



# POLYMER TESTING

Prepared & Conducted by  
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B Tech. M. E. PGD. - CTM. Ph.D.

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# SUMMARY

Polymers have become an indispensable part of our lives. In the midst of technical advancements, polymers are being proactively used in a variety of applications that a lot of competitive materials have found difficult to get absorbed in. The applications in various sectors include packaging, electrical and electronics, building and construction, medical, automotive, agriculture to name a few.

Huge diversity in the market exists in terms of manufacturers involved in different products. Although they use different processing methods, the pressure of ensuring high product quality is there for all of them. Polymer testing ensures that the material complies with the specifications applicable to each of those products.

This course provides an overview of the methodology for testing various polymer properties which is essential for designing the product, specifying the material to be used, ensuring quality control on finished products, their failure analysis, and for understanding the structural behavior of newer materials.

The course is of great interest for industry professionals at top, middle- and first-line management, entrepreneurs and those who are seeking to make their career in the domain of Quality Control and Quality Assurance in the polymeric industry.

## **LECTURE 1: INTRODUCTION**

Lecture 1 presents an overview about polymers, standards, specifications, and the need of polymer testing along with its role in polymer industry

## **LECTURE 2: MECHANICAL PROPERTIES**

Lecture 2 covers introduction to mechanical properties, stress-strain curve, universal testing machine, tensile testing, flexural testing, compressive testing, impact strength testing, hardness test, abrasion resistance testing, fatigue, creep, and stress relaxation.

## **LECTURE 3: THERMAL PROPERTIES**

Lecture 3 covers introduction to thermal properties, testing polymers for various thermal properties such as thermal conductivity, thermal expansion, heat deflection temperature and Vicat softening temperature.

## **LECTURE 4: PERMEATION PROPERTIES**

Lecture 4 covers introduction to thermal properties, testing polymers for various permeability characteristics such as water vapor and gas transmission rate.

## **LECTURE 5: ELECTRICAL PROPERTIES**

Lecture 5 covers introduction to electrical properties, testing polymers for various electrical properties such as dielectric strength, dielectric constant, dissipation factor, electrical surface and volume resistivity and arc resistance.

## **LECTURE 6: CHEMICAL PROPERTIES**

Lecture 6 covers introduction to chemical properties, testing polymers for various chemical properties such as immersion tests, stain resistance, stress cracking resistance (solvent and environmental) etc.

## **LECTURE 7: OPTICAL PROPERTIES**

Lecture 7 covers introduction to optical properties, testing polymers for various optical properties such as refractive index, luminous transmittance, haze, color evaluation (spectrophotometric, colorimetric and visual evaluation) and gloss.

## **LECTURE 8: WEATHERING PROPERTIES**

Lecture 8 covers introduction to weathering characteristics, degradation, stabilization, testing polymers for natural and accelerated weathering tests, and resistance of plastic materials to microorganisms.

## **LECTURE 9: FLAMMABILITY CHARACTERISTICS**

Lecture 9 covers introduction to flammability characteristics, basics of fire and fire hazards, ignition properties and ignition temperature, limiting oxygen index, and ul 94 flammability testing

## **LECTURE 10: MELT AND SOLUTION FLOW PROPERTIES**

Lecture 10 covers introduction to flow properties, testing polymers for various flow properties such as melt flow index, dilute solution viscosity tests for thermoplastics, cup viscometry for thermosets, and rheometer (capillary, rotational and torque)

## **LECTURE 11: PHYSICOCHEMICAL ANALYSIS**

Lecture 11 covers introduction to physicochemical properties, testing polymers for various physicochemical properties such as density, specific gravity, water absorption, moisture analysis and sieve analysis, melting point and contact angle measurement

## **LECTURE 12: PRODUCT TESTING**

Lecture 12 covers introduction to product testing and case studies for injection/ rotational/ blow molded/ extruded plastic products.

## **LECTURE 13: BIODEGRADATION**

Lecture 13 covers introduction to biodegradation, its mechanism, difference in compostable/ thermo- and photo-oxo-biodegradable/ biodegradable polymers and the testing of plastics for their biodegradability.



## **PROF. (DR.) PRASHANT GUPTA**

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

Born on June 6th, 1987, Dr. Gupta is a Polymer Technologist and has obtained his Masters, Post Graduate Diploma and Ph. D. from Institute of Chemical Technology, Mumbai. With virtue of his excellence in PGD-CTM course, Dr. Gupta has been awarded with a Gold Medal for securing top merit in the course.

Dr. Gupta has 5.5 years of academic experience (teaching/research) along with Industrial Research & Development experience in managerial positions for around 3.5 years in polymer compounding, testing, processing, and composites. Dr. Gupta has more than 20 publications to his credit in peer reviewed journals and books with high impact international (Elsevier, Wiley, Springer, Taylor & Francis etc.) publishers.

His areas of expertise and teaching include testing and quality control, polymer additives and compounding, polymer processing technology, polymer recycling and waste management, biodegradable and oxo-degradable plastics for packaging, use of information and communication technology for effective teaching learning, pedagogy related to teaching-learning, artificial intelligence in teaching learning, content creation for virtual laboratory, its development and applications.

Dr. Gupta has 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, Rangotsav-Mumbai, AMAI-Ahmedabad, etc. and won several awards for best paper, poster, project etc. Dr. Gupta has also been recognized as a certified developer, mentor, and reviewer for Virtual Labs, Mumbai an initiative of IIT M, IIT D and IIT K under MHRD, India.

## **WORK EXPERIENCE:**

### **Organization Name: Maharashtra Institute of Technology**

Tenure: 19th Sep 2016 onwards

Assistant Professor-Plastics and Polymer Engineering Dept. (UGC Approved)

Junior Scientist, MIT-Center for Advanced Materials Research and Technology

### **Organization Name: Loxim Industries Ltd.**

Tenure: 1st Sep 2015 – 16th Sep 2016

HOD and Manager: R & D/Quality Control

Management and Customer Representative-ISO-TS 16949

### **Organization Name : Crest Composites and Plastics Pvt. Ltd,Ahmedabad**

Tenure: 21st Apr 14 –31st Aug 15

Assistant Manager, (R & D) Application Development

# THANK YOU

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