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PREPARATION OF EPOXY RESINS BASED ON DIPHENYLOLPROPANE WITH EPICHLOROHYDRIN

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Abstract:
The article analyzes epoxy resins, which are products of condensation of polyatomic phenols (diphenylolpropane, resorcinol) with compounds containing an epoxy group, such as glycerin epichlorohydrin, glycerin diglycidal ester, glycerin dichlorohydrin. Epoxy resins are products of the reaction of diphenylolpropane with epichlorohydrin. They are used both in pure form and as a starting material for the production of epoxy compounds.

Keywords: epoxy resin, preparation, products,epoxy group, oligomers, epichlorohydrin, diphenylpropane.

Epoxy materials have been widely distributed all over the world since the middle of the last century. Epoxy compounds are used in electrical engineering, radio electronics, automotive and aviation industries, in the production of fiberglass in construction, ship and mechanical engineering, in workshops for the repair of boat hulls and car body elements. Epoxy resin has found an effective application for waterproofing the floor and walls of basements and swimming pools. Paints and materials for interior and exterior decoration of buildings. Impregnations to increase the strength and waterproofing of porous materials: concrete, wood and others.

Epoxy resin is an oligomer containing epoxy groups and under the action of hardeners (polyamines, etc.) are able to form cross-linked polymers.

Epoxy resins are available in liquid and solid state. They are thermoplastic, but under the influence of various hardeners they turn into non-melting polymers.

Cured epoxy resins are characterized by high physical and mechanical properties, dielectric properties, high chemical resistance, excellent adhesion to many metals, and water resistance.

Diphenylolpropane (diane or bisphenol A) and epichlorohydrin have found the most practical and widespread use for the production of epoxy resins.

Diphenylolpropane is solid crystals, the melting point is 154-156 ° C, the content of free phenol is not more than 0.1%, moisture is not more than 1%.

Epichlorohydrin is a transparent colorless liquid, boiling point 116-118 ° C, density 1.15– 1.16, flash point 40.5 ° C, the content of the basic substance 98-99%. The reaction takes place in an alkaline medium in the presence of a NaOH solution.

The technological process of manufacturing epoxy resin

Epichlorohydrin is loaded into a stainless steel reactor with a steam jacket and a stirrer and heated to 40-50 ° C. When the agitator is running, diphenylolpropane is gradually introduced. After dissolving diphenylolpropane and obtaining a homogeneous solution , a solution of caustic soda is added with a thin stream from the measuring cup and at 60-70 °C carry out the condensation process, which lasts 1.5-2 hours. All this time the agitator should work. After that, turn off the heating of the device, load the water, continuing mixing. After the mixing stops, the resulting resin is allowed to settle. The separation of layers occurs faster at 40-50 ° C. The amount of water is determined by volume (usually two or three times). Washing (mixing, settling, followed by separation of the water layer) continues until the complete removal of table salt formed by the reaction. Flushing is controlled by sampling (washing water) in the presence of chlorine and alkali.

The resin is dried in the same apparatus. To do this, the resin is heated to 40-50 ° C, the refrigerator is connected according to a direct scheme (with vacuum) and dried until the condensation of water in the refrigerator stops and the resin foams. Resin drying is also carried out without vacuum – at atmospheric pressure and a temperature of about 120 ° C. Resin drying continues until a transparent resin sample is obtained at 20-25 ° C. The finished resin is poured into an aluminum container.

Depending on the molar ratio of the initial components, the final components can be liquid, viscous and solid.

Due to the fact that the washing of liquid (low molecular weight) resin is much easier to produce than viscous (high molecular weight), low molecular weight resins are first obtained, which are then fused with the quantities of definylolpropane required by calculation and at the same time the necessary high molecular weight resins are obtained.

Cured epoxy resins have a small number of cross-links located at a considerable distance from each other, so the chain segments between the cross-links have some mobility. As a result, they are less brittle and differ from other resins by higher bending strength.

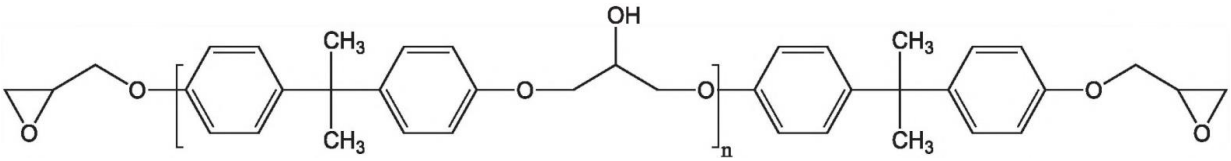
The excess and lack of hardener in the epoxy composition negatively affects the quality of the polymer: strength, resistance to heat, potent chemicals, water decreases. If there is a lack of hardener, the product becomes sticky due to unbound resin. The excess of the free hardener is gradually released on the polymer surface. For different compounds, the resin and the curing component are taken in different proportions, which is reflected in the instructions. In modern compounds, the ratio of 1:2 or 1:1 is most common.

Plasticizers and modifiers (dibutyl phthalate, thiokol and polyesters) increase elasticity and impact strength, reduce viscosity, improve frost resistance of epoxy compositions, but at the same time reduce heat resistance, adhesive properties, moisture resistance, and most importantly dielectric properties.

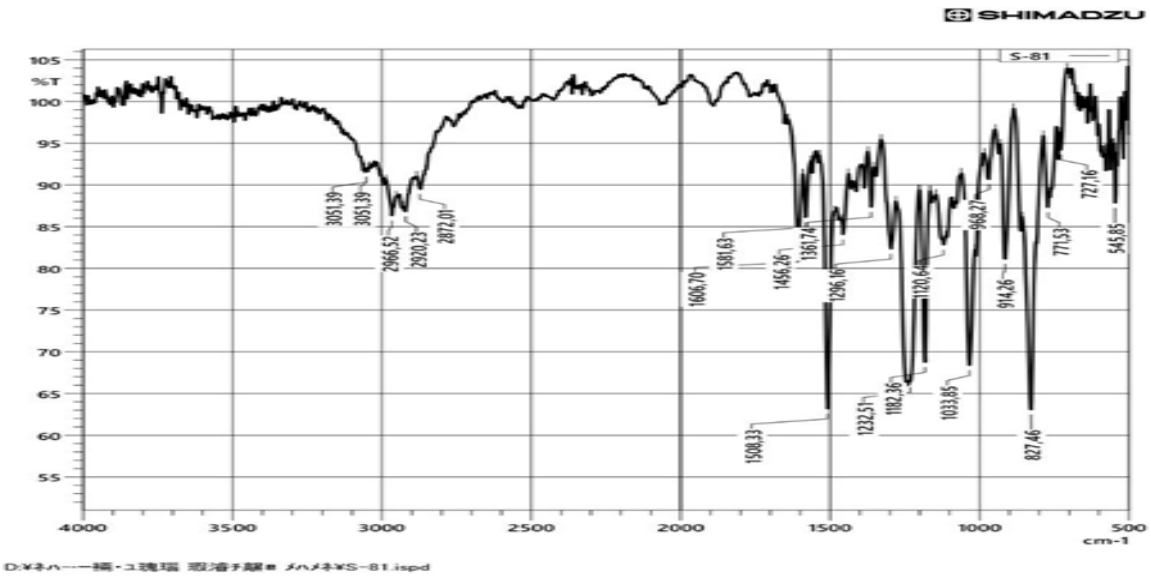
Fillers (quartz sand, marshalite, asbestos) increase the hardness and heat resistance of the composition, reduce shrinkage during curing, increase thermal conductivity, reduce the thermal coefficient of expansion, and also reduces the cost of the composition.

The global production of epoxy resins exceeds 1 million tons per year.

Polymers based on these resins have average physical and mechanical properties and are most widely used in industry.



The product obtained in the laboratory is an epoxy resin (epichlorohydrin and bisphenol A). the result of the IR spectrum.



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