

# PU 104A: Polyurethane Adhesives & Sealants

## Course Description:

This course offers an in-depth exploration of polyurethane adhesives and sealants, covering the CASE (Coatings, Adhesives, Sealants, and Elastomers) market landscape, underlying chemistry, and practical formulation science. Participants will gain a thorough understanding of 1- and 2-component systems, structural and flexible adhesive technologies, sealant and binder applications, and science and test methods used to evaluate performance. Real-world case studies throughout the course connect chemistry principles to industry applications in construction, packaging, infrastructure, and more.

## Market Overview

- Polyurethane Markets (Rigid, Flex Foam, and CASE)
- CASE Market overview
- Adhesive & Sealant market size and distribution based on chemistry and application type
- Advantages/Disadvantages of different chemistries
  - Contingent upon market data availability
- Market Trends (Growth Rates, Technology Drivers, Value Chains)

## Polyurethane Chemistry & Material Science

- Brief history of polyurethane technology
- Polyurethane components and raw technologies
- Pre-polymers: Preparation and usage
- Overview of polyurethane materials science
- Polyurethane morphology & dynamics

## Brief Overview of Other Chemistries/Technologies

## Formulation Science

### 1-Component Systems

- Component selection and performance
- Cure time, NCO content, and bubbling
- Typical formulation additives

### 2-Component Systems

- Formulation criteria
- Balancing mix ratio and viscosity
- “One-shot” vs. prepolymer systems

## Structural Adhesives

- Definition of structural adhesives
- Formulation considerations
- Case study: Adhesives in Home Construction

## Flexible Adhesives

- Definition of flexible adhesives
- Formulation considerations
- Case study: Laminating/Packaging Adhesives

## Sealants

- Sealants vs. caulks
- Sealant types: 1-component, 2-component, foaming sealants
- Case study: Road and bridge expansion joint sealants

## Binders

- Introduction to PU binders
- Polyurethane binders: 1-component and 2-component
- Applications: Foam rebond, rubber crumb, wood, mineral, aggregate, etc.

## Adhesion Science & Test Methods

- Fundamental theories of adhesion
- Surface science, surface preparation, and failure modes
- Common mechanical test methods: shear, peel, pull-off, dynamic analysis
- Common durability test methods: UV, temperature, moisture exposure
- Hands-on demonstration