

|                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| <p style="text-align: center;"><b>KLM<br/>Technology Group</b></p> <p>Practical Engineering Guidelines<br/>for Processing Plant Solutions</p> | <div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;"> <p style="margin: 0;"><b>KLM</b></p> </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p style="margin: 0; color: blue;"><b>Technology</b></p> <p style="margin: 0; color: blue;"><b>Group</b></p> </div> </div> | <p style="text-align: right;">Page 1 of 6</p> <p style="text-align: right;">Rev 3.0</p> |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|

## Advanced Olefin Polymer Reactor Fundamentals and Troubleshooting

### Introduction

The success of every company depends of each employee's understanding of the business's key components. Employee training and development will unlock the companies' profitability and reliability. When people, processes and technology work together as a team developing practical solutions, companies can maximize profitability and assets in a sustainable manner.

Most unit operations are divided in to two sectors; the reactor section and the separation section. The high value products are produced in the reactor section and purified in the separation section. The proper reactor design and catalyst selection can greatly improve company profit margins. The net effect is to produce increasing amounts of higher value products by improving selectivity.

Reactor design and catalyst developments are one of the largest Research and Development (R&D) Divisions in Chemical Engineering. To stay abreast of the current reactor designs and catalyst developments should be an operations personnel's target.

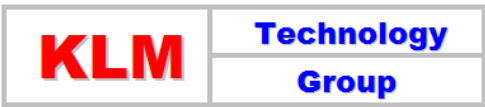
### Course Objective

This course will guide the participants to develop key concepts and techniques to operate, select and optimize Olefin Polymer Reactor processes. These key concepts can be utilized to make design and operating decisions. Training and development is an investment in future success – give yourself and your employees the keys to success.

Reactors are the most important part in almost all chemical related industries. The success of a chemical plant usually depends on the efficiency, robustness and safe operation of the reactor system. In this course, participants will be provided with the fundamentals and basic application of reaction engineering and chemistry principles to reactor design. In addition participants will also be exposed to the available technologies in polyolefins manufacturing specifically polyethylene and polypropylene.

#02-12 Block Aronia  
Jalan Sri Perkasa 2  
Taman Tampoi Utama  
81200 Johor Bahru, Malaysia

Phone + 60 07-421-8396  
Email: [info@klmtechgroup.com](mailto:info@klmtechgroup.com)  
Internet: [www.klmtechgroup.com](http://www.klmtechgroup.com)  
Internet: [www.kolmetz.com](http://www.kolmetz.com)

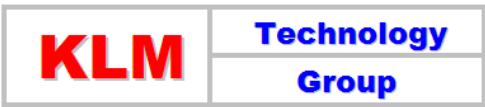
|                                                                                                                                  |                                                                                    |                                   |
|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------|
| <p align="center"><b>KLM<br/>Technology Group</b></p> <p>Practical Engineering Guidelines<br/>for Processing Plant Solutions</p> |  | <p>Page 2 of 6</p> <p>Rev 3.0</p> |
|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------|

## What You Can Expect To Gain

- Overview of the Catalytic Processes in a Petrochemical Plant
- Catalyst Evaluation Techniques
- An understanding of Reactor and Catalyst interaction
- Basic chemical reaction engineering principles in the process industries
- Understand the value streams for the petrochemical industry
- Evaluate the process technologies available in polyolefin manufacturing
- Gain valuable knowledge on reactor maintenance and troubleshooting
- The operation, control and trouble shooting of a reactors and associated equipment
- An overview of reactors, practical solutions as well as theory
- An understanding of essential reaction concepts
- Valuable practical insights for trouble free design and field proven techniques for commissioning, start up and shutdown of reactor operations
- To tailor your approach to specific design, analysis and trouble shooting problems.

#02-12 Block Aronia  
Jalan Sri Perkasa 2  
Taman Tampoi Utama  
81200 Johor Bahru, Malaysia

Phone + 60 07-421-8396  
Email: [info@klmtechgroup.com](mailto:info@klmtechgroup.com)  
Internet: [www.klmtechgroup.com](http://www.klmtechgroup.com)  
Internet: [www.kolmetz.com](http://www.kolmetz.com)

|                                                                                                                 |                                                                                    |                            |
|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------|
| <b>KLM</b><br><b>Technology Group</b><br><br>Practical Engineering Guidelines<br>for Processing Plant Solutions |  | Page 3 of 6<br><br>Rev 3.0 |
|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------|

## Typical Course Outline

### 1. Chemical Reactions

- a. Single reactions
- b. Multiple reactions
- c. Homogeneous reactions
- d. Heterogeneous reactions

### 2. Catalyst

- a. Definition
- b. Type of Catalyst

### 3. Types of Chemical Reactors

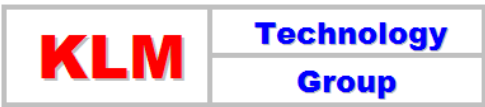
- a. Batch Reactor
- b. Continuous Reactor
- c. Multiphase Reactors
- d. Isothermal and Non-Isothermal Operations

### 4. Overview of Chemical Reactor Operations in Industry

- a. Chemical Reactors in Petroleum Refinery
- b. Chemical Reactors in Petrochemical Industry
- c. Chemical Reactors in Polymer Process Industries

#02-12 Block Aronia  
Jalan Sri Perkasa 2  
Taman Tampoi Utama  
81200 Johor Bahru, Malaysia

Phone + 60 07-421-8396  
Email: [info@klmtechgroup.com](mailto:info@klmtechgroup.com)  
Internet: [www.klmtechgroup.com](http://www.klmtechgroup.com)  
Internet: [www.kolmetz.com](http://www.kolmetz.com)

|                                                                                                                                         |                                                                                    |                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------|
| <p align="center"><b>KLM</b><br/><b>Technology Group</b></p> <p>Practical Engineering Guidelines<br/>for Processing Plant Solutions</p> |  | <p>Page 4 of 6</p> <p>Rev 3.0</p> |
|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------|

## 5. General Introduction

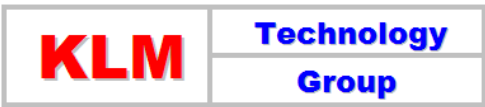
- a. Generic monomer processes for C2 & C3
- b. Naphtha & Gas Cracking Processes
- c. Refinery
- d. Polymer in general
  - Polyethylene Chemistry & Reaction
  - Polypropylene Chemistry & Reaction
- e. Polymerization Processes

## 6. Operational & Maintenance Problems in Polymer Processes

- a. Gas phase process
- b. Slurry process
- c. Bulk process
- d. Hybrid process
- e. Solution process
- f. High pressure process

## 7. Plant Troubleshooting

- a. Operational
- b. Maintenance

|                                                                                                                          |                                                                                    |                                   |
|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------|
| <p><b>KLM</b><br/><b>Technology Group</b></p> <p>Practical Engineering Guidelines<br/>for Processing Plant Solutions</p> |  | <p>Page 5 of 6</p> <p>Rev 3.0</p> |
|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------|

## Who Should Attend

- People who are making day to day decisions regarding operation, design, maintenance, and economics of process industry plants.
  1. 1<sup>st</sup> Line Operations personnel,
  2. Operation Supervisors,
  3. 1<sup>st</sup> Line Maintenance personnel,
  4. Maintenance Supervisors,
  5. Senior Plant Supervisors,
  6. Operations Engineers
  7. Process Support Engineers,
  8. Design Engineers,
  9. Cost Engineers
- An engineer or chemist who must troubleshoot and solve catalyst problems in a plant, an engineering office or laboratory.
- Technical Engineers, Operating Engineers, Process Support Personnel, Chemist, and Managers
- Engineering graduates/technologists who will be using catalyst in their daily work.
- Technical Process engineers doing process design and optimization projects and studies that need who need advanced skills for more complex modeling tasks.
- Plant Operation Support Engineers checking plant performance under different operating conditions, and who are involved in design of new facilities or revamps of existing facilities.
- R&D engineers and researchers using catalyst for process synthesis, upgrade or modifications.
- Ideal for veterans and those with only a few years of experience who want to review or broaden their understanding of process safety.

#02-12 Block Aronia  
Jalan Sri Perkasa 2  
Taman Tampoi Utama  
81200 Johor Bahru, Malaysia

Phone + 60 07-421-8396  
Email: [info@klmtechgroup.com](mailto:info@klmtechgroup.com)  
Internet: [www.klmtechgroup.com](http://www.klmtechgroup.com)  
Internet: [www.kolmetz.com](http://www.kolmetz.com)

- Other professionals who desire a better understanding of the subject matter.