



# **Titanium Dioxide Pigment Plant Operations**

## **Course: Chloride Process, Oxidation and Finishing**



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### **Introduction:**

Titanium dioxide pigment plant operations, covering the chloride process, oxidation and finishing, is the subject of this 5-day course for chlorination, oxidation, finishing and pigment laboratory units, which ends with a Pigment Quality and Chloride Loop Reliability Plan for a case plant. Plants lose saleable pigment and recycled chlorine when chlorinator bed upsets, vanadium carry-over, oxidiser scaling and uneven surface coating come to light only at final pigment testing. Nominees already operate, supervise or test in a chloride-route pigment plant and work through case studies on reactor logs,  $\text{TiCl}_4$  analyses and pigment lot records. CoreConcept Training Center delivers this titanium dioxide pigment course.

### **Course Objectives:**

- Compare chloride and sulfate routes and set a plant baseline for chlorine usage, feedstock consumption and pigment yield
- Control fluid-bed chlorinator temperature, coke ratio and bed conditions while separating iron and other metal chlorides from crude  $\text{TiCl}_4$
- Operate condensation, vanadium removal and distillation so that purified  $\text{TiCl}_4$  meets the specification for the oxidiser
- Run the oxygen burner, rutilisation additive dosing and scale control in the oxidation reactor to hold the target particle size
- Sequence wet milling, inorganic surface coating, washing, drying and micronising, and release pigment lots on tinting strength, undertone, brightness, oil absorption and dispersibility
- Prepare a pigment quality and chloride loop reliability plan that ranks chlorine safety, waste and bottleneck actions for a case plant

### **Target Audience:**

- Chlorination section operating staff responsible for chlorinator feed, bed temperature and crude  $\text{TiCl}_4$  condensation
  - Oxidation section operating staff responsible for burner conditions, scale removal and chlorine recycle compressors
  - Finishing section staff responsible for milling, surface coating, filtration, drying and micronising lines
  - Pigment laboratory staff responsible for in-process analyses and final lot release testing
  - Shift supervising staff responsible for permits, chlorine and  $\text{TiCl}_4$  release response and handover across plant sections
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## Course Outline:

### Day 1: Chloride Route Chemistry, Feedstocks and Plant Baseline

- Chloride and Sulfate Routes Compared for Rutile Pigment Output
- Ilmenite, Upgraded Slag and Natural Rutile Feedstock Grades
- Carbochlorination Reaction Balance With Coke, Chlorine and Oxygen
- Rutile Refractive Index and Crystal Size Effects on Opacity
- Plant Baseline Sheet for Chlorine Usage and Pigment Yield

### Day 2: Fluid-Bed Chlorination and $\text{TiCl}_4$ Purification

- Fluid-Bed Chlorinator Temperature, Bed Height and Coke Ratio Control
- Iron Chloride and Metal Chloride Separation in Cyclones
- Crude  $\text{TiCl}_4$  Condensation, Spray Cooling and Slurry Handling
- Vanadium Oxychloride Removal by Chemical Reduction Treatment
- $\text{TiCl}_4$  Distillation Column Operation and Purity Analysis

### Day 3: Oxidation Reactor Control and Pigment Finishing Steps

- Oxygen Preheater and  $\text{TiCl}_4$  Burner Flame Control
- Aluminium Chloride Dosing for Rutile Conversion and Particle Size
- Wet Milling and Hydroclassification of Base Pigment Slurry
- Alumina, Silica and Zirconia Surface Coating Precipitation Sequence
- Filtration, Washing, Drying and Steam Micronising With Organic Treatment

### Day 4: Oxidiser Scaling, Pigment Test Failures, Chlorine Safety and Waste

- Oxidiser Wall Scale and Flue Scouring Media Management
- Tinting Strength, Undertone and Brightness Test Interpretation
- Oil Absorption and Dispersibility Failures Traced to Coating Steps
- Chlorine and  $\text{TiCl}_4$  Release Detection and Emergency Response
- Metal Chloride Waste Neutralisation and Solid Residue Disposal

### Day 5: Case Study Building a Pigment Quality and Chloride Loop Reliability Plan

- Case Plant Chlorinator and Distillation Log Review
  - Chlorine Recycle Loop Loss Analysis From Case Data
  - Case Pigment Lot Test Records Against Grade Specifications
  - Reliability Actions for Burner, Scaling and Micronising Bottlenecks
  - Pigment Quality and Chloride Loop Reliability Plan Completion
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## Skills You Will Gain:

- Chlorinator Bed Control
- $\text{TiCl}_4$  Purity Management
- Oxidiser Particle Size Control
- Surface Coating Sequencing
- Pigment Lot Release Testing
- Chlorine and  $\text{TiCl}_4$  Emergency Response
- Metal Chloride Waste Handling
- Chloride Loop Loss Analysis

## Why Attend This Course:

- Deliver a Pigment Quality and Chloride Loop Reliability Plan for a case plant to the production manager and the pigment quality lead
- Decide whether an off-grade lot traces back to  $\text{TiCl}_4$  purity, oxidiser conditions or the coating and micronising steps
- Avoid chlorine losses,  $\text{TiCl}_4$  releases, oxidiser shutdowns for scale and rejected pigment lots that cut output and customer confidence
- Brief shift operators and laboratory technicians on chlorinator control limits, coating sequences and lot release checks

## Conclusion:

Back at work, the participant hands the Pigment Quality and Chloride Loop Reliability Plan to the production manager, the pigment quality lead and the maintenance planner. They use it to agree chlorinator and distillation control limits, set scale removal and burner maintenance intervals, adjust coating recipes and decide which chlorine safety and waste handling upgrades to fund. After the first quarter under the plan, the plant should compare chlorine usage per tonne, off-grade lots, oxidiser run length and release incidents against the baseline and revise the actions that have not delivered.

## Frequently Asked Questions FAQ:

### What should participants know before the titanium dioxide pigment plant operations course?

Participants should already work in a chloride-route pigment plant section or its laboratory and read process trends or test reports. Basic inorganic chemistry helps. Bringing anonymised chlorinator logs,  $\text{TiCl}_4$  analyses or pigment lot records lets them apply the case study to their own plant.

## **How does titanium dioxide pigment plant operations differ from a paint formulation course?**

This course covers making the white pigment itself, from feedstock chlorination and  $\text{TiCl}_4$  purification to oxidation, surface coating and lot release. Paint formulation courses start with finished pigment and deal with binders, dispersion, tinting and batch release of coatings.

## **Why does particle size control matter in titanium dioxide pigment plant operations?**

Light scattering, and so opacity and tinting strength, depends on rutile crystal size. Oxidiser conditions and rutilisation additive dosing set this size, and milling and micronising only break up agglomerates, so errors made in the reactor cannot be corrected later.

## **What do participants take back from the titanium dioxide pigment plant operations course?**

Participants take back a Pigment Quality and Chloride Loop Reliability Plan with a plant baseline sheet, chlorinator and distillation control limits, a chlorine loop loss analysis, a lot release test matrix and ranked safety, waste and bottleneck actions.

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