

# AMPL19 TECHNOLOGY OF THERMOSET POLYMERS

## UNIT-1 POLYESTER RESINS

- 1.1 Polyester Resins- unsaturated polyesters resins: Raw material: poly-basic acids, polyfunctional glycols. Curing of resins through unsaturation of the resin/polymer backbone.
- 1.2 Curing systems, catalysts and accelerators.
- 1.3 Polyester based composites & their recipes, Water reducible polyesters, high solid polyesters/ polyesters for powder coatings Moulding compositions, DMC, SMC, fibre and film forming compositions.

## UNIT-2 PHENOLICS

- 2.1 Basic components of the polymer. Different kinds of phenols and their derivatives, different kinds of aldehydes used.
- 2.2 Novolacs and Resol: effect of the ratio of phenol to aldehyde on the nature and the property of the polymer.
- 2.3 Theory of resinification and effect of pH on the reaction mechanism and the reaction product.
- 2.4 Curing of phenolics Modification of phenolics such as novolac-epoxy oil soluble and oil reactive.
- 2.5 Phenolic moulding compounds, ingredients, compounding and applications.

## UNIT-3 AMINO RESINS

- 3.1 Basic raw materials used like urea/melamine/ aniline/ formaldehyde. Synthesis of UF and MF resins.
- 3.2 Theory of resinification and effect of pH on the reaction mechanism and the reaction product.
- 3.3 Properties and application of the UF, MF and AF resins Modification of resins with alcohols and phenols Moulding materials, compounding, processing and applications.

## UNIT-4 EPOXY RESINS

- 4.1 Epoxy resins: Basic raw materials like epichlorohydrin and di hydroxy phenol. Different di hydroxy phenolic compounds which can be used.
- 4.2 Classification of epoxy resins. Synthesis of epoxy resins. Ratios of reaction components and their effect on the properties of reaction product and molecular weight in particular.
- 4.3 Curing of the resin: curing agents like amines, acids, anhydrides, etc.
- 4.4 Epoxy compositions and their ingredients, like diluents, flexibilizers, etc.
- 4.5 Epoxy adhesives along with their recipes.
- 4.6 Novolac epoxy, epoxy acrylates, Modified epoxides & epoxy resins for advanced applications.

## UNIT-5 POLYURETHANES

- 5.1 Thermoset: Basic components: isocyanates and diols, different diisocyanates and diols used Reactions of isocyanates with various other functional groups Synthesis of polymers Polyurethane foams, polyester and polyether foams.
- 5.2 Processes like one-shot process, Polyether pre-polymers, Quasi-pre-polymer polyether foams, etc.

- 5.3 Difference between thermoset & thermoplastic PU. Flexible foams Polyurethanes in Coatings Polyisocyanates IPN using polyurethanes-acrylic blends Silicones Thermoplastic and Thermoset:
- 5.4 Preparation of intermediates, Grignard's method, direct method, olefin addition method, sodium condensation method, rearrangement of organo chlorosilanes.
- 5.5 Nature and effect of Si-H, Si-O, Si-Si, and Si-C bond.
- 5.6 Effect of different functional groups on properties, Silicone fluids, resins, elastomers, RTV silicones. Their compounding, processing and applications. Silicone modified resins.

#### **UNIT-6 THERMOSETTING ACRYLICS**

- 6.1 Synthesis of acrylic polymers and co-polymers, different techniques.
- 6.2 Structure property relationship application of thermosetting acrylics, like anaerobic adhesives, laminating resins, etc.

#### **UNIT-7 ALKYD RESINS**

- 7.1 Basic components like polyfunctional alcohols, poly-basic acids, vegetable oils/fatty acids.
- 7.2 Different types of drying oils: drying, semi-drying and non-drying with examples.
- 7.3 Influence of all these components in the synthesis and properties of the final alkyds obtained modification of alkyds: modification with rosin, maleic anhydride, acrylics, vinyls, imides etc.
- 7.4 Miscellaneous thermosetting polymers: Polyimides, plasma-polymers & other thermoset polymers

#### **Reference Books:**

1. Text book of Polymer Science by Billmeyer, John Wiley and Sons 1984.
2. Encyclopedia of Polymer Science and Technology, John Wiley and Sons, Inc 1965.
3. Text book of Polymer Science by Billmeyer, John Wiley and Sons 1984.
4. Encyclopedia of Polymer Science and Technology, John Wiley and Sons, Inc 1965.
5. Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, Inc 1988.