Catalyst Design and Advanced Process Applications Training Course

Ref: #ACE9674

Course Introduction / Overview:

This training course gives a comprehensive look into the core principles of catalyst design and their advanced applications in chemical processes. Catalysis is at the heart of most industrial chemical reactions, making it crucial for enhancing reaction rates, selectivity, and energy efficiency. This program is designed to equip participants with a deep understanding of catalytic systems, from the fundamental principles of surface chemistry and reaction mechanisms to the practical aspects of preparing and characterizing catalysts. We explore different types of catalysts, including heterogeneous, homogeneous, and biocatalysts, and their use in various industrial applications like petrochemicals, pharmaceuticals, and environmental control. The course content is informed by leading academic research in the field. The book Principles of Catalyst Development by J. T. Richardson and R. J. D. C. M. L. Van den Bosch serves as a foundational reference. BIG BEN Training Center is committed to giving a forward-thinking curriculum that equips professionals with the skills needed to innovate and optimize catalytic processes.

Target Audience / This training course is suitable for:

- Chemical and process engineers.
- R&D chemists and scientists.
- Materials scientists.
- Petrochemical and refining professionals.
- Academics and students in chemical engineering.
- Professionals in pharmaceutical manufacturing.
- Environmental engineers.

Target Sectors and Industries:

- Petroleum refining.
- Chemical manufacturing.
- Pharmaceuticals.
- Environmental services and remediation.
- Plastics and polymers.
- Government agencies and research institutes.
- Automotive (for catalytic converters).

Target Organizations Departments:

- Research and development.
- Process engineering.
- Operations and production.
- Materials science.
- Quality assurance.
- Environmental, health, and safety.
- Product innovation.

Course Offerings:

By the end of this course, the participants will have able to:

- Describe the fundamental principles of catalysis and reaction mechanisms.
- Design and synthesize catalysts with specific properties.
- Use advanced characterization techniques to analyze catalytic materials.
- Differentiate between homogeneous, heterogeneous, and biocatalysis.
- Evaluate catalyst performance metrics and deactivation mechanisms.
- Apply catalytic principles to improve industrial processes.
- Use computer-aided methods in catalyst discovery and design.
- Address the environmental and economic aspects of catalytic processes.

Course Methodology:

This training course uses a mix of interactive and practical training methods to give dynamic learning experience. The curriculum combines theoretical lectures with real-world case studies to bridge the gap between academic concepts and practical application. Participants will use hands-on activities, including group workshops and scenario-based exercises, to reinforce their understanding of key topics. We use discussions and Q&A sessions to encourage a collaborative learning environment, where participants can share experiences and insights. The course also includes an in-depth analysis of successful and unsuccessful projects from various industries to highlight best practices and common pitfalls. This approach gives participants the confidence to apply their new knowledge directly to their professional roles. At BIG BEN Training Center, we believe that an engaging and interactive format is key to mastering new skills, so we focus on giving immediate feedback and continuous support throughout the training. The methods are designed to ensure every participant leaf with a clear, practical skill set.

Course Agenda (Course Units):

Unit One: Fundamentals of Catalysis.

- Introduction to catalysis and catalysts.
- Reaction mechanisms and kinetics.
- Adsorption, diffusion, and reaction on surfaces.
- Types of catalysts: heterogeneous and homogeneous.
- Role of catalysts in industrial processes.

Unit Two: Catalyst Synthesis and Design.

- Principles of catalyst design.
- Synthesis methods for heterogeneous catalysts.
- Preparing support and active phases.
- Designing homogeneous catalytic systems.
- Catalyst screening and optimization.

Unit Three: Catalyst Characterization.

- Introduction to catalyst characterization.
- Surface area and porosity measurement.
- X-ray diffraction (XRD) and microscopy.
- Spectroscopic techniques.
- Temperature-programmed techniques.

Unit Four: Industrial Catalytic Processes.

- Catalysis in petroleum refining.
- Catalysis in the petrochemical industry.
- Catalysis for environmental applications.
- Biocatalysis and its industrial applications.
- Case studies in advanced catalytic reactors.

Unit Five: Catalyst Deactivation and Emerging Trends.

- Causes and types of catalyst deactivation.
- Regeneration and recycling of catalysts.
- Nano catalysis and single-atom catalysis.
- Computational methods in catalysis.
- Sustainable catalysis and green chemistry.

FAQ:

Qualifications required for registering to this course?

There are no requirements.

How long is each daily session, and what is the total number of training hours for the course?

This training course spans five days, with daily sessions ranging between 4 to 5 hours, including breaks and interactive activities, bringing the total duration to 20 - 25 training hours.

Something to think about:

How will the development of machine learning and artificial intelligence in catalyst design accelerate the creation of novel materials with unprecedented efficiency and selectivity for sustainable chemical processes?

What unique qualities does this course offer compared to other courses?

This training course is unique because it bridges the gap between the fundamental science of catalysis and its practical application in industrial settings. While other courses may focus on either the theoretical or applied side, our program gives a comprehensive view, enabling participants to not only understand how catalysts work but also to design and use them effectively. We don't just present information; we help you find out how to solve real-world problems through detailed case studies and hands-on exercises. The curriculum covers a wide range of topics, from traditional industrial catalysts to cutting-edge areas like Nano catalysis and computational methods, ensuring that participants get a modern and relevant education. It’s an advanced program that gives professionals the skills to innovate and optimize catalytic processes, which are critical to many of today’s most important industries.