BLACKBIRD FOR TRAINING

# Advanced Developments in Process Engineering: Innovations and Applications

15 – 19 February 2027
Düsseldorf (Germany)



# Advanced Developments in Process Engineering: Innovations and Applications

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## Introduction

This intensive program delivers a deeper and more sophisticated exploration of modern chemical engineering practices, with a clear focus on advanced process optimization, high-efficiency powder technologies, and next-generation industrial solutions. It goes beyond foundational knowledge to examine how complex systems behave under real operational conditions and how engineers can enhance performance using integrated, data-driven approaches.

Particular attention is given to powder processing operations—one of the most technically demanding areas in chemical industries. The course addresses not only the mechanics of grinding, classification, and material handling, but also the underlying process dynamics, scale-up challenges, and performance limitations that impact productivity and product quality.

By combining advanced engineering principles with sustainability strategies and digital transformation tools, this course equips participants to design, analyze, and optimize highly efficient, resilient, and future-ready processing systems.

## Course Objectives

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

- Critically evaluate emerging technologies and innovations in chemical engineering.
- Design and optimize sustainable and energy-efficient chemical processes.
- Analyze complex powder processing systems and identify performance bottlenecks.
- Apply advanced grinding, classification, and separation techniques in industrial contexts.
- Interpret particle behavior and its impact on system efficiency and product characteristics.
- Utilize advanced simulation tools and data analytics for process optimization.
- Integrate digital solutions into chemical and solid-processing operations.
- Develop strategic approaches to improve operational reliability and industrial scalability.



# Course Outlines

## Day 1: Advanced Trends and Industrial Challenges

- Evolution of chemical engineering in high-performance industries.
- Advanced process design and system integration concepts.
- Global industrial challenges: efficiency, emissions, and resource constraints.
- Process intensification and optimization methodologies.
- Performance benchmarking and key industrial metrics.

## Day 2: Sustainable Process Engineering & Energy Optimization

- Advanced concepts in sustainable and green process design.
- Energy integration and heat recovery systems.
- Carbon reduction strategies in process industries.
- Lifecycle analysis and resource efficiency optimization.
- Case studies on large-scale sustainable chemical operations.

## Day 3: Advanced Powder Processing & Grinding Technologies

- In-depth analysis of particle mechanics and powder behavior.
- High-efficiency grinding technologies and performance modeling.
- Process scale-up challenges and equipment optimization.
- Advanced classification systems and separation efficiency analysis.
- Powder flow dynamics, agglomeration, and handling complexities.
- Industrial troubleshooting and performance improvement strategies.
- Workshop: Process optimization in grinding and classification systems.

## Day 4: Digital Transformation & Smart Process Optimization

- Integration of digital technologies in chemical processing systems.
- Advanced data analytics for predictive performance and maintenance.
- Machine learning applications in process optimization.
- Dynamic simulation and digital twins in chemical engineering.
- Real-time monitoring and intelligent control systems.
- Case studies of fully optimized smart processing plants.

## Day 5: Industrial Implementation & Strategic Optimization

- Frameworks for deploying advanced technologies in existing operations.
- Process integration and system redesign for maximum efficiency.
- Risk analysis and operational reliability in complex systems.
- Continuous improvement models and performance sustainability.
- Development of strategic action plans for industrial application.
- Final integrated case study and technical evaluation.



## Why Attend this Course: Wins & Losses!

- Build a deeper, more analytical understanding of complex chemical processes.
- Master advanced powder processing and high-efficiency grinding systems.
- Enhance your ability to solve real industrial challenges with practical solutions.
- Gain expertise in integrating sustainability within process design.
- Leverage digital tools and analytics to optimize performance.
- Strengthen your capability to lead process improvement and innovation initiatives.

## Conclusion

This advanced course provides a comprehensive and technically rich perspective on modern chemical engineering, focusing on high-impact areas such as powder processing, sustainability, and digital transformation. It is designed to strengthen both analytical thinking and practical problem-solving in complex industrial environments.

**Participants leave with the ability to critically assess processes, implement advanced optimization techniques, and drive measurable improvements in efficiency, reliability, and product quality. The knowledge gained supports not only immediate operational enhancements but also long-term strategic development in evolving industrial landscapes.**

