

Oilfield Chemistry and Corrosion

Calendar: 4th day semester

Contact Hours: TP 45,0h; OT 7,5h

Scientific Area: Chemical and Industrial Engineering

Intended learning outcomes (knowledge, skills and competences to be developed by the students):

This curricular unit will give students a thorough introduction to the fundamental principles of oilfield chemistry and corrosion. On completion of this module, students should be able to:

- a) Explain the properties and application of a range of chemicals used in the oilfield, namely in corrosion control for oil and gas production
- b) Understand the principal theories of corrosion science and engineering, with particular reference to the oil and gas industry.

Syllabus:

- 1 - Fundamentals of oilfield chemistry including corrosion chemistry, water injection chemicals.
- 2 – Oilfield chemical products: stimulation products, drilling fluids, production chemicals, cementing chemicals, and enhanced oil recovery products.
- 3 - Oilfield chemical raw materials: Commodity Chemicals (Cement, Barite, Bromine Compounds, Acids, Calcium Chloride, Clays), Specialty Chemicals (Surfactants) Polymers (Cellulose Polymers, Natural Gums, Guar Gum, Xanthan Gum, Polyacrylamides), gases (nitrogen, carbon dioxide) and other raw materials.
- 4 - Thermodynamics of electrochemical corrosion: Pourbaix and Evans diagrams, electrochemical reactions, polarization and corrosion rate calculation and measurement. Corrosion tests and standards.
- 5 - Classification of corrosion: General corrosion, localized corrosion, MIC, FAC, SCC, CO₂ and H₂S corrosion
- 6 - Introduction to coating and corrosion protection

7 - Pipeline materials and corrosion resistant alloys

Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:

Considering the fundamental objective of this curricular unit it was divided into two major parts, a first one where it is expose the properties and application of a range of chemicals used in the oilfield, and another one where it is expose the main theories of corrosion science and engineering, with special reference to oil and gas.

In chapter 2 and 3, the physicochemical properties of the raw materials resulting from the exploitation of oil and gas will be described, together with physico-chemical properties and functions of several chemicals used in the various operations of extraction / exploitation of a field oil.

The remaining chapters (chapters 4, 5, 6 and 7) will be devoted to corrosion, a sourced primarily by the aforementioned problematic chemicals. Thus, in chapter 4 it will be shown the thermodynamic principles of corrosion phenomenon, as well as determination (measurement and calculation) of corrosion rates. In the 5th chapter will describe what types of corrosion, and finally in chapters 6 and 7 a brief introduction to the techniques of protection against corrosion and selection of alloys for use in pipelines.

References:

- [1] Johannes Fink, "Oil field chemicals", Gulf Professional Pub., ISBN 0750677031
- [2] Nestor Perez, "Electrochemistry and corrosion science", Kluwer Academic, 2004. ISBN: 1402077440
- [3] David E. J. Talbot, James D. R. Talbot "Corrosion science and technology", CRC Press, 2007, ISBN 9780849392481
- [4] Robert Baboian, "Corrosion tests and standards: application and interpretation", ASTM International, 2005
- [5] Pierre R. Roberge, "Handbook of corrosion engineering", McGraw-Hill, 2000, ISBN: 0070765162
- [6] Mars G. Fontana, "Corrosion engineering", McGraw-Hill, 1967, ISBN: 007021460