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
  o Insulation – rigid and spray
  o Polyiso board
  o Adhesives and sealants
  o Floor coatings
• Furniture
  o Comfort furniture and mattress
  o Foam to foam bonding adhesives
  o 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