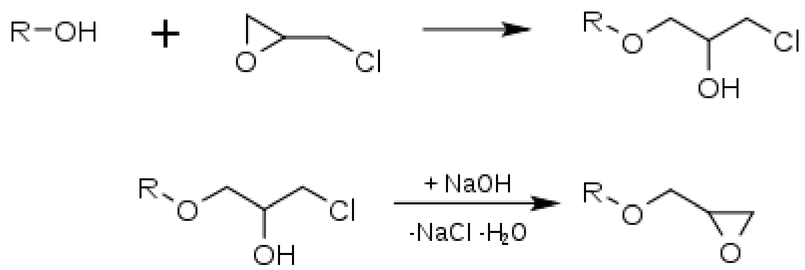
Epoxy Resins

Clear **casting resin** and table top **epoxy** are both very popular for encasing and suspending memorabilia, coating bars and countertops, river tables, **resin** art, jewelry, tumblers and more. These two **resins** are quite similar in some ways, but they are very different to work with and are meant for different **uses**. **We stock a large range of different Epoxies for different applications including Flooring Epoxy- feel free to contact us for your specific application.**

Generally quite more expensive than Polyesters, used in the manufacture of adhesives, plastics, paints, coatings, primers and sealers, flooring and other products and materials that are used in building and construction applications.Epoxy resins may be reacted (cross-linked) either with themselves through catalytic homopolymerisation, or with a wide range of co-reactants including polyfunctional amines, acids (and acid anhydrides), phenols, alcohols and thiols (usually called mercaptans). These co-reactants are often referred to as hardeners or curatives, and the cross-linking reaction is commonly referred to as curing.

Reaction of polyepoxides with themselves or with polyfunctional hardeners forms a thermosetting polymer, often with favorable mechanical properties and high thermal and chemical resistance. Epoxy has a wide range of applications, including metal coatings, use in electronics/electrical components/LEDs, high tension electrical insulators, paint brush manufacturing, fiber-reinforced plastic materials, and adhesives for structural and other purposes. Epoxies are thermoset plastics made by the reaction of two or more industrial chemical compounds.

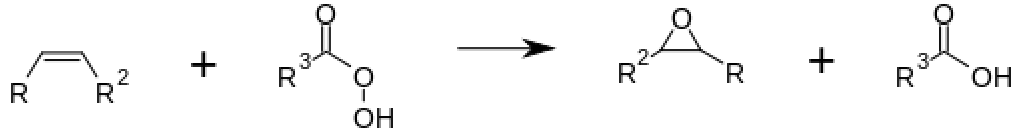
Most of the commercially used epoxy monomers are produced by the reaction of a compound with acidic hydroxy groups and epichlorohydrin:



First a hydroxy group reacts in a coupling reaction with epichlorohydrin, followed by dehydrohalogenation.

Epoxy resins produced from such epoxy monomers are called glycidyl-based epoxy resins. The hydroxy group may be derived from aliphatic diols, polyols (polyether polyols), phenolic compounds or dicarboxylic acids. Phenols can be compounds such as bisphenol A and novolak. Polyols can be compounds such as 1,4-butanediol. Di- and polyols lead to diglycid polyethers. Dicarboxylic acids such as hexahydrophthalic acid are used for diglycide ester resins. Instead of a hydroxy group, also the nitrogen atom of an amine or amide can be reacted with epichlorohydrin.

The other production route for epoxy resins is the conversion of aliphatic or cycloaliphatic alkenes with peracids:[2][3]

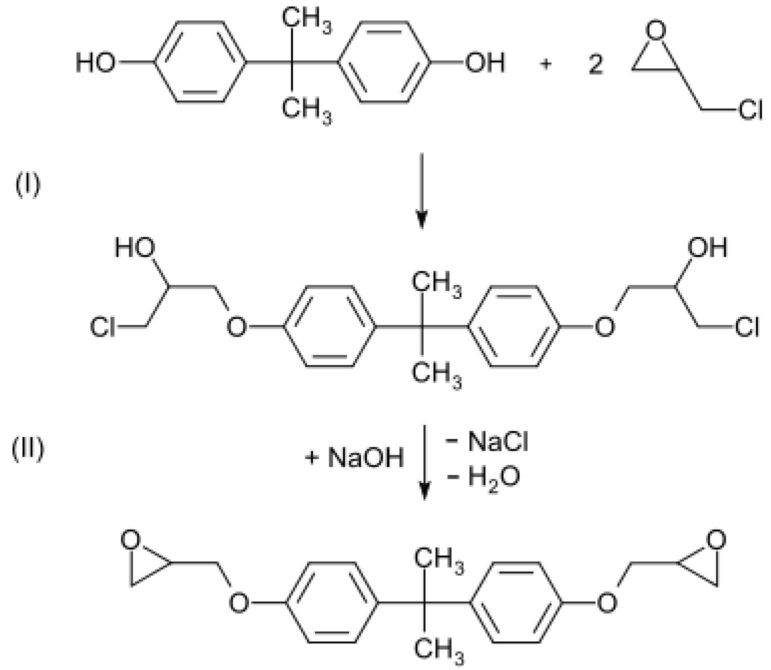


As can be seen, in contrast to glycidyl-based epoxy resins, this production of such epoxy monomers does not require an acidic hydrogen atom but an aliphatic double bond.

The epoxide group is also sometimes referred to as a *oxirane* group.

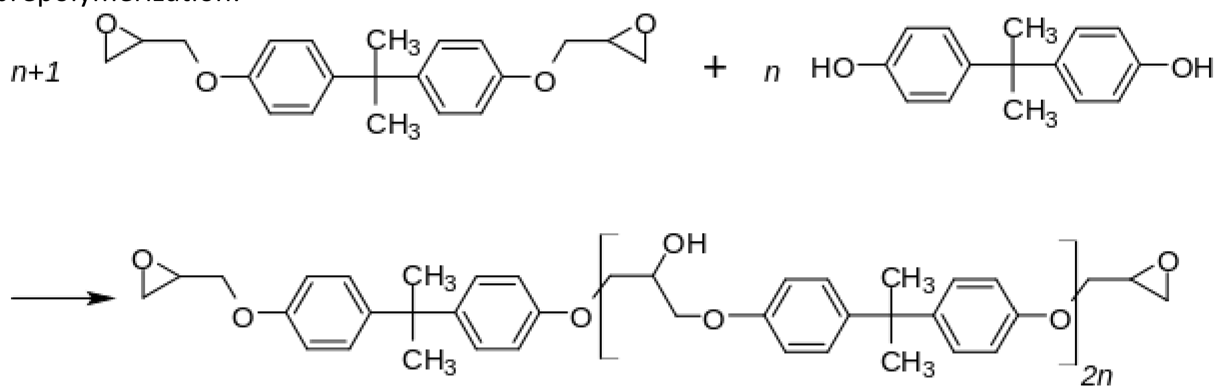
Bisphenol-based epoxy resins[edit]

The most common epoxy resins are based on reacting epichlorohydrin (ECH) with bisphenol A, resulting in a different chemical substance known as bisphenol A diglycidyl ether. This represents the most basic, i.e. lowest molecular weight type of epoxy resin, which is more commonly known as BADGE or DGEBA. Currently, BADGE-based resins are the most widely commercialised resins. Other common resins include BFDGE which is produced by reacting ECH with Bisphenol F.



In this two-stage reaction, epichlorohydrin is first added to bisphenol A (bis(3-chloro-2-hydroxy-propoxy)bisphenol A is formed), then a bisepoxide is formed in a condensation reaction with a stoichiometric amount of sodium hydroxide. The chlorine atom is released as sodium chloride, the hydrogen atom as of water.

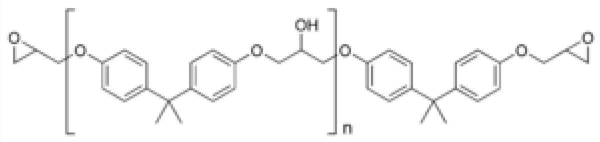
Higher molecular weight diglycidyl ethers (n ≥ 1) are formed by the reaction of the bisphenol A diglycidyl ether formed with further bisphenol A, this is called prepolymerization:



A product comprising a few repeat units (*n* = 1 to 2) is a viscous, clear liquid; this is called a liquid epoxy resin. A product comprising more repeating units (*n* = 2 to 30) is at room temperature a colourless solid, which is correspondingly referred to as solid epoxy resin.

Instead of bisphenol A, other bisphenols (especially bisphenol F) or brominated bisphenols (e. g. tetrabromobisphenol A) can be used for the said epoxidation and prepolymerisation. Bisphenol F may undergo epoxy resin formation in a similar fashion to bisphenol A. These resins typically have lower viscosity and a higher mean epoxy content per gram than bisphenol A resins, which (once cured) gives them increased chemical resistance.

Important epoxy resins are produced from combining epichlorohydrin and bisphenol A to give bisphenol A diglycidyl ethers.



Structure of bisphenol-A diglycidyl ether epoxy resin: *n* denotes the number of polymerized subunits and is typically in the range from 0 to 25

Increasing the ratio of bisphenol A to epichlorohydrin during manufacture produces higher molecular weight linear polyethers with glycidyl end groups, which are semi-solid to hard crystalline materials at room temperature depending on the molecular weight achieved. This route of synthesis is known as the "taffy" process. More modern manufacturing methods of higher molecular weight epoxy resins is to start with liquid epoxy resin (LER) and add a calculated amount of bisphenol A and then a catalyst is added and the reaction heated to circa 160 °C (320 °F). This process is known as "advancement".[4] As the molecular weight of the resin increases, the epoxide content reduces and the material behaves more and more like a thermoplastic. Very high molecular weight polycondensates (ca. 30 000 – 70 000 g/mol) form a class known as phenoxy resins and contain virtually no epoxide groups (since the terminal epoxy groups are insignificant compared to the total size of the molecule). These resins do however contain hydroxyl groups throughout the backbone, which may also undergo other cross-linking reactions, e.g. with aminoplasts, phenoplasts and isocyanates.

Epoxy resins are polymeric or semi-polymeric materials or an oligomer, and as such rarely exist as pure substances, since variable chain length results from the polymerisation reaction used to produce them. High purity grades can be produced for certain applications, e.g. using a distillation purification process. One downside of high purity liquid grades is their tendency to form crystalline solids due to their highly regular structure, which then require melting to enable processing.

An important criterion for epoxy resins is the epoxide group content. This is expressed as the "**epoxide equivalent weight**", which is the ratio between the molecular weight of the monomer and the number of epoxide groups. This parameter is used to calculate the mass of co-reactant (hardener) to use when curing epoxy resins. Epoxies are typically cured with stoichiometric or near-stoichiometric quantities of hardener to achieve the best physical properties.