CONCEPT

Industrial Electrochemistry and Electroplating: Process Control and Troubleshooting

23 – 27 May 2027
Riyadh - KAFD district five-star



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Ref: 626_18138 **Date:** 23 – 27 May 2027 **Location:** Riyadh - KAFD district five-star **Fees:** 20000 SAR

Introduction:

Industrial electrochemistry and electroplating lines lose money through burnt edges, pitting, poor adhesion, drifting baths, wasted rectifier energy and rejected parts that nobody traces back to cell physics or bath chemistry. This Core Concept course gives plant engineers the working tools to control electrolytic processes, from cell potentials, Faraday calculations and polarisation to zinc, nickel, chromium and copper deposition, aluminium anodising, Hull cell checks, current efficiency, effluent and shop safety. Participants finish with a Plating Line Control and Troubleshooting Plan for a case facility.

Course Objectives:

- Calculate deposit mass, thickness, plating time and current efficiency from ampere-hour records using Faraday laws
- Interpret electrode potentials, polarisation curves and cell voltage breakdowns to locate energy losses in an electrolytic cell
- Set current density windows, anode-to-cathode geometry, shields and racking to control current distribution and thickness uniformity
- Control pretreatment, bath composition, temperature, pH and additives using titration, Hull cell panels and deposit tests
- Diagnose burning, pitting, roughness, blistering, dullness and poor adhesion on plated and anodised parts and trace each to its process cause
- Produce a plating line control and troubleshooting plan covering bath analysis, rectifier checks, effluent treatment and chemical safety

Target Audience:

- Process engineers who set electrolytic operating windows and approve changes to bath chemistry and rectifier settings
- Production engineers who run plating, anodising or electrorefining lines and are responsible for throughput and rework
- Plating shop engineers who maintain tank chemistry, additions and Hull cell records
- Maintenance engineers who look after rectifiers, busbars, anodes, heating and filtration equipment on electrolytic lines
- Quality engineers who test deposit thickness, adhesion and appearance and release plated parts
- Environmental and utilities engineers who operate rinse, effluent and fume extraction systems serving plating shops

Course Outline:

Day 1: Electrochemical Cells, Potentials and Faraday Calculations

- Galvanic Versus Electrolytic Cells: Anode, Cathode, Electrolyte and External Circuit
- Standard Electrode Potentials, Nernst Relation and Reversible Cell Voltage
- Faraday Laws: Charge, Equivalent Weight and Deposited Mass Calculation
- Cell Voltage Breakdown: Reversible Voltage, Overpotentials and Ohmic Drop
- Current-State Audit of an Electrolytic Line: Rectifiers, Tanks and Ampere-Hour Logs

Day 2: Electrode Kinetics, Polarisation and Industrial Electrolysis Routes

- Activation, Concentration and Resistance Overpotential with the Tafel Relation
- Polarisation Curve Reading and Limiting Current from Mass Transport
- Primary, Secondary and Tertiary Current Distribution and Throwing Power
- Chlor-Alkali Membrane, Diaphragm and Mercury Cell Configurations Compared
- Copper Electrorefining, Zinc Electrowinning and Alkaline, PEM and Solid Oxide Water Electrolysers

Day 3: Pretreatment, Plating Chemistries and Anodising Lines

- Soak Cleaning, Electrocleaning, Pickling, Activation and the Waterbreak Test
- Acid, Alkaline and Cyanide Zinc Baths with Passivate Conversion Layers
- Watts Nickel, Bright Nickel and Hexavalent and Trivalent Chromium Deposition
- Acid Sulfate and Cyanide Copper Strike and Build Baths
- Sulfuric Acid and Hard Anodising of Aluminium with Pore Sealing Methods

Day 4: Bath Control, Energy Use and Deposit Defect Troubleshooting

- Hull Cell Panel Testing and Usable Current Density Range Reading
- Bath Analysis Schedule: Titration, pH, Specific Gravity, Additives and Impurity Limits
- Current Efficiency, Specific Energy Use and Rectifier Ripple Checks
- Defect Atlas: Burning, Pitting, Roughness, Treeing, Blistering and Poor Adhesion
- Hydrogen Embrittlement Relief Baking and Galvanic Corrosion at Plated Joints

Day 5: Plating Shop Walkthrough and Line Control Plan

- Line Walkthrough: Racking, Anode Bags, Agitation, Filtration and Busbar Contacts
- Rinse Water Reduction, Metal Recovery and Effluent Neutralisation and Precipitation
- Chemical Handling, Fume Extraction and Cyanide and Chromic Acid Safety Controls
- Case Facility Troubleshooting Exercise from Rejected Part Records
- Plating Line Control and Troubleshooting Plan Presentation and Peer Review

Skills You Will Gain:

- Faraday Plating Calculations
- Cell Voltage Analysis
- Current Distribution Control
- Plating Bath Chemistry Control
- Hull Cell Interpretation
- Anodising Process Control
- Deposit Defect Diagnosis
- Plating Effluent Management

Why Attend This Course:

- Return with a Plating Line Control and Troubleshooting Plan built on a case facility and ready to adapt to your own tanks
- Cut rejects by linking burnt edges, pitting and adhesion loss to current density, pretreatment or bath contamination
- Spend less rectifier energy per part by measuring current efficiency and cell voltage losses
- Compare electrolytic practice with engineers from metal finishing, automotive, chemicals, mining and utility plants

Conclusion:

Electrolytic lines stay in control when engineers connect what they see on the part to cell potentials, current distribution and bath chemistry. The course moves from cells and Faraday calculations, through electrode kinetics and electrolysis routes such as chlor-alkali, electrorefining and water electrolysers, to pretreatment, zinc, nickel, chromium and copper plating and anodising, then Hull cell control, energy use and defect diagnosis. The final day applies this in a line walkthrough and produces a control and troubleshooting plan.