

Epoxy Resins Technology Handbook (Manufacturing Process, Synthesis, Epoxy Resin Adhesives and Epoxy Coatings) 2nd Revised Edition

Author:- Dr. H. Panda

Format: paperback

Code: NI305

Pages: 576

Price: Rs.0US\$ 0

Publisher: NIIR PROJECT CONSULTANCY SERVICES

Usually ships within **5** days

Epoxy is a term used to denote both the basic components and the cured end products of epoxy resins, as well as a colloquial name for the epoxide functional group. Epoxy resin are a class of thermoset materials used extensively in structural and specialty composite applications because they offer a unique combination of properties that are unattainable with other thermoset resins.

Epoxies are monomers or prepolymers that further reacts with curing agents to yield high performance thermosetting plastics. They have gained wide acceptance in protecting coatings, electrical and structural applications because of their exceptional combination of properties such as toughness, adhesion, chemical resistance and superior electrical properties. Epoxy resins are characterized by the presence of a three membered cycle ether group commonly referred to as an epoxy group 1,2-epoxide, or oxirane. The most widely used epoxy resins are diglycidyl ethers of bisphenol-A derived from bisphenol-A and epichlorohydrin.

The market of epoxy resins are growing day by day. Today the total business of this product is more than 100 crores. Epoxy resins are used for about 75% of wind blades currently produced worldwide, while polyester resins account for the remaining 25%. A standard 1.5-MW (megawatt) wind turbine has approximately 10 tonnes of epoxy in its blades. Traditionally, the markets for epoxy resins have been driven by demand generated primarily in areas of adhesives, building and civil construction, electrical insulation, printed circuit boards, and protective coatings for consumer durables, amongst others.

The major contents of the book are synthesis and characteristics of epoxy resin, manufacture of epoxy resins, epoxide curing reactions, the dynamic mechanical properties of epoxy resins, physical and chemical properties of epoxy resins, epoxy resin adhesives, epoxy resin coatings, epoxy coating give into water, electrical and electronic applications, analysis of epoxides and epoxy resins and the toxicology of epoxy resins.

It will be a standard reference book for professionals and entrepreneurs. Those who are interested in this field can find the complete information from manufacture to final uses of epoxy resin. This presentation will be very helpful to new entrepreneurs, technocrats, research scholars, libraries and existing units. 1. Synthesis and Characteristics of Epoxy Resin Introduction

Structure of Epoxides
Epoxidation of Unsaturated Hydrocarbons
Catalytic Oxidation of Ethylene and Higher Olefins
Epoxidation by Peroxy Acids and Their Esters
Preparation of Peroxy Acids
In Situ Epoxidation
The Epoxidation Mechanism
Unsaturated Materials
Epoxidation by Inorganic Peroxy Acids
Epoxidation with Aliphatic and Aromatic Hydrocarbon Hydroperoxides
Epoxidation with Chromic Acid and Chromyl Compounds
Biological Epoxidation
Dehydrohalogenation of Substituted Hydroxyl Compounds
The Epoxidation Mechanism
Halohydrin Formation
Epoxides from Epichlorohydrin
Glycidyl Ethers
Glycidyl Esters
Nitrogen-Containing Epoxides
Thioglycidyl Epoxides
Silicon-Containing Epoxides
Organophosphorus Epoxides
Halogen-Containing Epoxides
Epoxides from Hydroxy Sulfonates or Halogenated Acetates
Epoxides from Glycols
Epoxidation by Condensation
Darzens Glycidic Ester Condensations
Epoxides from Ylids
Epoxides from Halogenated Ketones and Nickel Carbonyl
Epoxides from the Reaction of Diazomethane with Aldehydes or Ketones
Epoxides Containing Unsaturation
Conclusions

2. Manufacture of Epoxy Resins

Raw Materials
Manufacture
Plant Location
Machinery Needed
Profit

3. Epoxide-Curing Reactions

The Effect of Epoxide Structure on Reactivity with Curing Agents
The Mechanism of the Curing Reaction
Polyaddition Reactions
Polyamines
Polyamides
Polyureas
Polyurethanes
Polyisocyanates
Polymercaptans
Polyhydric Alcohols
Polyphenols
Polycarboxylic Acids

Polybasic Acid Anhydrides
Silanes and Silanols
Others
Polymerization
Anionic Catalysts
Cationic Catalysts

4. The Dynamic Mechanical Properties of Epoxy Resins

Basic Parameters

The Glassy Transition and Dynamic Mechanical Dispersion

Temperature and Frequency Interdependence

Experimental

Results and Discussion

Standard Measurements

Dynamic Measurements

Comparison of Results

Treatment by Reduced Variables

Conclusions

5. Physical and Chemical Properties of Epoxy Resins

Solubility and Surface Properties

Network Structure and Physical Properties

Aging and Chemorheology

Bisphenol a Epoxy Homopolymers and Copolymers

Thermal Transition Effects

Dynamic Mechanical Response

Relaxation and Fracture Properties

Properties Compared with Elastomers and Thermoplastics

6. Epoxy Resin Adhesives

Introduction

Theories of Adhesion and Adhesive-joint Strength

Wetting and Spreading Phenomena

Boundary-Layer Theory

Surface-Attachment Theory of Adhesive-Joint Strengths

Stress Distribution in Adhesive Joints

Rheological Aspects of Adhesives

Unified Interpretation of Adhesive-Joint Strengths

Physical and Mechanical Aspects of Epoxy-Resin Adhesives

Dynamic Mechanical Techniques

Mechanical Behavior of Epoxy Adhesives During Joint Formation

Strength of Adhesive Materials

Chemical Aspects of Epoxy-based Adhesives

Curing Agents for Bisphenol A Epoxy Adhesives

Modifiers for Bisphenol A Epoxy Adhesives

Adhesives Based on Other Epoxy Materials

Technological Properties of Epoxy-adhesive Systems

Cure and Thermal Softening Behavior of Epoxy Adhesives

Stress and Environmental Durability of Adhesive Joints

Applications of Epoxy Adhesives

Future Prospects

7. Epoxy Resin Coatings

Classification of Epoxy-Resin Coatings
Epoxy Resins Commonly Used in Coatings
Epoxy-Resin Esters
Esters Produced from Solid Epoxy Resins
General Remarks
Formulation Latitude
Esters Produced from Liquid Epoxy Resins
Precatalyzed Liquid Epoxy Resin for the Production of Solid Epoxy Resins and Epoxy-Resin Esters
Cooking Procedure
“Two-Step” Liquid-Epoxy-Resin Route to Epoxy-Resin Esters
Cooking Procedure
Solid-Epoxy-Resin Solution Coatings
Cold-Cured Epoxy-Resin Systems
Polyamine Curing Agents
Polyamine-Adduct Curing Agents
Polyamide-Resin Curing Agents
Polyamide-Adduct Curing Agents
Tertiary Amine Curing Agents
Industrial Maintenance Coatings Based on Cold-Cured Epoxy-Resin Systems
High-Film-Build Cold-Cured Epoxy-Resin Coatings
Application Instructions
Manufacturing Instructions
Epoxy Baking Finishes
Epoxy-Phenolic Coating Systems
Epoxy-Urea-Formaldehyde Resin Coating Systems
Epoxy-Thermosetting Acrylic Coating Systems
Liquid Epoxy Resins in Solventless and Super-High-Solids Systems
Special Application Equipment and Formulation for Solventless Systems
Manufacturing Instructions
Application
Ketimine Curing Agents
Manufacturing Instructions
Application
Curing Characteristics
Powder Coatings
Application Equipment
Epoxy-Resin Powder-Coating Formulations
Fusion-Produced Epoxy-Resin Powders
Manufacturing Instructions
Applications Instructions
Dry-blended Epoxy-Resin Powders
Manufacturing Instructions
Application Instructions
Properties and Applications
Thermoplastic Epoxy Resins
Zinc-Rich and General Purpose Shop Primers
Manufacturing Instructions
Application Instructions
Manufacturing Instructions
Application Instructions
Thermoplastic-Epoxy-Resin Crosslinked Systems
Water-Reducible Epoxy Resin Coatings

Water-Reducible Epoxy-Ester Baking Finishes

Manufacturing Instructions

Application Instructions

Water-Reducible Polyamide-Cured Epoxy-Resin Coatings

Manufacturing Instructions

Manufacturing Instructions

Water-Reducible Epoxy-Resin Coatings for Electrodeposition

General Remarks

Maleinization Step After Complete Esterification of the Epoxy Resin with Organic Acids

Cooking Procedure

Application Instructions

8. Epoxy Coating Give into Water

9. Electrical and Electronic Applications : Sealants and Foams

Electronic and Electrical Applications

Introduction

Casting

Potting

Encapsulation

Coatings

Sealing

Molding

Formulation of the Resin System

Internal Stresses

Rapid Cures

Flexibilizing Epoxy Resins

Fillers

Reactive Diluents

Cycloaliphatic Epoxides

High-Temperature Epoxy-Resin Systems

Flame-Retardant Epoxy Resins

Colorless Epoxy Resins

Epoxy Formulations

Molding

Molding Compounds

Molding Technology

Liquid-Injection Molding

Pellets and Preforms

Epoxy Sealants

Epoxy Foams

Gas-Blown Foams

Syntactic Foams

One-Package Foams

Epoxy-Foam Applications

Epoxy Strippers

Handling of Epoxy Casting Systems

10. Analysis of Epoxides and Epoxy Resins

Uncured Epoxy Resins

Qualitative Tests

Detection of Free Epoxy Groups

Determination of Epoxy Group—Lithium-Chloride Test

Reagents

Procedure

Determination of Epoxy Group—Periodic Acid Test

Reagents

Procedure

Determination of Epoxy Group—Pyrolysis Test

Reagents

Procedure

Determination of Epoxy Group—Lepidine Test

Reagents

Procedure

Detection of the Bisphenol A Skeleton

Determination of Bisphenol A Epoxy Resins—Mercuric Oxide and Nitric Acid Tests

Reagents

Procedure

Determination of Bisphenol A Epoxy Resins in Coatings—Nitric Acid Test Reagents

Reagent

Procedure

Determination of Bisphenol A Epoxy Resins—Filter-Paper Test

Reagents

Procedure

Determination of Bisphenol A Epoxy Resin—Formaldehyde Test

Reagents

Procedure

Determination of Bisphenol A Epoxy Resins—Phenylenediamine Test

Reagent

Procedure

Detection of Epoxy Resins Based on 4,4'-Diamino-diphenylmethane

Determination of Epoxy Resins Based on 4,4'-Diaminodiphenylmethane

Reagents

Procedure

Detection of Other Epoxy Resins

Quantitative Tests of the Epoxy Group

Hydrohalogenation Methods

Estimation of Epoxy Group—Hydrochloric Acid in Dioxane, Methyl Ethyl Ketone, or Dimethylformamide

Reagents

Procedure

Calculations

Estimation of the Epoxy Group—Pyridinium Chloride in Pyridine

Reagents

Procedure

Hydrohalogenation by Direct Titration

Estimation of Epoxy Group

Reagents

Procedure

Calculations

Other Chemical Methods

Estimation of Other Functional Groups

Hydroxyl Group

?-Glycol Group

Estimation of α -Glycol Group

Reagents

Procedure
Calculation
Chlorine
Esterification Equivalent Weight
Estimation of Esterification Equivalent Weight
Reagents
Procedure
Calculation
Infrared Spectroscopy
Technique
Epoxide Absorption Bands
Epoxy Resins
Quantitative Estimation
Following the Degree of Cure
Other Physical Methods
Ultraviolet Spectroscopy
Electron Spin and Nuclear Magnetic Resonance Methods
Gas Chromatography
Paper Chromatography
Thin-Layer and Gel-Permeation Chromatography
Handling Properties
Molecular Weight
Softening Point
Viscosity
Color
Blends and Compounds
Hardeners and Accelerators
Organic Acid Anhydrides
Determination of Acid and Anhydride Content
Reagents
Procedure
Calculations
Amines
Determination of Amine Number
Reagents
Procedure
Calculation
The Curing Process
Curing Characteristics of Epoxy Resin-Hardener Systems
Determining the Degree of Cure
Analysis of Cured Epoxy Resins

11. The Toxicology of Epoxy Resins

Introduction
Experimental Method
Materials
Acute Toxicity
Chronic Toxicity
Irritation
Sensitization
Results
Acute Toxicity
Chronic Toxicity

Irritation
Sensitization
Medical Experience with Epoxy Resins
Comment

12. Photographs of Machinery with Suppliers
Contact Details

About NIIR

NIIR PROJECT CONSULTANCY SERVICES (NPCS) is a reliable name in the industrial world for offering integrated technical consultancy services. NPCS is manned by engineers, planners, specialists, financial experts, economic analysts and design specialists with extensive experience in the related industries.

Our various services are: Detailed Project Report, Business Plan for Manufacturing Plant, Start-up Ideas, Business Ideas for Entrepreneurs, Start up Business Opportunities, entrepreneurship projects, Successful Business Plan, Industry Trends, Market Research, Manufacturing Process, Machinery, Raw Materials, project report, Cost and Revenue, Pre-feasibility study for Profitable Manufacturing Business, Project Identification, Project Feasibility and Market Study, Identification of Profitable Industrial Project Opportunities, Business Opportunities, Investment Opportunities for Most Profitable Business in India, Manufacturing Business Ideas, Preparation of Project Profile, Pre-Investment and Pre-Feasibility Study, Market Research Study, Preparation of Techno-Economic Feasibility Report, Identification and Section of Plant, Process, Equipment, General Guidance, Startup Help, Technical and Commercial Counseling for setting up new industrial project and Most Profitable Small Scale Business.

NPCS also publishes various process technology, technical, reference, self employment and startup books, directory, business and industry database, bankable detailed project report, market research report on various industries, small scale industry and profit making business. Besides being used by manufacturers, industrialists and entrepreneurs, our publications are also used by professionals including project engineers, information services bureau, consultants and project consultancy firms as one of the input in their research.

Our Detailed Project report aims at providing all the critical data required by any entrepreneur vying to venture into Project. While expanding a current business or while venturing into new business, entrepreneurs are often faced with the dilemma of zeroing in on a suitable product/line.

NIIR PROJECT CONSULTANCY SERVICES, 106-E, Kamla Nagar, New Delhi-110007, India.
Email: npcs.india@gmail.com Website: NIIR.org

Mon, 13 Jan 2025 06:33:36 +0000