

## PU 101: Polyurethane Chemistry

### Background of Polyurethane Technology

- History of the development
- Basic polyurethane chemistry overview
- Review of typical definitions and terms
- Thermoset vs thermoplastic

### Polyurethane Chemistry

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

### Coreactants – brief overview of chemical structure and reaction

- Polyether
- Polyester
- Acrylic
- Polyamines

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

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

### Typical Testing Parameters

- Rigid: compression, density, exposure to heat and water, open vs closed cell
- Flexible: flex, accelerated aging, flame resistance
- Coatings: hardness, accelerated weathering, appearance/gloss, chemical resistance
- Adhesives: green strength, shear strength, and shear modulus, bond strength, fracture,
- Elastomers: compression, hardness, modulus, chemical resistance
- TPU: hardness, tensile strength, compression, abrasion

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

- Automotive: OEM and refinish

- Building and Construction
  - Insulation – rigid and spray
  - Polyiso board
  - Adhesives and sealants
  - Floor coatings
- Furniture
  - Comfort furniture and mattress
  - Foam to foam bonding adhesives
  - Wood Coatings
- Appliances
- Packaging: foam and flexpac adhesives
- Composites
- Protective metal coatings
- Marine
- Textiles
- Sporting equipment
- Encapsulants and potting compounds
- Elastomers

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

- Foam: High-Pressure Impingement Metering Equipment
- Foam: Low pressure metering
- RIM
- Composites: Pultrusion
- Composites: Infusion
- Coatings and adhesives: Brush, roll, spray (plural component spray gun)
- TPU: Injection molding
- Elastomer machinery

Safe use and handling of isocyanates

Summary and Questions