



TRAINING PROGRAM



Polymerization & Plastic Material Selection And Testing

Course Overview:

This course defines the fundamentals that determine plastic properties; short-term and long-term property evaluations, property modifications, establishing the cost/performance profile and selecting a material supplier.

Course Outline:

1. Defining the fundamentals that determine plastic properties

- Molecular weight - the foundation of polymer technology
- The relationship to viscosity
- The relationship to properties
- Methods of measurement
- New technologies that change the rules
- Methods of polymerization - addition and condensation polymers
- Effect on properties
- Effect on processing
- Polarity - Why nylon absorbs water but not gasoline

- Amorphous and semi-crystalline polymers - the one thing you must know about polymer structure
- Detecting the presence of crystalline structure
- Effects on processing
- Effects on properties
- The role of polymer blend

2. Property Evaluations - Short-term

- Tensile, flexural, and compressive properties
- Impact properties - various methods of measurement
- Thermal properties
- Other properties - chemical resistance, optical, radiation resistance
- Why the data sheet properties do not work for material selection
- The behavior behind the numbers
- The role of material property databases and selection utilities

3. Property Evaluations - Long-term

- Effects of temperature
- Reduction in strength and stiffness at elevated temperatures
- Dimensional stability
- Structural changes due to thermal aging
- Thermal degradation and oxidation
- Loss of ductility at reduced temperatures
- Chemical resistance - effects of temperature and time
- Creep resistance, stress relaxation, and fatigue
- Defining the mechanisms
- Data presentation
- Accelerated testing methods - advantages and pitfalls
- The fundamental equivalence of temperature and time
- Environmental stress crack resistance - the differences from chemical attack
- Radiation resistance - weathering, ultraviolet, sterilization

4. Property Modifications

- Fillers and reinforcements
- Glass fibers - the long and the short of it

- Minerals - talc, mica, calcium carbonate and the new nanocomposites
- High performance fibers
- What gets used where and why
- Impact modifiers
- Colorants
- Stabilizers - importance to processing and part performance

5. Establishing the Cost/Performance Profile

- Defining application requirements
- Matching requirements to a cost-effective material family
- Design properties versus inherent properties
- Designing for manufacturing - wall thickness, viscosity & process selection
- The role of simulation

6. Selecting a Material Supplier

- Sampling versus sustained performance
- Quality systems and audits
- Technical support
- Majors versus independent compounders
- The role of distribution

7. Case Studies - Successes and Failures