

PU 104B: Polyurethane Elastomers and Coatings

Course Description:

This course provides a comprehensive look at two major polyurethane application areas: elastomers and coatings. The course begins with foundational polyurethane technology and progresses through the structure-property relationships of elastomers, the full range of elastomer types and processing methods, and an extensive review of polyurethane coatings — from raw material selection and coating systems to application methods, safety, and film characterization. Real-world case studies across multiple market segments bridge chemistry fundamentals with practical, industry-relevant applications.

Intro to Polyurethane Technology

Basic polyurethane overview

Definition of typical coatings and paints

Definition of typical elastomers

Polyurethane Elastomers (Solid and Microcellular)

- Structure/Property relationships of polyurethane elastomers
 - Basic polymer morphology fundamentals (soft and hard segments)
 - T_g and T_m, measurement and physical property effects
 - Dynamic properties - hysteresis
 - Effect of formulation components on properties

Comparison of urethanes versus non-urethane elastomers

Elastomer raw materials

Types of urethane elastomers, formulation, market segments, and applications

- Cast elastomers
- Prepolymers and quasi prepolymers
- One shot and RIM
- Spray elastomers
- Thermoplastic polyurethane
- Millable polyurethane elastomers
- Microcellular elastomers

Polyurethane Coatings

- Intro to Polyurethane based coatings – timeline, included technologies, basics

- Coating markets, different market segments and industry trends
 - Automotive
 - Building and Infrastructure
 - Corrosion
 - General Industrial
 - OEM
 - Textiles
- Coating Resins Review – Competitive technology comparisons
 - Acrylic
 - Epoxy
 - Polysiloxane
 - Polyurethane
- Types of Polyurethane Coatings
 - One component solventborne including moisture cure
 - One component waterborne
 - Two component solventborne
 - Two component waterborne
 - 100% solids
 - UV/E beam
- Polyurethane coating raw materials and reasons for selection
 - Resins – polyesters, polyethers, polyaspartics, hydroxy functional acrylics
 - Isocyanates/Crosslinkers – aromatic, aliphatic, carbodiimide
 - Polyurethane Dispersions (PUD)
 - UV cure resins
- Application Methods
 - Brush, roll, spray, dip and flow, ribbon coat, deposition
- Safe storage, handling, and application
- Characterization of final coating film properties
 - Physical testing
 - Weathering – Accelerated and field testing
 - Chemical testing
- Case Studies
 - In-use case studies in multiple market segments
 - Detail on material selection, prep, application and in-use update

