



## Coating of Halogenated Epoxy Resins on Aluminium, Copper and Steel Plates

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### Abstract

*Applications of sophisticated primers, surfaces and topcoats have greatly increased the life of coated article. Coatings have also triggered the development in the field of marine, automobile, architectural, maintenance and fiber optics coatings. Also, specifically coatings that control absorption or emission for temperature control, aircraft coatings that withstand the effects of UV radiation, absorption and the impact of air and dirt. Coatings based on epoxies-hardeners-fatty acids compositions are widely discovered with modifications as per need, those are particularly incorporated in automobile, construction, marine, aircraft, electrical, food-dairy industries, leather and tanning industries and chemical industries. Phenolic resins are well known for two major applications in molding and laminates.*

*They are also applied in other applications. All the plates were dried and heated in an oven at 90<sup>o</sup> C for 2h to ensure complete evaporation of solvent from the coatings. Then coated plates were post cured at 150<sup>o</sup> C for 2h to complete curing. A fine coating was observed on plates with good adhesion to the substrates. The coated plates were tested for their surface resistivity and water, acid and salt resistance. The surface resistivity was found more than 2000 MΩ. The coating was deteriorated slowly after 24 h due to small cavities at the surfaces or cavities due to entrapped solvent molecules on the film's surface. Bonds could be made to metals and glass without resorting to the application of pressure irregular surfaces. Therefore the discovery of the bonding function of epoxy resins introduced a new concept in adhesive materials and inaugurated the modern approach to the technology of adhesive bonding.*

**Key Words:** Fiber-resin, Absorption, Emission, Coated plates.



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**EXPERIMENTAL:** Cast phenolic resins are important plastic material. Self-extinguishing phenolic resin foams are developed recently but are more expensive than well expanded polystyrene. Other commercially practiced phenol formaldehyde resins are 'fiber-resin perform moldings', which provides characteristics of molded powder and laminates. Such perform

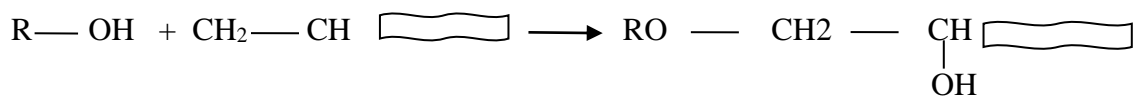
moldings are particularly useful in carrying containers, protective covers, television receiver backs, molded suitcases and in computer parts. Phenolic resins are useful in surface coating materials and in adhesive preparation. They are also applied to impregnate wood and metal coil to give a rigid, heat and water resistance structure. Epoxy resins are firmly established in number of important applications like surface coatings, encapsulation of electronic components, other applications include adhesives, castings and laminates though they are relatively high cost.

Curing of epoxy resins takes place either through epoxy group or hydroxyl group involves two types of curing agents, catalytic system and polyfunctional cross-linking agents.

The catalytic cross-linking occurs in presence of hydroxyl group, which may be present due to the following circumstances:

1. They will be present in the higher molecular weight homologues of the diglycidyl ether of bisphenol A.
2. They may be introduced by the curing agent or modifier.
3. They will be formed as epoxy rings are opened during cure.
4. In unreacted phenol type materials they are present as impurities.

The epoxy-hydroxyl reaction is given by as below:



There is a large range of composites available commercially, which include the phenolic, amino plastics, polyesters, epoxides, silicones and the furan resins reinforced with natural fibres like jute, hemp, cotton, sisal, banana and coir and also with man-made fibers like carbon, aramid, paper asbestos and glass fibers. Thermosetting resins are widely applied than thermoplastic resins. Some of the more common thermosetting resins used in the preparation of composites are epoxies, polyurethanes, phenolic, polyamides, and polyimides.

The use of epoxy esters in powder coating has two main advantages as compared with solvent-based system.

- (1) Absence of solvents reduces health and safety hazards.

(2) For special heavy-duty application, a high film thickness can be obtained in one application without danger of solvent evaporation or film porosity.

Suitably modified epoxy esters are also used for both anodic and cathodic electro deposition as automotive primers.

Although epoxy esters have similarities with alkyd resins, they offer films with some superior film properties in particular, adhesion, flexibility, chemical resistance and color.

They have advantage of air-drying or stoving or they can be co-cured with phenolic or amino resins. The epoxy esters can be applied by roller coating, spraying and brushing or electro deposition.

Also they offer advantages like

- Excellent flexibility
- Better chemical resistance
- Excellent durability
- Good adhesion
- Ease of handling
- Rapid air dry or back curing
- Good film toughness

Above all these advantages make epoxy esters a versatile coat almost used in every facets of life such as

- Automotive primers
- Appliance primers
- Flexible tube coatings
- Drum linings
- Marine finishes
- Floor sealers and top coats
- Metal decorating lacquers
- Enamels for hardware and metal furniture
- Industrial maintenance primers and top coats

ECBEMF / EBB (1 g) and BCF (0.5 g) were dissolved in 50 ml of acetone and applied on 5 cm x 1 cm aluminium, copper and steel plates by means of a smooth brush. All the plates were allowed to dry at room temperature for 30 mins. The dried plates were heated in an oven below

90<sup>o</sup> C for 2h to ensure complete evaporation of solvent from the coatings. Then coated plates were post cured at 150°C for 2h to complete curing. A very fine coating was observed on plates with good adhesion to the substrates.

Average thickness of coatings on metal plates Resin	Thickness, $\mu\text{m}$		
	Aluminium	Copper	Mild Steel
ECB	20	16	13
ECM	11	26	63
EBB	23	40	16

## RESULTS:

The coated plates were tested for chemical resistance and surface conductivity.

### (1) Surface conductivity

The insulation property of coatings was measured by two probes standard multimeter Model No. S-200, Dot Tech. The surfaces of all metal plates were found insulating (resistance > 2000M $\Omega$ ). The current surface conductivity test was carried out at several places of the same plate to ensure perfect insulation property of coating.

### (2) Chemical resistance of coatings:

All the coated plates were subjected to chemical resistance by immersing in each of 10% HCl, NaCl and distilled water. The immersed plates were observed periodically. All coated plates were intact up to 24h and then coating was deteriorated slowly and coated films removed from the substrate surface. This might be due to small cavities at the surfaces or cavities due to entrapped solvent molecules on the film's surface.

Epoxy esters have similarities with alkyd resins, they offer films with some superior film properties in particular, adhesion, flexibility, chemical resistance and color. The use of epoxy esters in powder coating has two main advantages as compared with solvent-based system.

(1) Absence of solvents reduces health and safety hazards.

(2) For special heavy-duty application, a high film thickness can be obtained in one application without danger of solvent evaporation or film porosity.

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