# COURSE OVERVIEW FE0077
# Material Selection & Properties

**Course Title**
Material Selection & Properties

**Course Date/Venue**
Please refer to page 3

**Course Reference**
FE0077

**Course Duration/Credits**
Five days/3.0 CEUs/30 PDHs


**Course Description**

***This practical and highly-interactive course includes various practical sessions and exercises. Theory learned will be applied using our state-of-the-art simulators.***

This course is designed to provide participants with a detailed and up-to-date overview of Material Selection & Properties. It covers the importance of material selection in engineering maintenance; the types of engineering materials; the physical properties, mechanical properties and metallurgical and chemical properties of materials; the importance in ensuring material quality and performance according to relevant standards like ASTM/NACE/API; the application in design and construction of refinery equipment using API and ASME construction codes; the process units and operating parameters as well as corrosive species in refinery operations; the behavior of materials in various environments; and the degradation mechanisms in the oil and gas industry.

During this interactive course, participants will learn the different types of corrosion and corrosion morphology; the corrosion inhibitors and protective coatings using corrosion control methods; the principles of cathodic protection and criteria for selecting materials based on corrosion resistance; the standards and testing for corrosion control; the properties of carbon steel (CS) and low alloy steel (LAS), stainless steels, nickel base alloys, copper base alloys and titanium alloys; the comparative analysis of materials; and the material failures and the principles of failure analysis.

By the end of the training, participants will demonstrate clear understanding of various engineering materials used in refinery services, their properties and corrosion behavior with relevance to international codes and standards.

## Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain a comprehensive knowledge in material selection and properties
- Identify the types of engineering materials as well as determine physical properties, mechanical properties and metallurgical and chemical properties of materials
- Ensure material quality and performance according to relevant standards like ASTM/NACE/API
- Apply design and construction of refinery equipment using API and ASME construction codes
- Identify process units and operating parameters as well as corrosive species in refinery operations
- Explain the behavior of materials in various environments and degradation mechanisms in the oil and gas industry
- Recognize the different types of corrosion and corrosion morphology
- Apply corrosion inhibitors and protective coatings using corrosion control methods
- Understand the principles of cathodic protection and criteria for selecting materials based on corrosion resistance
- Apply standards and testing for corrosion control as well as discuss the properties of carbon steel (CS) and low alloy steel (LAS), stainless steels, nickel base alloys, copper base alloys and titanium alloys
- Carryout comparative analysis of materials and analyze material failures including its causes and prevention
- Develop steps in conducting a failure analysis of metal using proper tools and techniques like fractography and metallography
- Evaluate material performance and analyze life cycle cost in material selection

## Exclusive Smart Training Kit - H-STK®


*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

## Who Should Attend

This course provides an overview of all significant aspects and considerations of material selection and properties for mechanical, metallurgical and chemical engineers with one/two years of relevant experience in QA and maintenance. The course is also beneficial for experienced engineers, it would be refreshing and upscaling their skills.

## Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

## Course Date/Venue

| Session(s) | Date | Venue |
|---|---|---|
| 1 | August 31- September 04, 2025 | Safir Meeting Room, Divan Istanbul, Taksim, Turkey |
| 2 | October 19-23, 2025 | Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE |
| 3 | November 23-27, 2025 | Crowne Meeting Room, Crowne Plaza Al Khobar, an IHG Hotel, Al Khobar, KSA |
| 4 | December 15-19, 2025 | Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE |

## Course Fee

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|---|---|
| Istanbul | **US$ 6,000** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day. |
| Dubai/Al Khobar/Abu Dhabi | **US$ 5,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day. |

## Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

## Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

## Certificate Accreditations

Haward's certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

**Course Instructor(s)**

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

**Dr. Tony Dimitry**, PhD, MSc, BSc, is a **Senior Corrosion & Metallurgical Engineer** with over **30 years** of industrial experience. His expertise covers **Corrosion** Prevention, **Cathodic Protection** Systems, **Corrosion Control**, **Corrosion Inhibition**, **Corrosion** Management in Process Operations, **Corrosion** Engineering, **Metallurgical** Failure Analysis & Prevention, **Fabrication & Repair**, **Corrosion** & Prevention of Failures, **Material** Selection, **Welding** Technology, **Welding Defects** Analysis, **Brazing/Soldering**, **Steel Manufacturing**, **Facility Integrity**, **Ladle Furnace Treatment**, **Ferro-Alloys Production**, **Tank Farm & Tank Terminal Safety**, Integrity Management, Fitness-for-Service (**FFS**), Process Plant Equipment, **Pressure Vessels**, **Piping & Storage Facilities**, Piping **Vibration** Analysis & Practical Engineering Solutions, Remaining Life Assessment & Repair of **Pressure Equipment & Piping**, **Pipeline** Operations & Maintenance, Gas Transportation Piping Code, **Maintenance** Management, **Reliability** Management, **Rotating Equipment**, **Static Equipment**, **Failure Analysis**, **FMEA** and **Preventive & Predictive** Maintenance. Currently, he is in charge of the **metallurgical failure analysis** and the usage of fracture mechanics for determining crack propagation in impellers of turbines.

During his career life, Dr. Dimitry held a significant position such as the **Operations Engineers**, **Technical Trainer**, **HSE Contracts Engineer**, **Boilers Section Engineer**, **Senior Engineer**, **Trainee Mechanical Engineer**, **Engineer**, **Turbines Section Head**, **Professor**, **Lecturer/Instructor** and **Teaching Assistant** from various multinational companies like **Chloride Silent Power Ltd.**, **Technical University of Crete**, **National Nuclear Corporation**, **UMIST Aliveri Power Station** and **HFO Fired Power Station**.

Dr. Dimitry has **PhD**, **Master** and **Bachelor** degrees in **Mechanical Engineering** from the **Victory University of Manchester** and the **University of Newcastle**, **UK** respectively. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and an associate member of the American Society of Mechanical Engineers (**ASME**) and Institution of Mechanical Engineers (**IMechE**). He has further delivered various trainings, seminars, courses, workshops and conferences internationally.

## Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

***Day 1***

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| *0730 – 0800* | *Registration & Coffee* |
| *0800 – 0815* | *Welcome & Introduction* |
| *0815 – 0830* | ***PRE-TEST*** |
| *0830 - 0930* | ***Types of Engineering Materials***<br>*Metals: Ferrous and Non-Ferrous • Non-Metals: Polymers, Ceramics, Composites • Special Materials: Smart Materials and Nanomaterials* |
| *0930 - 0945* | *Break* |
| *0945 - 1200* | ***Physical Properties of Materials***<br>*Density, Melting Point, Thermal Conductivity, Electrical Conductivity • Examples and Applications in Refinery Services* |
| *1200 – 1300* | ***Mechanical Properties of Materials***<br>*Strength, Hardness, Toughness, Ductility, Fatigue Resistance • Testing Methods: Tensile Testing, Hardness Testing, Impact Testing* |
| *1300 - 1315* | *Break* |
| *1315 – 1345* | ***Metallurgical & Chemical Properties***<br>*Phase Diagrams, Microstructure Analysis • Chemical Composition and Its Impact on Properties* |
| *1345 - 1420* | ***ASTM/NACE/API Standards***<br>*Overview of Relevant Standards • Importance in Ensuring Material Quality and Performance* |
| *1420 - 1430* | ***Recap***<br>*Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow* |
| *1430* | *Lunch & End of Day One* |

***Day 2***

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|---|---|
| *0730– 0830* | ***API & ASME Construction Codes***<br>*Overview of API and ASME Codes • Application in Design and Construction of Refinery Equipment* |
| *0830 – 0915* | ***Process Units & Operating Parameters***<br>*Major Process Units in Refineries: Distillation, Hydrocracking, Reforming, etc. • Key Operating Parameters: Temperature, Pressure, Flow Rates* |
| *0915 – 0930* | *Break* |
| *0930– 1100* | ***Corrosive Species in Refinery Operations***<br>*Common Corrosive Species: $H_2S$, $CO_2$, Water, Chlorides • Impact on Materials and Equipment* |
| *1100 – 1215* | ***Behavior of Materials in Various Environments***<br>*Atmospheric, Aqueous, Soil Environments • Effects of Acids, Alkalis and other Refinery Chemicals* |
| *1215 – 1230* | *Break* |
| *1230 – 1300* | ***API 571 - Damage Mechanisms***<br>*Overview of Degradation Mechanisms in the Oil & Gas Industry • Common Damage Types: Corrosion, Erosion, Fatigue* |

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| *1300 – 1420* | ***Case Studies on Material Performance***<br>*Real-world Examples of Material Performance and Failure • Lessons Learned and Best Practices* |
| *1420 – 1430* | ***Recap***<br>*Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow* |
| *1430* | *Lunch & End of Day Two* |

***Day 3***

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|---|---|
| *0730 – 0830* | ***Corrosion Fundamentals***<br>*Basic Principles of Corrosion • Types of Corrosion: Uniform, Galvanic, Pitting, Crevice, Intergranular* |
| *0830 – 0915* | ***Corrosion Morphology***<br>*Visual Identification of Different Corrosion Types • Microscopic Examination Techniques* |
| *0915 – 0930* | *Break* |
| *0930 – 1100* | ***Corrosion Control Methods***<br>*Design Considerations to Minimize Corrosion • Use of Corrosion Inhibitors and Protective Coatings* |
| *1100 – 1215* | ***Cathodic Protection Systems***<br>*Principles of Cathodic Protection • Types: Sacrificial Anode, Impressed Current Systems* |
| *1215 – 1230* | *Break* |
| *1230 – 1300* | ***Material Selection for Corrosion Resistance***<br>*Criteria for Selecting Materials Based on Corrosion Resistance • Examples of Materials Suitable for Different Corrosive Environments* |
| *1300 – 1420* | ***Standards & Testing for Corrosion Control***<br>*Relevant Standards: ASTM, NACE • Corrosion Testing Methods: Salt Spray, Immersion Tests* |
| *1420 – 1430* | ***Recap***<br>*Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow* |
| *1430* | *Lunch & End of Day Three* |

***Day 4***

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|---|---|
| *0730 – 0830* | ***Carbon Steel (CS) & Low Alloy Steel (LAS)***<br>*Properties, Advantages and Limitations • Applications in Refinery Services* |
| *0830 – 0915* | ***Stainless Steels***<br>*Types: Austenitic, Ferritic, Martensitic, Duplex • Properties and Applications* |
| *0915 – 0930* | *Break* |
| *0930 – 1100* | ***Nickel Base Alloys***<br>*Characteristics and Uses in High-Temperature and Corrosive Environments • Common Alloys: Inconel, Monel* |
| *1100 – 1215* | ***Copper Base Alloys***<br>*Properties and Applications in Heat Exchangers, Piping • Common Alloys: Brass, Bronze* |
| *1215 – 1230* | *Break* |

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|---|---|
| *1230 – 1300* | ***Titanium Alloys***<br>*Properties and Advantages in Corrosive Environments • Typical Applications in Refineries* |
| *1300 – 1420* | ***Comparative Analysis of Materials***<br>*Strengths and Weaknesses of Different Materials • Case Studies Comparing Material Performance in Similar Applications* |
| *1420 – 1430* | ***Recap*** |
| *1430* | *Lunch & End of Day Four* |

***Day 5***

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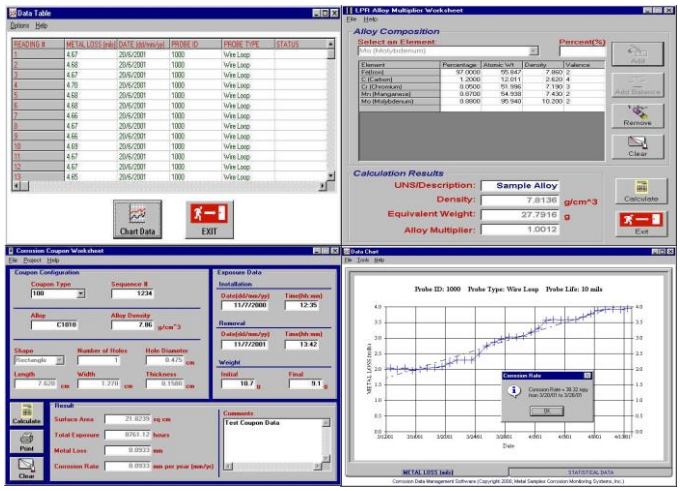
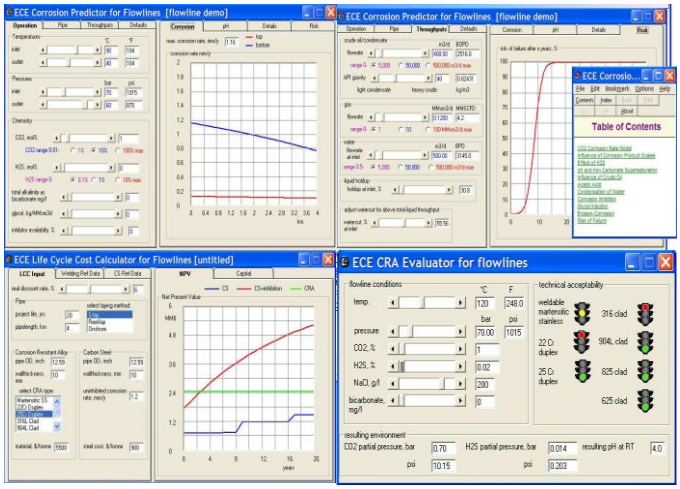
|---|---|
| *0730 – 0845* | ***Material Failures***<br>*Types of failures: Brittle, Ductile, Fatigue, Creep • Causes and Prevention* |
| *0845 – 0915* | ***Principles of Failure Analysis***<br>*Steps in Conducting a Failure Analysis • Tools and Techniques: Fractography, Metallography* |
| *0915 – 0930* | *Break* |
| *0930 – 1100* | ***Case Studies of Material Failures***<br>*Real-life Examples of Material Failures • Analysis of Failure Causes and Preventive Measures* |
| *1100 – 1215* | ***Evaluating Material Performance***<br>*Methods to Assess Material Performance in Service • Importance of Regular Inspection and Maintenance* |
| *1215 – 1230* | *Break* |
| *1230 – 1330* | ***Life Cycle Cost Analysis of Materials***<br>*Cost Considerations in Material Selection • Balancing Initial Costs with Long-Term Performance and Maintenance* |
| *1330 – 1420* | ***Course Conclusion***<br>*Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course* |
| *1420 - 1430* | ***POST-TEST*** |
| *1430* | *Lunch & End of Course* |

## Simulator (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the simulators "Corrosion Data Management Software (CDMS)" and "Electronic Corrosion Engineer (ECE®) 5".



**Corrosion Data Management Software (CDMS)**



**Electronic Corrosion Engineer (ECE®) 5**

## Course Coordinator

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