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## Epoxy That Cures At Low Tmepratuees

Epoxy use is a main source of occupational asthma among users of plastics [21]Bisphenol A, which is used to manufacture a common class of epoxy resins, is a known endocrine disruptor.. Homopolymerisation[edit]Epoxy resin may be reacted with itself in the presence of an anionic catalyst (a Lewis base such as tertiary amines or imidazoles) or a cationic catalyst (a Lewis acid such as a boron trifluoride complex) to form a cured network.. Journal of Electron Microscopy Japan Society Microscopy 12 (1): 72 ^Luft, J H.. g 3,4-epoxycyclohexylmethyl-3,4-epoxycyclohexane carboxylate) This class also displays lower viscosity at room temperature, but offers significantly higher temperature resistance than the aliphatic epoxy diluents.. Epoxy Resin health hazards (California Department of Health Services) 21 April 2008 @ Wayback Machinehttps://web.. Aromatic amines present a particular health hazard (most are known or suspected carcinogens), but their use is now restricted to specific industrial applications, and safer aliphatic or cycloaliphatic amines are commonly employed.. Also aliphatic glycidyl epoxy resins usually have a low viscosity compared to aromatic epoxy resins.. About 9200 System Low Temperature Epoxy Rust-Oleum 9200 System is a very versatile, low VOC and low HAPS, two component phenalkamine epoxy.. Fusion Bonded Epoxy Powder Coatings (FBE) are extensively used for corrosion protection of steel pipes and fittings used in the oil and gas industry, potable water transmission pipelines (steel), and concrete reinforcing rebar.

(2015) Is Epoxy-Based Polymer Suitable for Water Shut-Off Application? SPE-176457-MS.. This parameter is used to calculate the mass of co-reactant (hardener) to use when curing epoxy resins.. CRC Press p 65 ISBN978-1-351-44995-3 Epoxies are the resins most commonly employed for electrical and electronic applications.. Curing epoxy resins[edit]Structure of a cured epoxy glue The triamine hardener is shown in red, the resin in black.. In principle, any molecule containing a reactive hydrogen may react with the epoxide groups of the epoxy resin.

[7] Claims of discovery of bisphenol-A-based epoxy resins include Pierre Castan[8] in 1943.. The secondary amine can further react with an epoxide to form a tertiary amine and an additional hydroxyl group.. They are therefore added to other epoxy resins as reactive diluents or as adhesion promoters.. The interior of a pocket calculator The dark lump of epoxy in the center covers the processor chipEpoxy resin formulations are important in the electronics industry, and are employed in motors, generators, transformers, switchgear, bushings, insulators, printed wiring boards (PWB), and semiconductor encapsulants.. ^Stäubli, W (1963) 'A new embedding technique for electron microscopy, combining a water-soluble epoxy resin (Durcupan) with water-insoluble Araldite'(PDF).

The rate of the reaction can be changed by using different hardeners, which may change the nature of the final product, or by controlling the temperature.. Aromatic amines were widely used as epoxy resin hardeners, due to the excellent end properties when mixed with a parent resin.. Insufficient heat during cure will result in a network with incomplete polymerisation, and thus reduced mechanical, chemical and heat resistance.. Epoxy resins are excellent electrical insulators and protect electrical components from short circuiting, dust and moisture.. g for UV coatings) Amines[edit]Polyfunctional primary amines form an important class of epoxy hardeners.. These are highly viscous to solid resins with typical mean epoxide functionality of around 2 to 6.. This obviated the problem of solvent retention under the film, which caused adhesion problems later on.

g through poor working hygiene or lack of protective equipment) over a long period of time.. They can be made flexible or rigid, transparent or opaque/colored, fast setting or slow setting.. In general, uncured epoxy resins have only poor mechanical, chemical and heat resistance properties.. Novolac epoxy resin[edit]General structure of epoxyphenol novolak with n usually in the range from 0 to 4.. These modifications are made to reduce costs, to improve performance, and to improve processing convenience.. Transformer and inductor hot spots are greatly reduced, giving the component a stable and longer life than unpotted product.. Due to the low dielectric constants and the absence of chlorine, cycloaliphatic epoxides are often used to encapsulate electronic systems, such as microchips or LEDs.. s) and are often referred to as reactive diluents They are rarely

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used alone, but are rather employed to modify (reduce) the viscosity of other epoxy resins.. (1961) 'Improvements in epoxy resin embedding methods'(PDF) The Journal of Biophysical and Biochemical Cytology.. The final product is then a precise thermo-setting plastic Until they are mixed the two elements are relatively inert, although the 'hardeners' tend to be more chemically active and should be protected from the atmosphere and moisture.. Compared with LERs (liquid epoxy resins) they have very low viscosities If, however, they are used in larger proportions as reactive diluents, this often leads to reduced chemical and thermal resistance and to poorer mechanical properties of the cured epoxides.. Common classes of hardeners for epoxy resins include amines, acids, acid anhydrides, phenols, alcohols and thiols.. Relative reactivity (lowest first) is approximately in the order: phenol < anhydride < aromatic amine < cycloaliphatic amine < aliphatic amine < thiol.. Thiols[edit]Also known as mercaptans, thiols contain a sulfur which reacts very readily with the epoxide group, even at ambient or sub-ambient temperatures.. [5] Cycloaliphatic epoxides are characterised by their aliphatic structure, high oxirane content and the absence of chlorine, which results in low viscosity and (once cured) good weather resistance, low dielectric constants and high Tg.. History[edit]Condensation of epoxides and amines was first reported and patented by Paul Schlack of Germany in 1934.. This epoxy is waterproof and capable of curing underwater The blue-coloured epoxy on the left is still undergoing curing.. 16 1 197 PMC2106182 ^Kushida, H (1963) 'A Modification of the Water-miscible Epoxy Resin 'Durcupan' Embedding Method for Ultrathin Sectioning'.. Epoxies were modified in a variety of ways, Reacted with fatty acids derived from oils to yield epoxy esters, which were cured the same way as alkyds.. ) New York: Marcel Dekker Inc p 794 ISBN0-8247-7690-9 ^Bayliss, D A ; Deacon, D.. Liquid epoxy resins in their uncured state are mostly classed as irritant to the eyes and skin, as well as toxic to aquatic organisms.. Higher molecular weight diglycidyl ethers ( $n \geq 1$ ) 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 syringe of '5-minute' epoxy glue, containing separate compartments for the epoxy resin and the hardener.. The chlorine atom is released as sodium chloride, the hydrogen atom as of water.. g trimethylolpropane triglycidyl ether) These resins typically display low viscosity at room temperature (10-200 mPa.. Polyester resins are typically low strength unless used with a reinforcing material like glass fibre, are relatively brittle unless reinforced, and have low adhesion.. 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).. Epoxy paints tend to deteriorate, known as 'chalking out', due to UV exposure [12]Polyester epoxies are used as powder coatings for washers, driers and other 'white goods'.. RAPRA Review Reports, 1996, ISBN978-1-85957-083-8, S 8 ^ abHakiki, Farizal et al.. [15] The chemical reactions in both cases are exothermic Large quantities of mix will generate their own heat and greatly speed the reaction, so it is usual to mix small amounts which can be used quickly.. Epoxy is either any of the basic components or the cured end products of epoxy resins, as well as a colloquial name for the epoxide functional group.. Reaction of polyepoxides with themselves or with polyfunctional hardeners forms a thermosettingpolymer, often with favorable mechanical properties and high thermal and chemical resistance.. g plant derived glycerol used to make epichlorohydrin) Health risks[edit]The primary risk associated with epoxy use is often related to the hardener component and not to the epoxy resin itself.. Many properties of epoxies can be modified (for example silver-filled epoxies with good electrical conductivity are available, although epoxies are typically electrically insulating).. In the electronics industry epoxy resins are the primary resin used in overmolding integrated circuits, transistors and hybrid circuits, and making printed circuit boards.. It is made up of approximately 50–100 manufacturers of basic or commodity epoxy resins and hardeners.. The hydroxy group may be derived from aliphatic diols, polyols (polyether polyols), phenolic compounds or dicarboxylic acids.. Use of blending, additives and fillers is often referred to as formulating (see: formulation.. 3 Aufl Hanser, München 2011, ISBN978-3-446-43047-1, S 437 ff ^Epoxy resin mixtures containing advancement catalysts'(PDF).. Large scale epoxidized vegetable oils such as epoxidized soy and lens oils are used to a large extent as secondary plasticizers and cost stabilizers for PVC.. [2]Epoxidized vegetable oils are formed by epoxidation of unsaturated fatty acids by reaction with peracids.. Epoxy resins produced from such epoxy monomers are called glycidyl-based epoxy resins.. This 'plastic tooling' replaces metal, wood and other traditional materials, and generally improves the efficiency and either lowers the overall cost or shortens the lead-time for many industrial processes.. Inc pp 124–125 ISBN978-0-442-26414-7 ^'Technical Advances in Epoxy Technology for Wind Turbine Blade Fabrication'(PDF).. While it is common to associate polyester resins and epoxy resins, their properties are sufficiently different that they are properly treated as distinct materials.. By curing, highly cross-linked polymers with high temperature and chemical resistance but low mechanical flexibility are formed due to the high functionality of these resins.. 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).. 9 (2) Rockefeller Univ Press p 409 ^McCreight, Tim; Bsullak, Nicole (2001) Color on Metal: 50 Artists Share Insights and Techniques.. Epoxy resins are also used for decorative flooring applications such as terrazzo flooring, chip flooring, and colored aggregate flooring.. [20] Exposure to epoxy resins can, over time, induce an allergic reaction Sensitization generally occurs due to repeated exposure (e.. [13]Some epoxies are cured by exposure to ultraviolet light Such epoxies are commonly used in optics,

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fiber optics, and optoelectronics.. ^US 2444333, Pierre Castan, 'Process for the manufacture of thermosetting synthetic resins by the polymerization of alkylene oxide derivatives', issued 1948-06-29, assigned to DeVoe & Reynolds^US 2456408, Sylvan Owen Greenlee, 'Synthetic drying compositions', issued 1948-12-14, assigned to DeVoe & Reynolds^'History of Epoxy Resin'.. Guild Pub ISBN978-1-893164-06-2 ^[1] An assessment of skin sensitisation by the use of epoxy resin in the construction industry, 2003^MayoClinic --> Occupational asthma May 23, 2009External links[edit]Look up epoxy in Wiktionary, the free dictionary.. However, the commercial use of fluorinated epoxy resins is limited by their high cost and low Tg.. doi: 10.2118/176457-MS^P Schlack, I G Farbenindustrie, German Patent 676 117 (1938), US Patent 2 136 928 (1938).. Epoxy materials tend to harden somewhat more gradually, while polyester materials tend to harden quickly, particularly if a lot of catalyst is used.. In general, epoxy adhesives cured with heat will be more heat- and chemical-resistant than those cured at room temperature.. As a result, a typical formulator sells dozens or even thousands of formulations—each tailored to the requirements of a particular application or market.. Normal gelcoat formulated for use with polyester resins and vinylester resins does not adhere to epoxy surfaces, though epoxy adheres very well if applied to polyester resin surfaces.. Epoxy coatings are also widely used as primers to improve the adhesion of automotive and marine paints especially on metal surfaces where corrosion (rusting) resistance is important.. Proceeding of The 39th IPA Conference and Exhibition, Jakarta, Indonesia, May 2015.. freepatentsonline com Retrieved 2018-08-29 ^L Hammerton, ed by Rebecca Dolbey: Recent Developments in Epoxy Resins.. Preliminary Study on Epoxy-Based Polymer for Water Shut-Off Application Paper IPA15-SE-025.. Important industrial grades are triglycidyl-p-aminophenol (functionality 3) and N,N,N',N'-tetraglycidyl-bis-(4-aminophenyl)-methane (functionality 4).. However, good properties are obtained by reacting the linear epoxy resin with suitable curatives to form three-dimensional cross-linked thermoset structures.. Epoxy adhesives can be developed to suit almost any application They can be used as adhesives for wood, metal, glass, stone, and some plastics. e10c415e6f