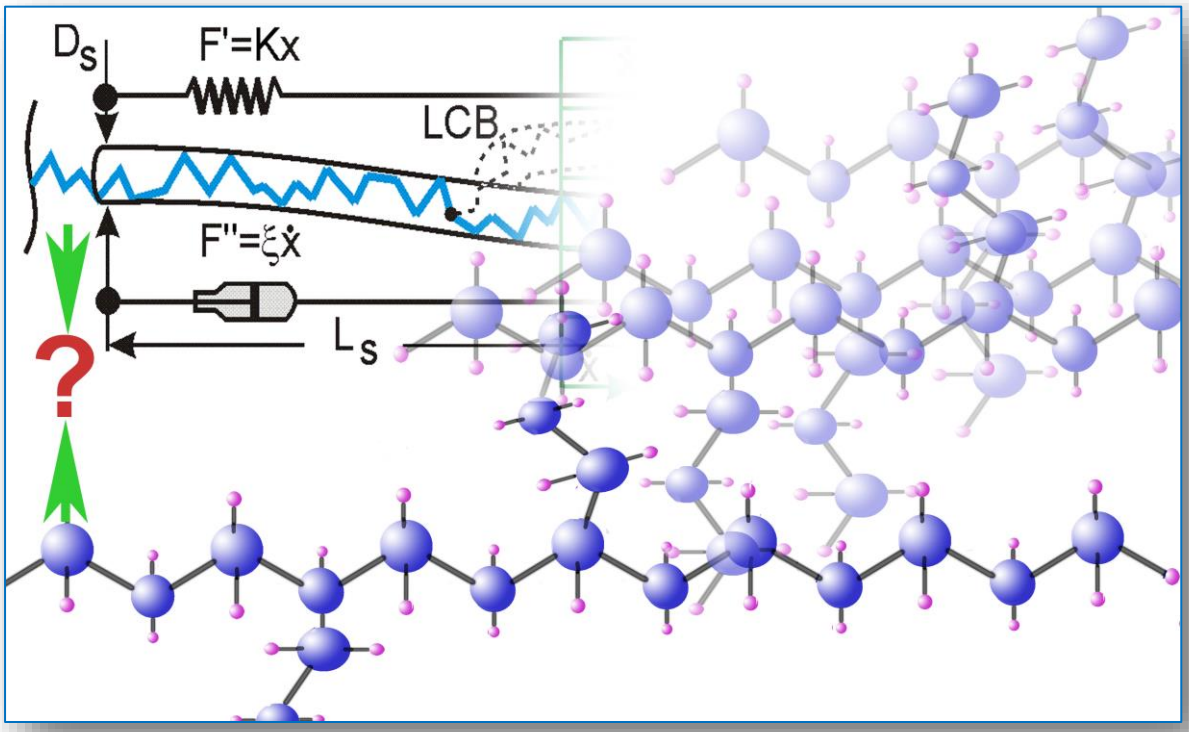
ICTD
المركز العالمي للتدريب والتطوير
International Centre For Training & Development



PCE246
Polymer & Polymerization Technology

Course Introduction:

This five-day course gives an overview of the polymer field from the synthesis of polymers to characterization, properties, and applications of polymers. All major synthetic methods are considered: step (condensation) polymerization, chain (addition) polymerization with ionic and radical variations, copolymerization, stereospecific polymerization, ring-opening polymerization, and synthetic reactions on formed polymers. Emphasis is placed on how the various synthetic methods are used to control structural features such as molecular weight, branching, crosslinking, and crystallinity. Among the properties that are analyzed are polymer solubility, molecular weight and molecular weight distribution, crystallinity (versus amorphous behavior), transition temperatures, mechanical properties, and the processing of polymers into useful products. The effect of molecular structure on these properties and the utilization of polymers are discussed in detail.

Course Objectives:

Upon successful completion of this course, the participants will be able to:

- ✓ Discuss your research concerns with the ICTD instructor which is leading polymer experts
- ✓ Be exposed to a state-of-the-art overview of polymer chemistry in a minimum amount of time
- ✓ Understand how to control polymer structure and molecular weight and their effects on polymer properties and applications
- ✓ Appreciate why branching and crosslinking occur
- ✓ Understand methods for property evaluations, particularly mechanical properties
- ✓ Learn how to improve properties by copolymerization and stereochemical synthesis

Who Should Attend?

This course is intended for scientists, engineers, or other technical staff with a B.S. or higher degree who need a comprehensive, up-to-date overview of this important field. No prior knowledge of polymer chemistry is assumed. The participant's degree can be in any area of chemistry, biochemistry, chemical engineering, or material science.

Course Outline:

Day 1:

Polymers Classification, Synthesis and Control of Properties

- Introduction to Polymers
- Classification of Polymers
- History

- How Mechanisms Affect Properties
- Molecular Weight
- Nomenclature
- Commercial Polymers

Step Polymerization Reactions

- Characteristics
- Mechanisms
- Process Conditions and Equilibrium
- Crosslinking
- Dendrimers
- Commercial Applications

Chain Polymerization Reactions

- Characteristics
- Mechanisms
- Initiation & Inhibitors
- Common Monomers
- Radical Chain Polymerization
- Heterogeneous Polymerization
- Commercial Applications

Day 2:

Ionic Polymerization Reactions

- Characteristics
- Mechanisms
- Initiation and Inhibitors
- Common Monomers
- Living Polymer Systems
- Commercial Applications

Chain Copolymerization

- Types of Copolymers
- Properties of Copolymers
- Control of Copolymer Composition
- Commercial Applications

Ring-opening Polymerization

- Characteristics
- Mechanisms

- Commercial Applications

Day 3:

Stereochemistry of Polymerization

- Characteristics and Definition
- Synthetic Approaches
- Crystallization
- Commercial Applications

Selecting a commercial polymer to fit your needs

Synthesizing a new polymer

Polymer Properties, Characterization, and Processing

Day 4:

Polymer Solutions & Molecular-Weight Determination

- Conformations
- Thermodynamics
- Molecular-Weight Determination

Solid-State Properties

- Entanglements
- The Crystalline State
- Thermal Transitions
- Mechanical Properties

Viscoelasticity & Rubber Elasticity

- Dynamic Mechanical Analysis
- Dielectric Relaxation
- Time-Temperature Superposition
- Rubber Elasticity

Day 5:

Additives Blends, & Composites

- Plasticizers & Fillers
- Blends & Impact-Modified Plastics
- Composites

Thermoplastics, Elastomers, & Thermosets

- Polyolefins
- Vinyl Polymers

- Engineering Thermoplastics
- Elastomers
- Thermosets

Polymer Processing, & Rheology

- Basic Processing Operations
- Rheology
- Rheometry

Course Certificate:

International Center for Training & Development (**ICTD**) will award an internationally recognized certificate(s) for each delegate on completion of training.

Course Methodology:

A variety of methodologies will be used during the course that includes:

- (30%) Based on Case Studies
- (30%) Techniques
- (30%) Role Play
- (10%) Concepts
- Pre-test and Post-test
- Variety of Learning Methods
- Lectures
- Case Studies and Self Questionaires
- Group Work
- Discussion
- Presentation

Course Fees:

To be advised as per course location. This rate includes participant's manual, hand-outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Timings:

Daily Course Timings:

08:00 - 08:20 Morning Coffee / Tea

08:20 - 10:00	First Session
10:00 - 10:20	Coffee / Tea / Snacks
10:20 - 12:20	Second Session
12:20 - 13:30	Lunch Break & Prayer Break
13:30 - 15:00	Last Session