COURSE OVERVIEW FE1025
Metallography Interpretation

Course Title
Metallography Interpretation

Course Date/Venue
Please refer to page 3

Course Reference
FE1025

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 Metallography Interpretation. It covers the metallographic terminology and principles of microstructural examination; the sample selection and orientation, metallographic standards and guidelines and metallurgical structures; and the abrasive cutting methods, avoiding heat damage during sectioning, cutting speed and coolant use and safety considerations.

Further, the course will also discuss the mounting of samples, grinding procedures, polishing techniques and etching procedures; the documentation and archiving covering microstructural image capture methods, proper labeling of samples and images, digital storage and retrieval systems and linking results to material records; the optical microscopy, microscopy in metallography, image capture and calibration; and the quantitative grain size measurement, phase percentage determination and inclusion rating systems.

During this interactive course, participants will learn the microhardness testing and correlation and stereological techniques, heat treatment structures and deformation structures; welding metallography, casting metallography, corrosion-related structures and non-ferrous metallography; the failure analysis using metallography, inclusion rating and cleanliness assessment and coating and surface treatment evaluation; and the over-etching and misinterpretation, mistaking artifacts for microstructural features, incorrect grain size measurement and misidentifying phases.

Course Objectives

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

- Apply and gain an in-depth knowledge on metallography Interpretation
- Discuss metallography, metallographic terminology and the principles of microstructural examination
- Carryout sample selection and orientation and recognize metallographic standards and guidelines including metallurgical structures
- Apply abrasive cutting methods, avoiding heat damage during sectioning, cutting speed and coolant use and safety considerations
- Illustrate mounting of samples, grinding procedures, polishing techniques and etching procedures
- Carryout documentation and archiving covering microstructural image capture methods, proper labeling of samples and images, digital storage and retrieval systems and linking results to material records
- Apply optical microscopy, microscopy in metallography, image capture and calibration
- Recognize quantitative grain size measurement, phase percentage determination and inclusion rating systems
- Employ microhardness testing and correlation and stereological techniques as well as describe heat treatment structures and deformation structures
- Discuss welding metallography, casting metallography, corrosion-related structures and non-ferrous metallography
- Apply failure analysis using metallography, inclusion rating and cleanliness assessment and coating and surface treatment evaluation
- Avoid over-etching and misinterpretation, mistaking artifacts for microstructural features, incorrect grain size measurement and misidentifying phases

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 metallography interpretation for materials engineers and metallurgists, quality assurance and quality control personnel, failure analysis engineers, laboratory technicians and analysts, production and manufacturing engineers, research and development (R&D) scientists, technical inspectors and auditors.

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.

Accommodation

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

Course Date/Venue

Session(s)	Date	Venue
1	September 29-October 03, 2025	Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
2	October 05-09, 2025	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE
3	November 30-December 04, 2025	Meeting Plus 9, City Centre Rotana, Doha Qatar
4	December 14 - 18, 2025	Crowne Meeting Room, Crowne Plaza Al Khobar, an IHG Hotel, Al Khobar, KSA

Course Fee

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

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:

Mr. Greg Combrink, MSc, BSc, is a **Senior Corrosion Engineer** with over **30 years** of industrial experience within the **Oil**, **Gas**, **Petrochemical**, **Refinery**, **Utilities** and **Power** industries. His wide expertise widely covers in the areas of **Corrosion** Control & Monitoring, **Corrosion Inhibition**, **Inhibitor Effectiveness** Calculation, **Metallurgy**, **Corrosion Failure Investigation**, Environmental Testing for **Corrosivity Classification**, **Stress Corrosion Cracking** Investigations & Testing, **Corrosion** Testing & Evaluation, **Corrosion** Mitigation, **Corrosion & Cathodic** Protection Survey, **Corrosion & Material** Testing, **Corrosion Cracking** Investigations & Testing, **Corrosion** Prevention & Risk, **Cathodic Protection** Systems Design & Implementation, **Coating** Technology & Applications, **Coating** Inspection & Corrosion Mechanism, **Coating** Application & Quality Control, **Metal Casting** Technology, **Material Sustainability** Testing, **Material Selection** Testing, **Electrochemical & Exposure** Testing, Contamination Control of Lubricants/Fuels & Process Fluids, **Tribology & Lubrication**, Rust Removal, **NDT** Testing, Underground Minerals Corrosivity, Conventional & Air Spray Coating, Stainless Steel **Welded Tanks**, **Heat & Mass Transfer**, **Metal** Analysis and Friction Testing & Non-Skid Surfaces.

During his career life, Mr. Combrink has gained his practical and field experience through his various significant positions and dedication as the **CEO/Technical Director**, **Corrosion Engineering Director**, **Corrosion Engineer**, **Officer-in-Charge & General Manager**, **Technical Manager**, **Programme Manager**, **Corrosion Projects Manager**, **Corrosion Specialist**, **Metalworking Product Applications Engineer**, **Manager/Officer-In-Charge Materials Lab**, **Sub-Lieutenant**, **Senior Instructor/Trainer** and **Reactor Technician** for various companies such as the Corrosion Hub, Total Contamination Control SA (Pty) Ltd, Bora Corrosion Solutions, Solar Even Pty Ltd, University of Johannesburg, University of Witwatersrand, Castrol South Africa, Sa Navy, SA Police, Geyser Enode and Metal Casting Technology Station.

Mr. Combrink has a **Master's** degree in **Corrosion Science & Engineering** from the **University** of **Manchester Institute** of **Science** and **Technology** (**UMIST**), **UK** and a **Bachelor's** degree in **Chemical Engineering**. Further, he is an **Accredited Assessor & Moderator** from the South African Qualifications Authority (**SAQA**) and an **Accredited Assessor & Committee Member** (**Corrosion Protection**) from the South African Qualification & Certification Committee (**SAQCC**). He is also a **Fellow** from the Corrosion Institute Ghana (**CorrIGh**), an **Executive Committee Member/Former President** from the Corrosion Institute of Southern Africa (**CorrISA**) and a **Member** of the Southern African Institute of Tribology (**SAIT**) and has further delivered numerous trainings, courses, seminars, conferences and workshops globally.

Course Program

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

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Metallography*** *Definition & Objectives of Metallography • Historical Development of Metallographic Analysis • Role in Quality Control & Failure Investigation • Importance in Materials Science & Engineering*
0930 – 0945	*Break*
0945 – 1030	***Metallographic Terminology*** *Microstructure, Macrostructure and Grain • Phases, Constituents & Inclusions • Grain Boundaries & Dislocations • ASTM Grain Size Notation*
1030 – 1130	***Principles of Microstructural Examination*** *Light Optical Microscopy (LOM) Basics • Resolution & Magnification Principles • Interaction of Light with Metals • Importance of Sample Preparation*
1130 – 1215	***Sample Selection & Orientation*** *Sampling from Welds, Castings & Rolled Products • Representativeness of Samples • Orientation for Structural Features • Avoiding Sampling-Induced Artifacts*
1215 – 1230	*Break*
1230 – 1330	***Metallographic Standards & Guidelines*** *ASTM E3: Sample Preparation Guidelines • ASTM E407: Etching of Metals • ISO 643: Steels – Micrographic Determination • Common Industry-Specific Standards*
1330 – 1420	***Overview of Metallurgical Structures*** *Ferrite, Pearlite, Bainite, Martensite • Austenitic & Ferritic Stainless Steels • Non-Ferrous Alloy Structures • Cast versus Wrought Microstructures*
1420 – 1430	***Recap*** *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

0730 – 0830	***Sectioning & Cutting*** *Abrasive Cutting Methods • Avoiding Heat Damage During Sectioning • Cutting Speed & Coolant Use • Safety Considerations*
0830 - 0930	***Mounting of Samples*** *Hot Mounting (Thermosetting Resins) • Cold Mounting (Epoxy & Acrylic) • Transparency versus Opaque Mounts • Edge Retention Techniques*
0930 – 0945	*Break*
0945 – 1100	***Grinding Procedures*** *Sequential Grit Sizes • Avoiding Subsurface Deformation • Use of Water/Lubricant During Grinding • Checking Flatness During Preparation*

1100 – 1215	***Polishing Techniques*** *Mechanical Polishing Principles • Polishing Cloth Selection • Avoiding Relief & Pull-out • Cleaning Between Stages*
1215 – 1230	*Break*
1230 – 1330	***Etching Procedures*** *Purpose of Etching in Metallography • Chemical Etchants for Ferrous & non-Ferrous Metals • Electrolytic Etching Techniques • Common Problems & Troubleshooting*
1330 – 1420	***Documentation & Archiving*** *Microstructural Image Capture Methods • Proper Labeling of Samples & Images • Digital Storage & Retrieval Systems • Linking Results to Material Records*
1420 – 1430	***Recap*** *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

0730 – 0830	***Optical Microscopy*** *Bright-Field, Dark-Field & Polarized Light Techniques • Depth of Field & Contrast Enhancement • Adjusting Illumination for Clarity • Limitations of Optical Microscopy*
0830 – 0930	***Electron Microscopy in Metallography*** *SEM Principles & Applications • Secondary & Backscattered Electron Imaging • Sample Coating for Conductivity • Advantages over Optical Microscopy*
0930 – 0945	*Break*
0945 – 1100	***Image Capture & Calibration*** *Camera Systems for Metallography • Magnification Calibration Procedures • Image Resolution & Format Considerations • Common Image Distortions & Corrections*
1100 – 1215	***Image Analysis Software*** *Quantitative Grain Size Measurement • Phase Percentage Determination • Inclusion Rating Systems • Automated versus Manual Analysis*
1215 – 1230	*Break*
1230 – 1330	***Microhardness Testing & Correlation*** *Vickers & Knoop Microhardness Testing • Indentation Location & Preparation • Correlation with Microstructure • Interpreting Hardness Maps*
1330 – 1420	***Stereological Techniques*** *Measuring Grain Size (ASTM E112) • Volume Fraction Estimations • Mean Intercept Length Method • 2D to 3D Extrapolation Principles*
1420 – 1430	***Recap*** *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

0730 – 0830	***Heat Treatment Structures*** *Annealed & Normalized Microstructures • Quenched & Tempered Steels • Age-Hardening in Aluminum Alloys • Over-aging & Grain Coarsening*
0830 – 0930	***Deformation Structures*** *Cold-Worked Grain Elongation • Recovery & Recrystallization • Strain-Induced Martensite • Twinning in Metals*
0930 – 0945	*Break*
0945 – 1100	***Welding Metallography*** *Heat-Affected Zone (HAZ) Features • Solidification Structures in Weld Metal • Welding Defects (Porosity, Cracking) • Etching for Weld Microstructure*
1100 – 1215	***Casting Metallography*** *Dendritic Growth Patterns • Segregation & Microshrinkage • Inclusions & Porosity Analysis • Grain Refinement Evaluation*
1215 – 1230	*Break*
1230 – 1330	***Corrosion-Related Structures*** *Intergranular Corrosion Signs • Pitting Initiation & Propagation • Stress Corrosion Cracking • Corrosion Product Identification*
1330 – 1420	***Non-Ferrous Metallography*** *Aluminum Alloy Structures • Copper Alloys & Brass • Nickel-Based Superalloys • Titanium Alloy Microstructures*
1420 – 1430	***Recap*** *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 Four*

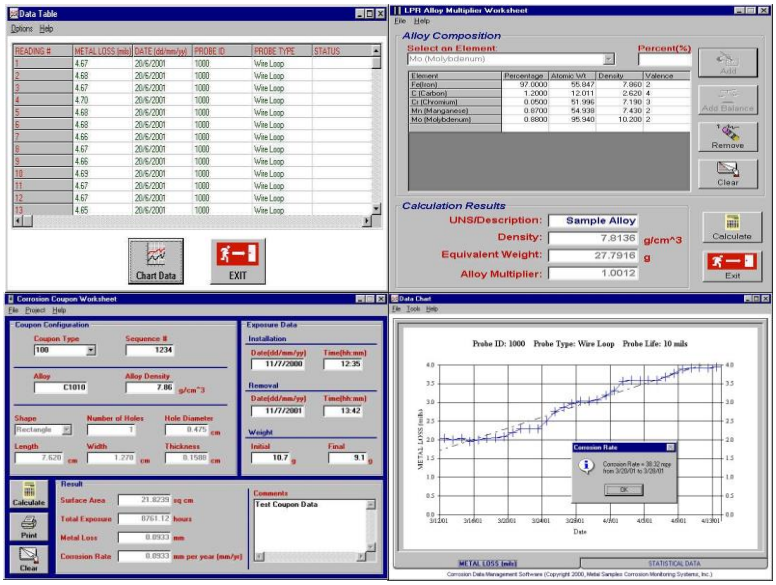
Day 5

0730 – 0830	***Failure Analysis Using Metallography*** *Role of Metallography in Root Cause Analysis • Identifying Fatigue, Creep & Wear Damage • Fracture Surface Microstructural Clues • Correlation with Mechanical Testing Results*
0830 – 0930	***Inclusion Rating & Cleanliness Assessment*** *ASTM E45 Inclusion Rating Methods • Sulfide, Oxide & Silicate Inclusions • Clean Steel Evaluation • Inclusion Effect on Mechanical Properties*
0930 – 0945	*Break*
0945 – 1100	***Coating & Surface Treatment Evaluation*** *Electroplated Coating Examination • Diffusion Coatings (Carburizing, Nitriding) • Thermal Spray Coatings • Coating Adhesion & Thickness Analysis*
1100 – 1215	***Case Studies in Metallographic Interpretation*** *Weld Failure Investigation • Heat-Treatment Process Validation • Casting Defect Analysis • Corrosion-Induced Failures*
1215 – 1230	*Break*

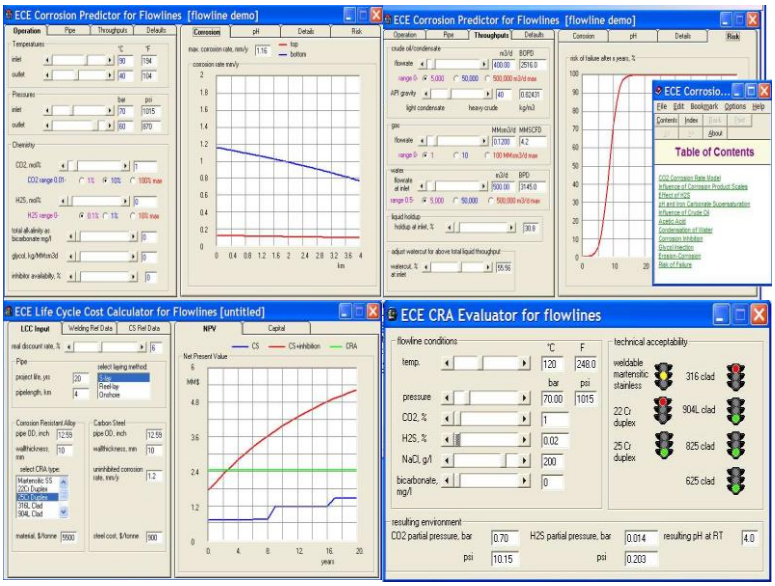
1230 – 1345	***Common Interpretation Errors*** *Over-Etching & Misinterpretation • Mistaking Artifacts for Microstructural Features • Incorrect Grain Size Measurement • Misidentifying Phases*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
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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