Crystallization Process Engineering Training Course

Professional Development Training Course Outline

Category	General Training	**Duration**	5 Days
Base Fee	$1,500 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Crystallization Process Engineering is a critical discipline in chemical engineering, pharmaceutical manufacturing, fine chemicals, food processing, and advanced materials production. It focuses on the design, optimization, and control of crystallization kinetics, nucleation, crystal growth, supersaturation, and solid–liquid separation processes. Modern industries demand highly efficient and scalable crystallization systems to achieve high-purity crystals, controlled particle size distribution (PSD), polymorphism control, and yield optimization, making this training essential for engineers and process professionals.

Crystallization Process Engineering Training Course equips participants with deep expertise in industrial crystallization technology, batch and continuous crystallizers, anti-solvent crystallization, cooling crystallization, and reactive crystallization systems. It bridges theory with real-world industrial applications, enabling learners to solve challenges related to scaling up, process intensification, impurity rejection, and crystal habit modification. Participants will gain practical insights into process modeling, PAT (Process Analytical Technology), CFD in crystallization, and industrial case-based troubleshooting.

Programme Curriculum

Crystallization Process Engineering Training Course

Introduction

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Course Duration

5 days

Course Objectives

1. Master crystallization thermodynamics and phase equilibrium
2. Understand nucleation theory and crystal growth kinetics
3. Optimize supersaturation control strategies
4. Design batch and continuous crystallization systems
5. Improve particle size distribution (PSD) control techniques
6. Analyze polymorphism and crystal habit modification
7. Apply anti-solvent and cooling crystallization methods
8. Enhance process scale-up and scale-down methodologies
9. Implement Process Analytical Technology (PAT) tools
10. Reduce impurities through selective crystallization
11. Improve yield and recovery efficiency in industrial crystallizers
12. Model crystallization processes using simulation tools
13. Troubleshoot industrial crystallization failures and fouling issues

Target Audience

1. Chemical Process Engineers
2. Pharmaceutical Manufacturing Engineers
3. Industrial Chemists & Formulation Scientists
4. Food Processing Engineers
5. Research & Development (R&D) Scientists
6. Plant Operators & Production Supervisors
7. Quality Control & Quality Assurance Professionals
8. Graduate Students in Chemical Engineering & Material Science

Course Modules

Module 1: Fundamentals of Crystallization Science

- Phase diagrams and solubility curves
- Supersaturation driving force concepts
- Nucleation mechanisms
- Crystal growth theories
- Thermodynamic equilibrium in crystallization
- **Case Study:** Sodium chloride crystallization optimization in brine processing plant

Module 2: Nucleation and Crystal Growth Kinetics

- Homogeneous vs heterogeneous nucleation

- Growth rate laws and population balance
- Metastable zone width (MSZW) analysis
- Effect of impurities on nucleation
- Kinetic modeling techniques
- **Case Study:** Control of crystal size in pharmaceutical API production

Module 3: Industrial Crystallizer Design

- MSMPR, batch, and draft tube baffled crystallizers
- Cooling crystallizer configurations
- Evaporative crystallization systems
- Scale-up design principles
- Mixing and heat transfer effects
- **Case Study:** Sugar crystallization in refinery production scale-up

Module 4: Supersaturation and Process Control

- Supersaturation generation techniques
- Anti-solvent addition control strategies
- Temperature-programmed crystallization
- Feedback and feedforward control systems
- Dynamic process control loops
- **Case Study:** API purity enhancement via controlled anti-solvent addition

Module 5: Particle Size Distribution (PSD) Engineering

- PSD measurement techniques
- Agglomeration and breakage phenomena
- Crystal morphology control
- Seeding strategies
- Product consistency optimization
- **Case Study:** Uniform crystal size distribution in fertilizer production

Module 6: Polymorphism and Solid-State Chemistry

- Crystal forms and polymorphic transitions
- Stability and transformation kinetics
- Solvate and hydrate formation
- Impact on bioavailability (pharma)
- Analytical characterization
- **Case Study:** Polymorphic control of paracetamol crystallization

Module 7: Process Analytical Technology (PAT) & Modeling

- In-situ monitoring techniques
- Real-time process monitoring
- Computational Fluid Dynamics (CFD)
- Population balance modeling
- Digital twin of crystallization systems
- **Case Study:** Real-time crystallization monitoring in antibiotic production

Module 8: Industrial Troubleshooting & Scale-Up

- Fouling and clogging prevention
- Yield loss diagnostics
- Scale-up from lab to plant
- Process intensification strategies
- Root cause analysis (RCA) tools
- **Case Study:** Troubleshooting blocked crystallizer in chemical manufacturing plant

Training Methodology

This course employs a participatory and hands-on approach to ensure practical learning, including:

- Interactive lectures and presentations.
- Group discussions and brainstorming sessions.
- Hands-on exercises using real-world datasets.
- Role-playing and scenario-based simulations.
- Analysis of case studies to bridge theory and practice.
- Peer-to-peer learning and networking.
- Expert-led Q&A sessions.
- Continuous feedback and personalized guidance.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	27 Nov 2026	Online	$1,000
23 Nov 2026	27 Nov 2026	Physical	$1,500
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$4,500
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$6,000

Ready to enroll or request a customized program? Book online or contact us:

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Email: info@fineskilltrainingcenter.com | Website: www.fineskilltrainingcenter.com