Difference Between Polyester Resin and Epoxy Resin

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Key Difference – Polyester Resin vs Epoxy Resin

Polyester resin and epoxy resin are two widely used polymer matrix materials, especially in manufacturing of fiber composite. Most widely used fibers include glass and carbon fibers. The type of fiber and polymer matrix system is chosen based on the final set of properties of the end-product. The key difference between polyester resin and epoxy resin is that **epoxy resin has adhesive properties while polyester resin does not have adhesive properties.**

What is Polyester Resin?

Polyester resin is widely applied in manufacturing fiberglass-reinforced plastics (FRP) profiles, which are used for structural engineering applications and making FRP rebars. Polyester resins can be used as a strengthening material and as a corrosion resistant polymer composite. Unsaturated polyester resin is the most widely used type of polyester resin which contains double-covalent bondsin its polymer chains.

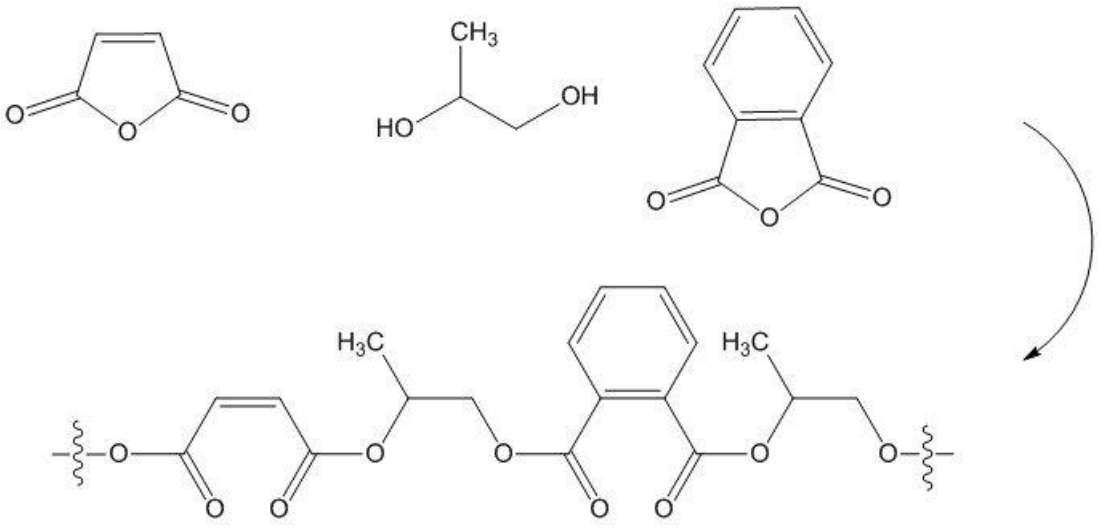

Figure 01: Unsaturated Polyester Resin

The properties of resin can be based on the acid monomer used in the polymerization reaction. Better mechanical and physical properties can be obtained in orthophthalic, isophthalic, and terephthalic polyesters. This resin is usually clear to greenish in color. However, it is possible to determine the color by using pigments. Polyester resins are also compatible with fillers. Polyester resins can be cured at room temperature or at higher temperatures. This depends on the polyester formulation and on the catalyst used during the manufacturing process. Therefore, the glass transition temperature of polyester resin varies between 40 to 110 °C.

What is Epoxy Resin?

Epoxy resin is a widely used polymer matrix; it is especially used in the production of carbon fiber-reinforced products in structural engineering applications. Epoxy resins are well-known for their adhesive properties along with their strengthening ability. The resins are used as adhesives to bind procured fiberglass reinforced plastic (FRP) strips to concrete. In addition, epoxy resins are applied to the dry fiber sheets in the field and then cured in-situ. This ultimately provides strength by acting as the matrix and as an adhesive that holds the fiber sheet on the substrate.

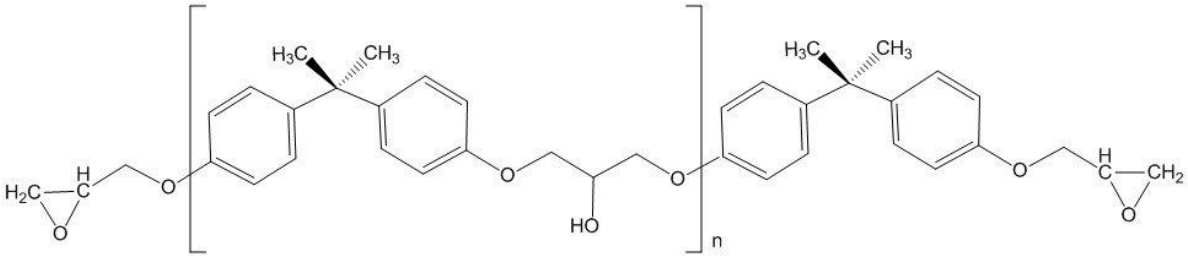

Figure 02: Diglycidyl ether of bisphenol-A epoxy resin structure

Epoxy resins are also used to make FRP tendons and FRP stay cables for bridges. When compared to polyester resin, epoxy resin costs more, which restricts its use in the manufacturing of larger FRP profiles. Epoxy resins contain one or more epoxide groups. If the epoxy is a product of the reaction between bisphenol A and epichlorohydrin, it is referred to as *bis A epoxies*. Epoxies made from alkylated phenol and formaldehyde are known as *novolacs*. Unlike polyesters, epoxy resins are cured with acid anhydrides and amines by condensation polymerization. Epoxy resins have excellent corrosion resistance and are less subjected to thermal cracking. As thermosetting resins that can be used in 180 °C or higher temperatures, epoxies are widely used in the aerospace industry. Epoxies can be cured at room temperature or elevated temperatures, which depend on the monomers used in the production process. Usually, post-cured epoxy resin composites at high temperatures have higher glass transition temperatures. Therefore, the glass transition temperature of an epoxy resin depends on the formulation and cure temperature and can be in the range of 40-300 °C. Epoxy resins are clear to amber in color.

What is the Difference Between Polyester Resin and Epoxy Resin?

Polyester Resin vs Epoxy Resin	
Polyester resin is produced by free-radical polymerization.	Epoxy resin is produced by condensation polymerization.
Adhesive Properties	
Polyester resins do not have adhesive properties.	Epoxy resins have adhesive properties.
Shrinkage	
The shrinkage is high.	The shrinkage is low.
Environmental Durability	
Environmental durability is low.	Environmental durability is high.
Applications	
Polyester resins are less likely to be used in high thermal applications.	Epoxy resins are more likely to be used in high thermal applications.
Glass Transition Temperature	
Glass transition temperature is 40 to 110 °C.	Glass transition temperature is 40-300 °C.
Cost	
Polyester resin is not expensive.	Epoxy resin is expensive.
Toxicity	
Polyester resin is highly toxic.	Epoxy resin is less toxic.

Summary – Polyester Resin vs Epoxy Resin

Both polyester resin and epoxy resin are two polymer matrix materials widely used in the manufacturing of fiber composites for structural engineering applications. Polyester resin is produced by free radical polymerization between dibasic organic acids and polyhydric alcohols in the presence of catalysts, whereas epoxy resins are produced by the condensation polymerization of bisphenol A and epichlorohydrin. Polyester resins provide strength and corrosion resistance, whereas epoxy resins provide adhesive

properties, strength, and high environmental stability. This is the difference between polyester resin and epoxy resin.

References:

1. Bank, Lawrence Colin. Composites for construction: structural design with FRP materials. John Wiley & Sons, 2006.
2. Bartmann, Dan, et al. Homebrew wind power: a hands-on guide to harnessing the wind. Buckville, 2009.

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