

**PE28: Crystallization and Drying - Solids Processing Technology and Design Fundamentals**

This course examines the principle for crystallization and solid drying unit. The teaching approach is methodology-oriented. The course outline are following.

**Date:** 2 Days Course - Check upcoming dates in [www.chemengedu.com](http://www.chemengedu.com)

**Time:** 9:00-17:00

**Price & Promotions:** See rate and promotions in [www.chemengedu.com](http://www.chemengedu.com)

**Venue:** Check venue in [www.chemengedu.com](http://www.chemengedu.com)

**Registration:** By Training Registration Page in [www.chemengedu.com](http://www.chemengedu.com) or contact Khun Piyarat 089 118 6531, [chemengedu.training@gmail.com](mailto:chemengedu.training@gmail.com)

**Agenda & Course Outline:**

**Day 1:**

8:00 AM – 9:00 AM Register

9:00 AM – 12:00 PM

**1. Basic principles**

- What is the crystallization process
- How to specify temperature and pressure of solution crystallization
- Mechanism of crystallization
  1. How are the crystals produced
  2. What is supersaturation ?
  3. Nucleation (Primary: Homogeneous/Heterogeneous and Secondary)
  4. Crystal growth steps (Mass transfer rate VS Reaction rate)
  5. Specify the supersaturation ratio
  6. Solvent selection
  7. Estimating crystallization yield
- Mass and Energy balance

**2. Controlling crystallization product**

- Effect of cooling rate
- Control the crystallization by seeding
- Controlling supersaturation (Cooling/Solvent addition rate)

12:00 PM – 13:00 PM Lunch Break

13:00 PM – 17:00 PM

- 3. Type of large scale crystallizer**
- 4. Large scale DTB crystallizer design**
  - Principle of DTB crystallizer
  - Concept and Criteria for design
  - DTB crystallizer design
- 5. Problems in crystallization (off-spec product)**
  - Mass transfer coefficient
  - Cycle of particle size distribution
  - Scale up issues

**Day 2:**

8:00 AM – 9:00 AM Register

9:00 AM – 12:00 PM

- 6. Basic principles**
  - Type of drying
  - Drying Periods
  - Drying characteristic curve
  - Rate of drying
  - Mass and Energy balance
- 7. Type of dryer**
  - Batch dryer
  - Continuous flow dryer
  - Dryer type selection

12:00 PM – 13:00 PM Lunch Break

13:00 PM – 17:00 PM

- 8. Principle of batch dryer design**
  - Determine the drying rate of solid
  - Estimate materials temperature
  - Determine the time to achieve required moisture content
- 9. Principle of continuous dryers**
  - Estimate the air temperature
  - Estimate the interface temperature
  - Mass and energy balance for counter-current/co-current flow dryer
  - Estimate the materials temperature
  - Determine volume/size of the dryer

**Your Instructor:**

*Assoc. Prof. Dr. Apinan Soottitantawat*

**PROFILE**

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- Outstanding Student Award from The Society of Chemical Engineering, Japan (SCEJ)
- Japanese Government Scholarship to study in Japan
- Gold Medal Honor Award in Chemical Engineering from The Engineering Institute of Thailand Under H.M. The King's Patronage (E.I.T.), Thailand
- Outstanding Student Award (Gold Medal Honor) Chemical Engineering from Faculty of Engineering, Chulalongkorn University, Thailand
- Honor Student Award, Faculty of Engineering, Chulalongkorn University, Thailand
- Senior licensed chemical engineer in Thailand, license no. ๗๗ 149
- Young Researcher Award, Faculty of Engineering, Chulalongkorn University, Thailand
- Holds 14 patents (2016)
- Hold 53 Research publications in ISI database (2016)
- Hold 3 review articles (2016)
- More than 100 Proceedings papers with some invited speaker
- Advisor for more than 30 graduated master students and 1 graduated doctoral student
- Problem solving/Process improvement via advisor of internship students
- Current research activity in encapsulation process improvement, spray drying process improvement, chemical process scale up
- Working Committee to design and set up a new curriculum for bachelor degree in Chemical Engineering, Faculty of Engineering, Chulalongkorn university FY 2011 and 2016
- Working Committee to design and set up a new curriculum for master degree in Chemical Engineering, Faculty of Engineering, Chulalongkorn university FY 2013 and 2016
- Working Committee to design and set up a new curriculum for master degree in Chemical Engineering, Faculty of Engineering, Chulalongkorn university FY 2014

**CAREER EXPERIENCES**

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June 27, 2011 - Present

Assistant Professor  
Department of Chemical Engineering, Faculty of Engineering  
Chulalongkorn University, Thailand

August 01, 2007 – June 26, 2011

Instructor  
Department of Chemical Engineering, Faculty of Engineering  
Chulalongkorn University, Thailand

May 01, 2006- July 31, 2007

Researcher  
National Nanotechnology Center (NANOTEC)  
National Science and Technology Development Agency (NSTDA), Thailand

April 01, 2005- March 31, 2006

AIST Research Staff

National Institute of Advanced Industrial Science and Technology (AIST),  
Tsukuba Central 5, Tsukuba, Japan

September 4-30, 2002

Visiting researcher at VTT Biotechnology,  
Technical research centre of Finland.

## TEACHING EXPERIENCES

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Lecture Course in Department of Chemical Engineering, Faculty of Engineering, Chulalongkorn University

## UNDERGRADUATE COURSES

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- **Introduction to Chemical Engineering Thermodynamic** (Thermodynamic of pure components/ 1<sup>st</sup>-2<sup>nd</sup> Law of Thermodynamic/ Flow device/ Valve/ Compressor/ Thermal efficiency of chemical process/ Exergy) > 5 years teaching experience (Main instructor contribute to all of topics)
- **Unit Operation I** (Macroscopic Momentum transfer/ Fluid Flow/ Fluid Mechanic/ Pump/ Mechanical Separation/ Filtration/ Centrifugal Separation/ Cyclone/ Decanter/ Sedimentation/ Pneumatic conveying/ Fluidization/Fluid Mixing ) > 7 years teaching experience (Main instructor contribute to all of topics)
- **Unit Operation II** (Distillation, Extraction, Absorption, Stripping, Adsorption, Crystallization, Leaching ) > 7 years teaching experience (Main instructor contribute to all of topics)
- **Unit Operation III** (Heat transfer, Heat exchanger, Boiler, Condenser, Evaporator, Cooling tower, Dryer) > 5 years teaching experience (Main instructor contribute to all of topics)
- **Particle Technology** (Particle characterization, Bulk properties of powder, Flow properties, Bin-Hopper-Silo Design, Powder Mixing, Spray drying, Size Enlargement and Granulation, Size reduction and Milling, Crystallizer, Pneumatic conveying) > 5 years teaching experience (Main instructor contribute to all of topics)
- **Chemical Plant Design** (Process Design, general process design, mass balance, mass balance with recycle stream, conceptual process design, PFD, HEN, materials of construction, equipment sizing-costing, economic analysis, feasibility study) > 2 years teaching experience (Main instructor contribute to almost of topics)

## GRADUATE COURSES

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- **Chemical Process Scale Up** (Introduction to chemical process scale up, methods in process scale up, systematic methods in process scale up, mixing tank scale up, emulsification process scale up, introduction to reactor scale up, process understanding for scale up, ideal reactor calculation, tank reactors scale up, fixed bed reactor scale up) > 4 years teaching experience (Main instructor contribute to all of topics)
- **Advance Reaction Kinetics and Reactor Design** (Reaction kinetics fundamental, ideal reactor design (CSTR/PFR), non-ideal flow reactor with residence time distribution, catalytic heterogeneous reactor, isothermal/adiabatic reactor calculation, industrial reactor design) > 2 years teaching experience
- **Advance Particle Technology** (Particle formation by liquid and gas phase reaction, encapsulation technology, hydrothermal process, nanoparticle, spray drying process, emulsification process, scale up process for particle formation) > 5 years teaching experience (Main instructor contribute to all of topics)

## **PUBLIC TRAINING**

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- 2015: **Fundamental of crystallization process**, organized TechnoBiz Communications Co., Ltd.
- 2015: **Fundamental of mechanical separation process**, organized TechnoBiz Communications Co., Ltd.
- 2015: **Fundamental of distillation design**, organized TechnoBiz Communications Co., Ltd.
- 2015: **Fundamental of extraction process**, In-house training for IRPC Co., Ltd.
- 2015: **Fluid Flow**, In-house training for Thai Oil Co., Ltd.
- 2014: **Chemical Process Scale up**, organized by Center of Excellence in Particle Technology, Chulalongkorn University, with more than 30 registers
- 2014: **Fundamental of distillation design**, In-house training for Patum Vegetable Oil Co., Ltd
- 2013/2014: **Mixing tank and emulsification process scale up** for Thai Cosmetic Manufacturers Association (TCMA)
- 2011: **Mini-Chemical Engineering course: Absorber and Stripper Fundamental and Design**, In-house training for Siam Mitsui PTA Co., Ltd.
- 2008: **Sampling method for particle measurement**, In-house training for Siam City Cement Co., Ltd

## **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF A MEMBER**

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Technology Promotion Association (Thailand-Japan), Life member  
 The Thai Institute of Chemical Engineering and Applied Chemistry, TIChE, Life Member  
 The Society of Chemical Engineers, Japan, (SCEJ), Member  
 Japan Society for Food Engineering (JSFE), Member  
 Thai Association of Particle Industries, Member

## **RESEARCH INTEREST**

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Encapsulation-Controlled Release, Chemical Process Scale-up, Particle technology, Drying technology, Porous Materials, Food Chemical Technology, Chemical Reaction Engineering