysman gave a brilliant presentation on how to manage corrosion situation in oil refining and petrochemistry. More information can be found in Appendix 17.

9 NEXT MEETINGS

2023 Autumn Full WP 15 Meeting:
This meeting will take place in Brussels Square Conference Center during the Eurocorr 2023 on Tuesday 29 August from 10h to 16h (the technical possibility to have an hybrid meeting has to be confirmed).

2024 Spring WP15 Meeting:
The form of this meeting will discuss during the 2023 Autumn Full WP 15 Meeting.