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# A Review on Study of Applying Epoxy Coating on TMT Bars

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**ABSTRACT:** Fusion Bonded Epoxy is very fast curing, thermosetting Protective Powder Coating. It is based on specially selected Epoxy resins and hardeners. The epoxy formulated in order to meet the specifications related to protection of steel bars as an anti-corrosion coating.

FBE is widely used in Rebar coating. It is the preferred over other protective systems, due to their several advantages. It acts as a barrier to corrosive chemicals and moisture. It is applied on preheated steel as a dry powder, which melts and cures to a uniform coating thickness.

Corrosion control property of the coating is dependent on its ability to be an excellent barrier against water, oxygen, chloride, and other aggressive elements thru concrete to the metal surface. However, for a coating to be an effective long-term corrosion protection system, it is essential that it stays bonded to the substrate during the entire life of the structure

## I. INTRODUCTION

- **SURFACE PREPARATION:** Surface preparation is essential to the ability of the coating to bond to the Rebar surface. This bonding is important to eliminate the environmental fluid migration between the substrate and the rebar coating. The surface is cleaned using steel grit to obtain surface profiles of 40-110 microns. During blast- cleaning the bar surface temperature shall be more than 3 °C above the dew point. The bar surface temperature shall always be more than 5 °C. The relative humidity shall not be greater than 85%. Abrasives shall be stored and used dry.

- **INDUCTION PRE-HEATING:** The bars moved at a scheduled speed. Uniform heating is of paramount importance for good coating properties. Induction heating is the only method for this coating process. It is essential to serve a clean oxide-free surface to the heater in order to obtain a constant application temperature.

- The heated steel is passed through a powder-spray booth where the dry epoxy powder is emitted from a number of spray nozzles. As the powder leaves the spray gun, an electrical charge is imparted to the particles. These electrically charged particles are attracted to the grounded-steel surface providing even coating coverage. When the dry powder hits the hot steel, it melts and flows into the anchor profile (i.e., the microscopic peaks and the valleys on the surface) and conforms to the ribs and deformations of the bar. The heat also initiates a chemical reaction that causes the powder molecules to form complex cross-linked polymers which give the material its beneficial properties. The melted epoxy resin reacts with the curing agent present in the FBE and bonds to the substrate, providing a highly cross-linked polymer with a sophisticated network of covalent and coordinate bonds. These high – energy bonds provide excellent adhesion between the coating and substrate.

- The amongst three adhesion forces between FBE and substrate, the two of them i.e. chemical and polar-polar adhesion are directly related to the number of bondable sites available on the substrate. Therefore to provide the



maximum bondable site to FBE the high peak heights are obtained by abrasive cleaning. It also depends upon the viscosity of the FBE system used and the application temperature.

#### Objectives-

1. To study fusion epoxy coating as an insulator for electrochemical cells.
- 2 To study the behavior of steel against epoxy coating

### II. METHODOLOGY

1. Enlist methods of research work and the research process
2. Making of Epoxy coating TMT bars

TMT bar is cleaned for surface contamination such as grease and oil by solvent cleaning. Shot blast cleaning is the most commonly used method for preparation of steel surfaces. This effectively removes rust, scales, slats etc. from the surface and produces an industrial grade of a clean and rough surface finish.pre-Heating.

Heating can be achieved by using several methods, but the most efficient method is induction heating. TMT bars are passed through a high frequency alternating current along with a magnetic field, which heats according to the required FBE coating application temperature. Typical application temperature for a stand-alone FBE is 225°C to 245°C.Epoxy Powder Application

### III. LITERATURE REVIEW

#### 1. Name of the paper(Adhesion of epoxy coating to Steel Reinforcement under alkaline conditions.2013 )

The author states that there is much controversy surrounding the field performance of ECR Bars. However, little study has been done on the role played by the alkalinity of the pore solution on the adhesion loss of Based on the experimental results discussed in Chapter 4, it is evident that an epoxy coating loses its adhesion to steel upon exposure to highly alkaline conditions. With an increase in Alkalinity the amount of adhesion loss or disbandment also increase alkalinity the amount of adhesion loss or disbandment also increases.

#### 2. EPOXY COATINGS FOR CORROSION PROTECTION OF REINFORCING STEEL IN CONCRETE STRUCTURES.1992

The author states that -In Sweden, interest in the use of epoxy-coated reinforcing steel in concrete structures exposed to aggressive environments.This literature survey shows the extent to which epoxy coatings are used for corrosion protection of reinforcing steel in concrete structures, and indicates requirements for epoxy-coated reinforcing steel. The material costs involved in the use of epoxy-coated steel are about 100% higher than with uncoated steel, but the total cost for a finished structure with epoxy-coated steel is about 5-10% higher than that of a structure with uncoated reinforcement)

#### 3. Name of the paper(CORROSION PERFORMANCE OF EPOXY-COATED REINFORCEMENT-MACROCELL TESTS 1998)

The author states that- A microcell corrosion experimental program was conducted to study the performance of bent epoxy coated bars. The effects of coating damage and deboning on the long-term corrosion performance of epoxy-coated reinforcement are major concerns to the industry. Damage to coating during fabrication, transportation, handling, storage, and concrete vibration is almost inevitable. Mostcatholic bars from control specimens experienced corrosion after 4.5 years of exposure. Corrosion tended to be more severe and extensive on one of the bars for each specimen.

#### 4. Name of the paper-Comparing the performance of epoxy-coated and galvanized Reinforcing 2013)

The author states that's-Epoxy-coated reinforcing steel was first used in 1973 on the Schuylkill Bridge near Philadelphia, PA, as a method to Reduce corrosion damage to bridge structures. Epoxy-coated reinforcing steel has been used in over 67 times more bridges covering over 90 times more area than galvanized reinforcing steel.Corrosion of Steel in Concrete When steel is placed into concrete it Develops a passive oxide film due to the High pH of the concrete. This passive film Prevents further corrosion.



**5. Fusion bonded epoxy coating on TMT bars )**

The author states that- Fusion Bonded Epoxy (FBE) coating is the fastest-growing type of pipe coating. Fusion bonded epoxy pipe coating market may witness gains owing to its high adhesion to metals, excellent chemical resistant, thermosetting, and lightweight properties. Fusion bonded epoxy pipe coating market may witness gains owing to its high adhesion to metals, excellent chemical resistant, thermosetting, and lightweight properties. These are mainly designed for oil & gas industry to help pipelines against corrosion..)

**6. phosphorus- based epoxy resin compaction as an effective anticorrosive coating for steel 2018)**

The author states that –Epoxy resin (ER) is an attractive material for metal protection against corrosion; it can form a strongly adhered film onto a metal surface through its multi coordination sites.-The anticorrosive formulation (ER–MDA–ZP) was prepared from the ER and the hardener 4,4'-methylene dianiline (MDA) in the presence of the anticorrosive pigment zinc phosphate (ZP).The epoxy and the hardener react to form a 3D cross-linked polymeric network with multicoordination sites (hydroxyl and amino groups) for metals.)

#### IV. RESULT & CONCLUSION

In an attempt to determine what causes the disbondment of an epoxy coating from steel, Chemical and image analyses were performed on epoxy samples obtained from ECR bars cast in High-alkali cement for 90 d. As discussed in Chapter 4, no significant change in the chemistry of the epoxy samples was observed using FTIR. Therefore, it is unknown to what extent presence of a high hydroxyl-ion concentration affects the chemical structure of the epoxy coating. To further investigate the cause, an optical microscope was used to determine whether exposure to highly alkaline solutions changes the appearance of the epoxy coatings. However, the epoxy Samples used were not of a good quality for this analysis. The images did not provide any satisfactory explanation, because the coating had the texture of rough steel caused by the melting of the epoxy powder and its subsequent filling in the rough profile. Thus, it was difficult to determine the presence of any cracks.

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