RADIATION CURABLE COATINGS

Radiation curable coatings are the polymer coatings, which are cured (cross-linking) when exposed to a radiation of ultra violet light (UV) or electron beam (EB).

- **Composition of radiation curable coatings**
- **Equipment for radiation curing**
- **Advantages and disadvantages of radiation curable coatings**

Composition of radiation curable coatings

Radiation curable coating consists of the following components:

- **Oligomers (prepolymers)** - reactive substances of relatively low molecular weight (intermediate between monomer and polymer), which are capable of furtherpolymerization. Cured (polymerized) oligomers determine the major properties of the radiation curable coating (adhesion to the substrate, strength, flexibility,corrosion protection). The function of oligomers is similar to that of binders in Solvent-borne paints and Water-borne paints. The following oligomers are used in radiation curable coatings:
  - Epoxy acrylate (the most popular oligomer)
  - Urethane acrylate
  - Polyester acrylate
  - Polyether acrylate
  - Acrylic acrylate
  - Silicone acrylate
- **Monomers** - low molecular weight substances reducing the viscosity of the radiation curable coatings. Monomers act similar to solvents in solvent-borne paints If lowering viscosity is the only function of a monomer it is called **monofunctional** monomer (e.g., isobornyl acrylate). **Multifunctional** (di-, tri-, tetra-, etc.) monomers have also other functions, for example they are involved in the formation of polymer network participating in cross-linking of oligomers during radiation curing.
- **Photoinitiators** absorb light (UV or visible) and initiate cross-linking reactions. The mechanism of the initiation is triggered by production of either free radicals (in free radicals polymerized systems) or cations (in a cationic photoinitiated systems). Photoinitiators are added in concentrations of 1-20%.
- **Additives** are used to modify and improve various functions of radiation curable coatings: pigments, fillers for viscosity control, wetting agents, defoamers and other additives for paints.

Equipment for radiation curing

- **Ultra violet curing.** Medium-pressure mercury vapor lamps or electrodeless gas-filled lamps generating the ultra violet radiation with a wave length of 200-400 nanometers are used for UV curing. The lamps may be equipped with semielliptical or parabolic reflectors to focus the light onto the curing coating. UV lamps are also equipped with shield protecting the personnel from the ultra violet radiation.
- **Electron beam curing.** The electrons bombard the coating surface forming free radicals required for the polymerization reaction.Electron beam is provided by electron gun accelerating and directing electrons emitted from the cathode surface in high vacuum. Two types of electron accelerators are used for EB curing: point cathode electron beam and linear cathode electron beam. EB equipment provides protection of the personnel from ionizing radiation (electrons and X-rays).

Advantages and disadvantages of radiation curable coatings

Advantages of radiation curable coatings:

- No Solvents
- Low VOC (volatile organic compounds)
- Low energy consumption
- Low capital investment
- Easy installation of equipment
- Low fire hazard
- High and consistent coating quality
- High production rate

Disadvantages of radiation curable coatings:

- Expensive raw materials
- Adhesion problems due to fast and high coating shrinkage
- Hazardous materials potentially causing skin irritation.
- Difficulties with curing 3-dimensional objects
- Difficulties with obtaining matte finish

Source : http://www.substech.com/dokuwiki/doku.php?id=radiation_curable_coatings