

# Metallurgy for Non - Metallurgists

Understanding the Practical Aspects of Metallurgy from the Expert!

Course Level : Basic

02<sup>nd</sup> - 06<sup>th</sup> December 2024 at Kuala Lumpur, Malaysia | 09<sup>th</sup> - 13<sup>th</sup> December 2024 at Bali, Indonesia



**Petrosync Distinguished Instructor**  
**M. El-Sayed Mahmoud Shama**

A lot of  
Practical Things,  
Case Studies  
and Exercises!

## International Certifications

- ▶ API 936 – Refractory Personnel - Certificate #52150
- ▶ API 510 – Authorized Pressure Vessel Inspector - Certificate #40900
- ▶ API 570 – Authorized Process Piping Inspector - Certificate #77129
- ▶ API 653 – Authorized Aboveground Storage Tank Inspector - Certificate #36169
- ▶ API 580 – Specialist Risk Based Inspection - Certificate #50552
- ▶ API 571 – Specialist Corrosion and Materials – Certificate #50434
- ▶ CSWIP 3.1 – Authorized Welding Inspector (TWI) – Certificate #16928
- ▶ CSWIP 3.2 – Senior Welding Inspector (TWI) – Certificate #29373
- ▶ ASNT Level II (RT, UT, MT and PT) – Certificate #C6000/101/115/120/124
- ▶ Qualified CSWIP BGAS Painting Inspector Grade 2

## PROGRAM SCHEDULE

08:00	Registration (Day1)
08:10 – 10:00	Session I
10:00 – 10:15	1 <sup>st</sup> Tea Break
10:15 – 12:00	Session II
12:00 – 13:00	Lunch Break
13:00 – 14:45	Session III
14:45 – 15:00	2 <sup>nd</sup> Tea Break
15:00 – 16:00	Session IV
16:00	End of Day

\*Schedule may vary for each training

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### Course Overview

Metal and its alloys has changed significantly in recent years, This training course will provide an integrated practical overview of metals and alloys and relating it to the mechanical and physical characteristics of metals; starting from materials testing and physical/mechanical properties, through corrosion properties and strength/deformation principals, and to ferrous and non-ferrous alloys and heat treatment. The course will then include ferrous alloys (plain and alloy steels, Stainless steels and cast irons) and non-ferrous alloys (for corrosion and high temperature applications, such as nickel, cobalt and titanium based alloys).

The nature of hot and cold working of metals and heat treatment, including annealing, normalizing, tempering and case hardening will be explained. The fundamentals of corrosion and corrosion prevention will also be presented in practical terms with examples to illustrate the key points.

The behavior of metals under various loading conditions (static, dynamic, fracture) will be presented and related to design methodology and procedures; rules of thumb, standards, and best industry practices.

Each of the major topics will be presented as individual units, and in the context of the overall usage of metal components and structures and failure mechanisms, and mechanical integrity.

### Course Objectives

Upon completion of this course, participants will have gained an understanding of the important principals of engineering involving properties and characteristics of metals and alloys, including fabrication and heat treatment of commercial steels and non-ferrous alloys. Participants will acquire sufficient knowledge and skills to independently evaluate possible metallurgical and design solutions, to recognize crucial metallurgical phenomena and intelligently discuss their metal problems with design engineers, metallurgists and fabricators.

Also they will able to understand how they will make right material selection decisions and how to protect metal from Corrosion and Erosion by Several ways as a recomeended Practise around oil and gas industries using Painting, coating, lining, Cathodic protection, Material selection, Improved design and Chemical inhibition.

Knowing the Type of corrosion on all the oil and gas and refinery facilities, and how to rectify and mitigate that Corrosion, and knowing also the Cathodic protection types, damage mechanisms on the refinery facilities, and ensuring that quality assurance standards and procedures are maintained.

### Who Should Attend?

This course is intended for those who use or supervise activities requiring the use of metal parts or structures. Those with little or no prior formal background who function as:

- ▶ Supervisors
- ▶ Engineers
- ▶ Planners
- ▶ Inspectors
- ▶ Designers
- ▶ Purchasers
- ▶ Material Personals
- ▶ Welding Engineer
- ▶ Corrosion Speciallists.
- ▶ Inspection Engineers.
- ▶ Researchers
- ▶ Investors
- ▶ Lab Personal
- ▶ And who seek a basic understanding of the practical aspects of metallurgy

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### Course Agenda

#### Day 1

- ▶ Pre – Test
- ▶ **Testing and Mechanical Properties of Metals**
- ▶ Tensile tests
- ▶ Impact tests
- ▶ Hardness tests
- ▶ Compression of mechanical properties
- ▶ **The Crystalline Structure of Metals**
- ▶ Bonding in metals
- ▶ Solidification crystal growth and structures of metals
- ▶ Defects in metals during solidification
- ▶ **Specimen Preparation and Microscopic Examination**
- ▶ The preparation (Mounting Grinding, Polishing and Etching) of metal specimens
- ▶ Metallurgical and Electron Microscopes
- ▶ **Dislocations and Strengthening Mechanisms in Metals**
- ▶ Edge Dislocation (line imperfections) in crystals
- ▶ Strengthening of metals by Grain Size Reduction, Solid Solution and Strain Hardening
- ▶ Softening of metals by annealing
- ▶ Comparison of Cold and Hot working of Metals
- ▶ **Binary Equilibrium Diagrams**
- ▶ Solubility and cooling curves
- ▶ Thermal Equilibrium Diagrams (Eutectic Type, Solid Solution Type and Combination Type)

Case study : Galvanic Corrosion Degredation

#### Day 2

- ▶ **Ferrous Alloys**
- ▶ Definitions and classifications and some uses of ferrous alloys including:
- ▶ Carbon steels
- ▶ Alloy steels
- ▶ Stainless steels
- ▶ Cast irons
- ▶ **Fabrication of Metals**

#### ▶ A selection of metal fabrication methods, including:

- ▶ Forming
- ▶ Casting
- ▶ Welding
- ▶ **Heat Treatment of Plain Carbon Steel**
- ▶ Hardening of carbon steel (by quenching)
- ▶ Annealing Normalizing
- ▶ Tempering
- ▶ Austempering
- ▶ Surface treatments
- ▶ Heat affected zone (HAZ) in welding
- ▶ **Non-Ferrous Alloys**
- ▶ Nickel and cobalt
- ▶ Titanium alloys

Case study: MIC Failure For Activated Carbon Filter

#### Day 3

- ▶ **Basic of the Corrosion in Metals**
- ▶ The electrochemical cell
- ▶ Types of electrochemical corrosion
- ▶ Theory of Corrosion
- ▶ Cost of Corrosion
- ▶ Cause of Corrosion
- ▶ Types of Corrosion
- ▶ Uniform Corrosion and Local Corrosion
- ▶ Pitting
- ▶ Stress Corrosion Cracking (SCC)
- ▶ Hydrogen damage (Embrittlement / Blistering)
- ▶ Galvanic Corrosion
- ▶ Crevice Corrosion
- ▶ Hydrogen Embrittlement.

Case study: Thermal Chock Leak Failure For Tube and shell heat exchanger

## IN-HOUSE SOLUTIONS

SAVE COST • IMPROVE PERFORMANCE • REDUCE RISK

PetroSync understands that in current economic climate, getting an excellent return on your training investment is critical for all our clients. This excellent training can be conducted exclusively for your organization. The training can be tailored to meet your specific needs at your preferred location and time. We will meet you anywhere around the globe.

If you like to know more about this excellent program, please contact us on +65 3159 0800 or email [general@petrosync.com](mailto:general@petrosync.com)

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### Course Agenda Continue

#### Day 4

- ▶ **Corrosion Control Technique**
- ▶ **Material selection**
- ▶ Effect of dissolved gases
- ▶ Stream Velocity
- ▶ Fiber Glass Type
- ▶ Under Ground GRP Material
- ▶ Limitation of Non-Metallic Material
- ▶ Cost of material
- ▶ **Improved Design**
- ▶ Examples of Impingement Corrosion
- ▶ Examples of avoiding crevice corrosion by design
- ▶ Incorporation of corrosion allowance
- ▶ **Chemical treatment**
- ▶ PH Control
- ▶ Removal of Dissolved Gases
- ▶ Application of Corrosion Inhibitor
- ▶ Biocides role in corrosion control
- ▶ Control of Microbial Corrosion
- ▶ Advantages of Corrosion Monitoring
- ▶ Corrosion Coupons
- ▶ Electrical Resistance (ER)
- ▶ On-Line Wall Thickness ( UT ) Measurements
- ▶ **Case study : High temperature Painting Failure For Heater Regeneration line**

#### Day 5

- ▶ **Types of Coatings**
- ▶ Wrapping
- ▶ Protective Coatings
- ▶ Heat-Shrinkable Sleeves
- ▶ Wrapping & Sleeves
- ▶ Surface Preparation
- ▶ Water jetting
- ▶ Abrasive blasting ( provides surface roughness ): Sand blasting and Grit blasting
- ▶ Surface Profile

- ▶ Paint Application Methods
- ▶ Climatic conditions during painting application
- ▶ Paint inspection
- ▶ Holiday detector test
- ▶ Cross Hatch Adhesion Test
- ▶ Dry film thickness ( DFT )
- ▶ Cathodic Protection
- ▶ Application of CP system
- ▶ Sacrificial anode system
- ▶ Impressed current system
- ▶ Cathodic protection monitoring
- ▶ Potential Measurement
- ▶ Reference electrode
- ▶ Installation of CP system
- ▶ Types of ground beds
- ▶ Typical Under-Tank Cathodic Protection System for New Tanks
- ▶ Impressed Current Cathodic Protection for Tank Internals
- ▶ ICCP for jackets
- ▶ Isolating flange kits
- ▶ Casings for Road Crossings
- ▶ Test Posts for CP Monitoring
- ▶ Stray-current corrosion
- ▶ Galvanizing, etc.
- ▶ Inhibitors, Types and usage
- ▶ **Case study: Creep Damage For Tube Heater**

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### Instructor Profile



## Petrosync Distinguished Instructor M. El-sayed Mahmoud Shama

Mohamed Shama is a senior inspection engineer with over 23 years of extensive experience within the petrochemical, refinery, utilities and oil and gas industries

He conducted training for API Certification Preparatory, Corrosion and Prevention, National Board and ASME PCC-2, ASME VIII Division 1 & 2, ASME V, ASME IV, Lifting Equipment Courses, CSWIP 3.2 and 3.1 Welding Courses, Pressure Relief Valves, NDT Techniques Training Courses

He has experiences and involve in many huge shutdowns in the oil and gas field including supervision of inspectors and technicians and performing internal inspection for all kind of Piping Systems, Pressure Vessels, Tanks, Boilers, Heat Exchangers, Filters, Towers, Coolers, Columns, Drums and Incinerators, Heaters, Driers, Air Vessels, MCHE, Hot Oil Waste Heat Recovery Units, Spheres, ISO-Containers, Bullets and all kind of refractory materials shaped and un-shaped

### Sample Major Project List

- ▶ Galvanic Corrosion Degradation Project in the water treatment unit in General Petroleum Company
- ▶ CAM Project (Competency Assessment Project) for two years including upgrade and repair defective materials
- ▶ Replacement of defected material of Activated Carbon Filter Vessel
- ▶ Replacement of regeneration heater tube material in Angola LNG plant after heater explosion
- ▶ Replacement and Upgrade of the Jetty Materials in SEGAS Plant

### Partial Client List

- ▶ Badr Eldin oil Company (Western Dessert)
- ▶ SABIC
- ▶ ADNOC
- ▶ KOC
- ▶ AGA
- ▶ Haya Water Oman
- ▶ Dubai Petroleum
- ▶ PetroRabigh
- ▶ Borouge
- ▶ and many more

### WHY YOU SHOULD ATTEND PETROSYNC'S EVENTS

- To ensure that all objectives of the course matches yours, all PetroSync programs are developed after intensive and extensive research within the industry
- PetroSync programs focus on your immediate working issues to ensure that you are able to apply and deliver immediate results in real work situations
- Application and implementation of industry knowledge and experience are the drivers for our course design, not theoretical academic lectures
- PetroSync training focuses on practical interactive learning tools and techniques including case studies, group discussions, scenarios, simulations, practical exercises and knowledge assessments during the course. Invest a small amount of your time to prepare before attending the course to ensure maximum learning
- PetroSync follows a rigorous selection process to ensure that all expert trainers have first-hand, up-to-date and practical knowledge and are leaders of their respective industrial discipline

## INVESTMENT PACKAGES

Please checklist the package that you are attending!

<input type="checkbox"/>	Metallurgy for Non - Metallurgists Schedules	Location	Price
<input type="checkbox"/>	02 <sup>nd</sup> - 06 <sup>th</sup> December 2024	Kuala Lumpur, Malaysia	USD 3,250
<input type="checkbox"/>	09 <sup>th</sup> - 13 <sup>th</sup> December 2024	Bali, Indonesia	USD 3,450

\* All prices are subject to change without notice and are not guaranteed, except that prices for an order that have been accepted by PetroSync is not subject to change after acceptance

\* Price is nett excluding Withholding Tax if any and will be quoted separately. Please send us the withholding tax payment receipt

### DELEGATE DETAILS

1st Delegate Name \_\_\_\_\_ Mr  Mrs  Ms  Dr  Others

Direct Line Number: \_\_\_\_\_ Email: \_\_\_\_\_

Mobile Number: \_\_\_\_\_ Job Title: \_\_\_\_\_

2nd Delegate Name \_\_\_\_\_ Mr  Mrs  Ms  Dr  Others

Direct Line Number: \_\_\_\_\_ Email: \_\_\_\_\_

Mobile Number: \_\_\_\_\_ Job Title: \_\_\_\_\_

3rd Delegate Name \_\_\_\_\_ Mr  Mrs  Ms  Dr  Others

Direct Line Number: \_\_\_\_\_ Email: \_\_\_\_\_

Mobile Number: \_\_\_\_\_ Job Title: \_\_\_\_\_

4th Delegate Name \_\_\_\_\_ Mr  Mrs  Ms  Dr  Others

Direct Line Number: \_\_\_\_\_ Email: \_\_\_\_\_

Mobile Number: \_\_\_\_\_ Job Title: \_\_\_\_\_

5th Delegate Name \_\_\_\_\_ Mr  Mrs  Ms  Dr  Others

Direct Line Number: \_\_\_\_\_ Email: \_\_\_\_\_

Mobile Number: \_\_\_\_\_ Job Title: \_\_\_\_\_

\*Please fill all the details including mobile number. This help us to contact participant if they are late in class or if there is any urgent update (through whatsapp/call)

### INVOICE DETAILS

Attention Invoice to: \_\_\_\_\_

Direct Line Number: \_\_\_\_\_ Fax: \_\_\_\_\_

Company: \_\_\_\_\_ Industry: \_\_\_\_\_

Address: \_\_\_\_\_ Postcode: \_\_\_\_\_

Country: \_\_\_\_\_ Email: \_\_\_\_\_

Please note:

- Indicate if you have already registered by Phone  Fax  Email  Web

- If you have not received an acknowledgement before the training, please call us to confirm your booking.

### PAYMENT METHODS

By Credit Card

By Direct Transfer : Please quote invoice number(s) on remittance advice

PetroSync Global Pte Ltd Bank details:

Account Name : PetroSync Global Pte Ltd

Bank Name : DBS Bank Ltd

Bank Code : 7171 • Bank Swift Code : DBSSSGSXXX • Branch code : 288

Account No : 0288-002682-01-6-022 (USD)

Bank Address : 12 Marina Boulevard, Level 3. Marina Bay Financial Centre Tower 3. Singapore 018982

All bank charges to be borne by payer. Please ensure that PetroSync Global Pte Ltd receives the full invoiced amount.

### COURSE CONFIRMATION

I agree to PetroSync's payment terms and cancellation policy.

Signature : \_\_\_\_\_

Date : \_\_\_\_\_

PAYMENT TERMS : Payment is due in full at the time of registration. Full payment is mandatory for event attendance.

## PROGRAMME CONSULTANT

Name : Cay Aagen

Email : registration@petrosync.com

Phone : +65 3159 0800

## TERMS AND CONDITIONS

### DISCLAIMER

Please note that trainers and topics were confirmed at the time of publishing; however, PetroSync may necessitate substitutions, alterations or cancellations of the trainers or topics or location (classroom / Virtual). As such, PetroSync reserves the right to change or cancel any part of its published programme due to unforeseen circumstances. Any substitutions or alterations will be updated on our web page as soon as possible.

### DATA PROTECTION

The information you provide will be safeguarded by PetroSync that may be used to keep you informed of relevant products and services. As an international group we may transfer your data on a global basis for the purpose indicated above. If you do not want us to share your information with other reputable companies, please tick this box

### CANCELLATION POLICY

Delegates who cancel after the training is officially confirmed run by email, are liable to pay the full course fee and no refunds will be granted. You may substitute delegates at any time as long as reasonable advance notice is given to PetroSync.

In the event that PetroSync cancels or postpones an In the event that PetroSync cancels or postpones or change the trainer or change the training location (classroom / virtual) of an event for any reason and that the delegate is unable or unwilling to attend in on the rescheduled date, you will receive a credit voucher for 100% of the contract fee paid. You may use this credit voucher for another PetroSync to be mutually agreed with PetroSync, which must occur within a year from the date of postponement.

PetroSync is not responsible for any loss or damage as a result of the cancellation policy. PetroSync will assume no liability whatsoever in the event this event is cancelled, rescheduled or postponed due to any Act of God, fire, act of government or state, war, civil commotion, insurrection, embargo, industrial action, or any other reason beyond management control.

### CERTIFICATE OF ATTENDANCE


80% attendance is required for PetroSync's Certificate of Attendance.

### DETAILS

Please accept our apologies for mail or email that is incorrectly addressed.

Please email us at registration@petrosync.com and inform us of any incorrect details. We will amend them accordingly.

### Find us on Social Media:

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### CHARGES & FEE(s)

- For Payment by Direct Telegraphic Transfer, client has to bear both local and oversea bank charges.

- For credit card payment, there is additional 4% credit card processing fee.