

# PU 101: Polyurethane Chemistry

## Background of Polyurethane Technology

- i. History of the development
- ii. Basic polyurethane chemistry overview
- iii. Review of typical definitions and terms
- iv. Thermoset vs thermoplastic

## Polyurethane Chemistry

- i. Aromatic and aliphatic reaction chemistry
- ii. Monomeric and polyisocyanates
- iii. Differentiation of chemistry and reaction: MDI, TDI, HDI, H12MDI, IPDI
- iv. Types of chemistries involved
  - o Rigid vs flexible
  - o 1K vs 2K
  - o Moisture cure
  - o Waterborne, PUDs
  - o UV
  - o Powder

## Coreactants – Brief overview of chemical structure and reaction

- i. Polyether
- ii. Polyester
- iii. Acrylic
- iv. Polyamines

## Formulating Components and Chemistry – what they are and why they are used

- I. Blowing Agents
- II. Fire retardants
- III. Mold release
- IV. Additives to polyurethane coatings: Catalysts, solvents/VOC, chain extenders, surfactants, others

## Typical Testing Parameters

- I. Rigid: compression, density, exposure to heat and water, open vs closed cell

- II. Flexible: flex, accelerated aging, flame resistance
- III. Coatings: hardness, accelerated weathering, appearance/gloss, chemical resistance
- IV. Adhesives: green strength, shear strength, and shear modulus, bond strength, fracture,
- V. Elastomers: compression, hardness, modulus, chemical resistance
- VI. TPU: hardness, tensile strength, compression, abrasion

## Polyurethane Market Applications – overview of breadth of applications and reasons for use

- i. Automotive: OEM and refinish
- ii. Building and Construction
  - o Insulation – rigid and spray
  - o Polyiso board
  - o Adhesives and sealants
  - o Floor coatings
- iii. Furniture
  - o Comfort furniture and mattress
  - o Foam to foam bonding adhesives
  - o Wood Coatings
- iv. Appliances
- v. Packaging: foam and flexpac adhesives
- vi. Composites
- vii. Protective metal coatings
- viii. Marine
- ix. Textiles
- x. Sporting equipment
- xi. Encapsulants and potting compounds
- xii. Elastomers

## Application Equipment – review the types of equipment used for using polyurethanes

- i. Foam: High-pressure impingement Metering Equipment
- ii. Foam: Low pressure metering
- iii. Composites: Pultrusion
- iv. Composites: Infusion
- v. Coatings and adhesives: Brush, roll, spray (plural component spray gun)

- vi. TPU: Injection molding
- vii. Elastomer machinery

Safe use and handling of isocyanates

Summary and Questions