

EPOXIES AT A GLANCE

EPOXY RESIN COMMITTEE



Who invented epoxies and why?

Originally used for dental fixtures, epoxies were created in the 1930s by two scientists, Dr. Pierre Castan in Switzerland and Dr. Sylvan Greenlee in the United States. The first epoxies were amber-coloured solids but soon became widely available as adhesives. Today, more than 50 different substances known as epoxy resins are available and used in a wide range of different applications.

What are epoxy resins?

Epoxy resins are a class of prepolymers and polymers containing more than one epoxide group. Through a chemical reaction called curing, epoxy resins are processed with other chemicals to produce epoxy plastics (more commonly known as epoxies). The vast majority of epoxy resins are industrially produced petroleum derivatives. Today, hundreds of resins are available, the most common produced with epichlorohydrin and Bisphenol A.

What do they look like?

Epoxy resins can come either as low-molecular honey-like liquids or as high-molecular substances. At room temperature they appear in a solid state, assuming a sugar-like aspect, following a process of crystallisation. Following an increase in temperature or when heat is applied, solid epoxy resins would reverse to their liquid state. Cured epoxies are often colourless or transparent; pigments can be used to change their appearance.

How are they produced?

Epoxies are produced by cross-linking an epoxy resin together with another chemical called 'hardener', or reacting the epoxy resin by itself through catalytic homopolymerisation. The most common substances used as hardeners are polyamines, aminoamides or phenolic compounds. The reaction between a resin and a hardener, also known as 'curing' process, creates a polymer with strong mechanical properties, great resistance and durability. The resulting epoxy plastic is more commonly referred to as just epoxy or, somewhat confusingly, also as epoxy resin. Depending on the type of reaction used to produce them, cured epoxy resins can have variable molecular chain lengths and purity grades corresponding to various molecular weights. The molecular weight of the resins determines their possible uses.

How are epoxies used?

Epoxies are used in a number of applications. Their largest applications are found in the construction sector, where thanks to their hardness, strength and durability they are used to coat and protect different materials and surfaces, including piping and flooring. They are also widely used in the energy sector, in particular for windmill blades. Epoxies are also commonly found in the automotive sector to preserve the outside of vehicles from corrosion as well as in the maritime and aerospace industries. Thanks to their insulating properties, they are increasingly common in electronics. Other applications include sports equipment, as powder coatings in household appliances as well as food and beverage cans.

What are the properties of epoxies?

Cured epoxy resins have a number of different properties. They are a very stable and durable material, suitable to build machines and structures with a long lifespan. Epoxies have also good mechanical properties, making them a hard material but flexible at the same time. Epoxies are also adhesives materials which can be used in many ways. Finally, both resins and hardeners can be stored for a long time if they are not mixed, which is why epoxies are also specified in do-it-yourself packages for experienced, safety-aware users.

Are epoxies safe?

Cured epoxy resins do not pose any risk to human health when handled in a professional manner and following the necessary safety measures. When sold in small quantities as two-component systems, composed of an epoxy resin and a hardener, the risk of handling epoxies comes via skin contact when mixing these components. The necessary safety information should be always available in the material safety data sheet sold with each product. When these precautions are taken, epoxies can be handled safely.

The Epoxy Resin Committee has developed numerous documents to help everyday users handling epoxies in safety. For more information, visit our [Worker Safety](#) section.