

19MSPS303 ADHESIVES AND COATINGS SCIENCE

Unit-I

Adhesives – concepts and terminology, functions of adhesives, advantages and disadvantages of adhesive bonding, theories of adhesion-mechanical theory, adsorption theory, electrostatic theory, diffusion theory, weak-boundary layer theory, Requirements for a good bond, criteria for selection of adhesives. Definition and mechanisms of adhesion-mechanical interlocking – interdiffusion theories–adsorption and surface reaction. Surface topography, wetting and setting, thermodynamic work of adhesion – influence of constitution on adhesion – interfacial bonding – coupling agents.

Unit II

Types of adhesives, structural adhesives, Urethane structured adhesives, Modified acrylic structural adhesives, phenolic adhesives and modifiers, anaerobic adhesives, cyanoacrylate adhesives, hot melt adhesives, pressure sensitive adhesives, RTV Silicone adhesives, sealants, water based adhesives. Specialty adhesives, adhesives in aerospace, adhesive in automobile industry, conductive adhesives, adhesives in building construction, adhesive in electrical industry. Inorganic adhesives – animal glues – caesin – starch – cellulose ; Adhesive from natural, butyl, nitrile, styrene – butadiene – carboxylic polymers and neoprene rubbers, polysulphide, phenolic resin, epoxy, polyurethane, polyvinyl acetate, polyvinyl alcohol, polyvinyl acetal, acrylic, high temperature silicone adhesives. Water based – pressure sensitive – hot melt adhesives – anaerobic adhesives; Principle of compounding – role of resin – fillers – antioxidants – accelerator systems.

Unit III

Joint design, stress, types of joints, selection of joint detail, joint criteria, and surface preparation of adherends-metals, plastics and rubbers. Adhesive bonding process- methods for adhesives application and bonding equipment, adhesives for specific substrates, testing of adhesives, adhesive specifications and quality control. Principle of fracture mechanics, Peel, Lap shear and Butt tensile tests. Pull out of an extendable fibre, various testing of adhesives, energy dissipation – plasticity – strength of elastomers.

Unit IV

Introduction to surface coatings –Components of paints. Pigments, pigment properties, different types, extenders, solvents, oils, driers, diluents, lacquers, varnishes, paint preparation, formulation, factors affecting pigment dispersion, preparation of pigment dispersion. Different types of paints- classification based on polymeric resin, emulsion, oil and alkyd paints, acrylic paints, epoxy coatings, polyurethane, silicones, formaldehyde based resins, chlorinated rubbers, and hydrocarbon resins. Classification based on application, fluoropolymers, vinyl resins, appliance finishes, automotive finishes, coil coatings, can coatings, marine coatings, aircraft coatings.

Surface preparation and paint application. Paint properties and their evaluation – mechanism of film formation, factors affecting coating properties, methods used for film preparation – barrier properties, optical properties, ageing properties, rheological properties and adhesion properties of coatings.

Text Books:

1. Gerald L. Schreberger, Adhesive in manufacturing, Marcel Dekker Inc., New York, 1983
2. Swaraj Paul, Surface Coatings, John Wiley & Sons, NY, 1985.

References:

3. W.C. Wake, Adhesion and the formulation of adhesives. Applied Science Publishers, London, 1976.

4. George Mathews, Polymer Mixing Technology, Applied Science Publishers.
5. Sheilds, Hand book of adhesives, Butterworths, 1984.
6. Adams; R.D. (Ed.), Adhesives Bonding: Science, Technology and Applications, Woodhesd Publishing Ltd, Cambridge, CRC Press, Boca Raton, (2005)
7. Comyn; J., Adhesion Science, Royal Society of Chemistry (1997)