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MIT Quest for Excellence | Gramaudyogik Shikshan Mandal's MIT A Group of Academic & Research Institutions AURANGABAD

Masterclass Workshop in **Mumbai**

INDUSTRIAL POLYMER TECHNOLOGY

MATERIALS, MANUFACTURING AND QUALITY CONTROL

Prepared & Conducted by

Dr. Prashant Gupta

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COURSE SCHEDULE

February 29th, 2024

TIMING : 09:00 - 18:30 (IST)

LOCATION:

MUMBAI

VENUE:

Xavier Institute of Management & Research
Xavier's College Campus, Mahapalika Marg,
Mumbai 400001.

COURSE FEES INCLUDES:

- Training Kit - Course Materials + Stationery
- Morning Tea, coffee, and snacks; lunch; Evening tea, coffee,and snacks
- Resolving queries during the Q&A session

PAY ONLINE:

www.polymerupdate.com/payment/makepayment

FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

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Summary :

This Masterclass Workshop aims to equip participants with the knowledge and skills necessary to excel in the field of industrial polymers, from understanding the fundamentals to mastering the manufacturing processes and quality control procedures. It is designed to provide the participants with a comprehensive knowledge of polymer engineering and technology and its practical applications. It will be divided into four modules, each covering essential topics in the field.

Module 1:
"Fundamentals of Polymers," will introduce participants to the basics of polymers, including key concepts like monomers, oligomers, and macromolecules. Basic chemistry principles related to polymers will also be discussed, along with the concept of molecular weight and its significance in polymer science.

Module 2:
"Polymeric Materials and Additives," will explore the wide-ranging applications of polymer materials across different industries. Participants will learn about commonly used thermoplastic polymers, such as PE, PP, PVC, PS, PC, ABS, Nylon, PET, and PBT, equipping them with the knowledge needed for informed material selection. The module will also cover various types of additives, including stabilizers, process aids, pigments, dyes, and masterbatches, offering a comprehensive overview of how these components enhance polymer performance. Attendees will also learn about specialized additives, such as nucleating agents, impact modifiers, foaming agents, flame retardants, coupling agents, antimicrobial agents, anti-fogging agents, and antistatic agents, and their significance in tailored polymer formulations.

Module 3:

"Quality Control of Polymers," will focus on the essential aspects of polymer testing and analysis. Common quality control methods for assessing mechanical, thermal, electrical, chemical, rheological, optical, and physiochemical properties will be explored. The workshop will emphasize the significance of quality control and assurance in ensuring that polymers meet specified standards and performance requirements.

Module 4:

"Industrial Manufacturing of Polymers," will cover various manufacturing processes, including injection molding and extrusion. Participants will gain insights into the machinery, techniques, and advanced methods used in industrial polymer processing. The module will also examine other processing methods such as blow molding, rotational molding, calendering, thermoforming, and 3D printing, providing participants with an understanding of the advantages and disadvantages of each technique.

In the final session, participants can ask questions and seek clarification on any aspects of the course, as well as review the key takeaways and practical applications of the concepts covered.

COURSE CONTENTS

Session 1:
Fundamentals of Polymers (30 minutes)

Lecture I: Introduction to Industrial Polymers & their Chemistry (30 minutes)

- A general overview on polymers concepts and definitions of monomers, oligomers, macromolecules, etc.
- Basic chemistry of polymers
- Concept of Molecular weight

Session 2:
Polymeric Materials and Additives (200 minutes)

Lecture II: Polymeric Materials and Selection (100 minutes)

- Overview of polymer materials and their applications
- General thermoplastic polymer materials used in different industries
- Properties of polymer materials
- Polymer selection criteria

Lecture III: Polymeric Additives (100 minutes)

- Types of additives such as stabilizers, process aids, etc. and their functions
- Technical requirements for usage of additives in polymers
- Mixing devices
- Pigments, dyes, masterbatches and color assessment
- Overview over additives such as Nucleating agents, Impact modifiers, Foaming agents, Flame retardants, Coupling agents, antimicrobial agents, Anti-fogging agents, Antistatic agents.

Session 3:
Quality Control of Polymers (90 minutes)

Lecture IV: Testing and Analysis of Polymer Materials (90 minutes)

- Overview of polymer testing
- Common Quality Control methods for mechanical, thermal, electrical, chemical, rheology, optical, physiochemical properties, etc.
- Quality control and assurance

Session 4:
Industrial Manufacturing of Polymers (120 minutes)

Lecture V: Processing of Industrial Thermoplastics-Part I (40 minutes)

- Injection Molding: Process, machinery, pressure cycle, plasticisation methodology, screw design, mold, injection and clamping units, utilities and auxiliaries, troubleshooting, advanced injection molding methods such as GAIM, co-injection, overmolding, LIM, LPIM.

Lecture VI: Processing of Industrial Thermoplastics - Part II (80 minutes)

- Extrusion: Process, machinery, extruder zones, single and twin screw extrusion, vented extruder, modular design, feeding concepts: volumetric and gravimetric, die design and operations, blown film extrusion, coextrusion, cast film/sheet extrusion, fiber extrusion, troubleshooting.

  Advancements in extrusion systems such as feed enhancement technology, triple screw extruders: parallel and non-parallel configurations, quad and octa screw extruders with various screw positioning systems, continues mixers, ring extruder and roller extruder

- Other methods such as Blow Molding, Rotational Molding, Calendering, Thermoforming, 3 D Printing etc.
- Advantages and disadvantages of different processing techniques

What will you learn?

- Understand the history, basic raw materials, and chemistry of polymers
- Describe various classification of polymers and their molecular weight
- Identify different types of polymer materials used in different industries and their properties (mechanical, thermal, electrical, etc.)
- Apply polymer selection criteria to choose the right polymer material for a specific application
- Explain the types of additives and their functions in polymer formulation design and optimization
- Understand how additives interact with polymer materials
- Identify common testing methods for mechanical, thermal, electrical, chemical, and rheology properties of polymers
- Interpret polymer test results and apply quality control and assurance techniques
- Understand the advantages and disadvantages of different polymer processing techniques (extrusion, injection molding, blow molding, rotational molding, compression molding, calendering, thermoforming, 3D printing, etc.)
- Apply the concepts covered in the course to solve practical problems in the polymer industry.

Who should attend?

Professionals working in the various functions as mentioned below for sectors such as chemical, plastic and polymer, manufacturing, automotive, electrical and electronics, sector etc where polymers find their use.

- **Researchers & Development Professionals in the Polymer Industry:** Those working in research and development departments of companies in the polymer industry can benefit greatly from this course. They will gain a deeper understanding of the fundamentals of polymers, their chemistry, and classification, which can help in developing new products or improving existing ones.

- **Quality Control Professionals:** Quality control professionals responsible for ensuring that the final products meet the required quality standards will benefit from the polymer testing session of the course. They will learn about common testing methods for mechanical, thermal, electrical, chemical, and rheological properties and how to interpret the test results.

- **Production Managers & Engineers:** Production managers and engineers involved in the manufacturing process of polymer products will benefit from the polymer processing session of the course. They will learn about the different processing techniques, their advantages and disadvantages, and how to select the appropriate technique for a given product.

- **Materials Engineers:** Materials engineers responsible for selecting the appropriate polymer materials for different applications will benefit from the polymeric materials and additives session of the course. They will learn about the different types of polymer materials, their properties, and selection criteria. They will also learn about the different types of additives and how to design and optimize formulations for specific applications.

- **Sales & Marketing Professionals:** Sales and marketing professionals in the polymer industry will benefit from this course as well. They will gain a deeper understanding of the fundamentals of polymers, polymeric materials and additives, polymer testing, and polymer processing techniques. This knowledge will enable them to communicate more effectively with customers and understand their needs better.

- **Graduate Students & Researchers:** Graduate students and researchers in the field of polymer science and engineering can also benefit from this course. It provides a comprehensive overview of the fundamentals of polymers, polymeric materials, and processing techniques, which can help in developing new ideas and research directions.

Dr. Prashant Gupta

B Tech. M. E. PGD - CTM. Ph. D.

Born on June 6th, 1987, Dr. Gupta is a Polymer Technologist. He has obtained his Master's degree, Postgraduate Diploma, and Ph.D. (Polymer Engineering and Technology) from the Institute of Chemical Technology, Mumbai. By virtue of his excellent academic performance in the PGD-CTM course, Dr. Gupta has been awarded a Gold Medal for securing a meritorious rank in the course. He is currently working as an Assistant Professor with the Department of Plastic and Polymer Engineering at Maharashtra Institute of Technology, Aurangabad, Maharashtra.

Dr. Gupta has specialized in the field of polymers since 2002. He has 9+ years of industrial and academic experience in faculty / leadership/ managerial positions in polymer compounding, processing, and composites. Dr. Gupta has more than 30 publications to his credit in peer-reviewed journals and books with international publishers (Elsevier, Wiley, Taylor & Francis, Springer, etc.).

Dr. Gupta has been a lead corporate trainer for the Polymerupdate Academy and has conducted more than 10 virtual and onsite masterclass courses. His areas of expertise and teaching include testing and quality control, polymer additives and compounding, polymer processing technology, polymer recycling, and waste management, biodegradable plastics, sustainability, and circular economy, use of information and communication technology for effective teaching-learning, pedagogy related to teaching-learning, artificial intelligence in education, content creation for virtual laboratory, its development, and applications.

Dr. Gupta has also offered his expertise in the form of technical presentations at more than 20 international and prestigious national conferences/events across the globe some of which include Eurotec-France, Antec-Mumbai, ICERP-Hyderabad, PPS-Mumbai, APM-Lucknow, APA-Chandigarh, etc. and won several awards for best paper, poster, project, etc. Dr. Gupta has also been recognized as a certified developer, mentor, reviewer, and Regional Technical Coordinator for Virtual Labs, Mumbai an initiative of IIT M, IIT D, and IIT K under MHRD, India.

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