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Prevention Of Corrosion by Using Epoxy Resin

Vanve Pragati B ., Dr V. R . Rathi ,
[1] *Student , Civil Engineering Department, Pravara College Of Engineering ,Maharashtra , India*
[2] *Professor , Civil Engineering Department, Pravara College Of Engineering , Maharashtra,India*

ABSTRACT

A could it be possible that to increase bonding strength of reinforcement of steel bar in concrete and reduce corrosion in that steel bar.Across the world may actually hold the key to solving each others problem? if gradually growing interest and research in bonding strength of reinforcement and its corrosion anything to go by the answer to this question could be an emphatic yes it times to come. Yes , there is enough evidence to prove that the Epoxy Resin coat does have potential to provide affordable sustainable bonding .So far as number of process have already been apply on this problem in world over ! though nothing much has been done about it as yet , the problem is further compounded as a considerable for bonding of reinforcement have its way to have more strength . At the same time ,even while the global contraction industry have ahead , in corrosion remains a major problem across the world .in this situation the Epoxy Resin Bar , an economical material made primarily from the Epoxy Resin holds a lot of promise to future . Through the materials itself have been invented nearly a hundred years ago , it has been revived as possible solution to various interrelated problem . because of that we can used the Epoxy Resin coated steel bar in concrete .

1. INTRODUCTION

Reinforced concrete is one of the maximum extensively used construction materials within the global. It isa flexible and low in cost fabric that usually performs its use nicely over its service life. Reinforced concrete is used in numerous methods, a number of the larger and better recognized makes use of which includes roadways, bridges, automobile parks, residential buildings and in enterprise; as an example it's far widely used in nuclear power plant. Itis in standard an exceptional creation cloth. Concrete by myself is right in compression, but bolstered concrete significantly increases the scope for making structures required to withstand other styles of mechanical force.

Corrosion is the deterioration of materials with the aid of chemical interaction with their environment. The term corrosion is from time to time also applied to the degradation of plastics, concrete and wooden, but usually refers to metals.

Corrosion can arise when metals are exposed to the surroundings together with reactions to water, acids, salts, and other chemicals

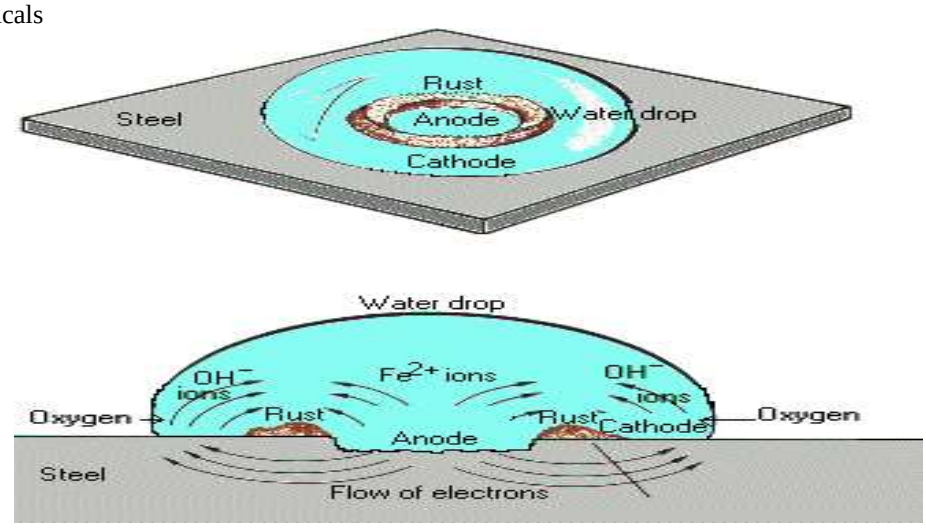


Fig -1 Corrosion

The primary factors controlling the initiation of the steel corrosion and its mechanism in concrete are summarized in the following points:

- The rate of steel depasivation
- The initiation of the macro cells due to the differential aeration and chloride absorption
- The low resistivity attributed by the concrete pore water
- The presence of oxygen to accelerate the corrosion process

The corrosion of steel in concrete is an electrochemical process, which results in the formation of a corrosion

cell. The following corrosion mechanism is the most likely for steel rebar embedded in the concrete when significant variations exist in the surface characteristics of the steel. The steel surface initiates cathodes and anodes electrically connected through the body of the steel bar. The "half cell reaction" takes place, by inducing an electromotive force known as standard redox potential when the metal is connected to a hydrogen electrode – see Equation 1

Equation 1

For iron: Fe --□ Fe^{+2} + 2 e - (Anode)
The electrons liberated at the anode migrate to the cathode and react in various ways dependant upon the pH value and the availability of oxygen. See Equation 2, Equation 3, and Equation 4.

Equation 2 : 2e + 2H + ½ O_2 □ H_2O
Equation 3: 2e + H_2O + ½ O2 □ H_2O
Equation 4: 2e + 2H □ H_2

1.1 Causes of Corrosion

Characteristics of water: Chemical and physical properties of water like alkalinity, presence of ions or impurities , temperature, hardness, flow or stability and pH dissolved solids influence the rate of corrosion of metal. Low pH ,soft or with primarily non-carbonate hardness, low alkalinity increases the rate of corrosion. Excess of oxygen, carbon dioxide and dissolved solids in water also increases the rate of corrosion.
Bacteria: Presence of bacteria in surrounding also accelerates the rate of corrosion. This is because accumulation of bacterial colonies increase the oxygen cell concentration accelerates pitting and tubercular. Bacterial colonies also produce carbon dioxide and block the deposition of calcium carbonate scale.

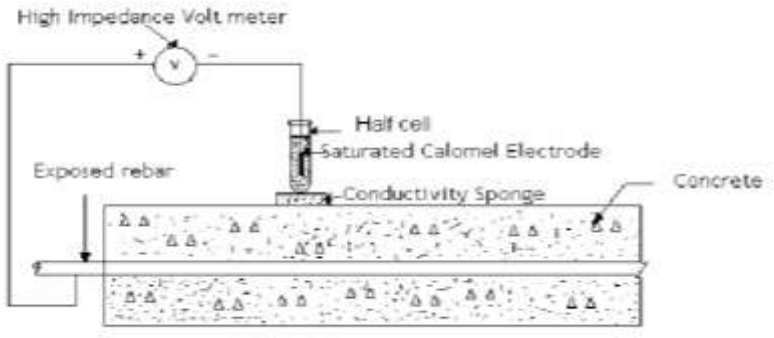
Other factors:

- Characteristics of metal, electrical currents are some other factors that influence the rate of corrosion.
- The problem is caused primarily by inorganic-salt induced corrosion of steel in concrete.
- The salt, primarily chloride, penetrates the concrete from sources such as road-deicing salts or seaexposure.
- It can also be built in through the use of salt-contaminated aggregate, seawater in or chloride-basedadmixtures.
- The chloride ion initiates and catalyzes the corrosion reaction.
- The iron corrosion products resulting from the reaction occupy a much greater volume that on and cause tremendous pressure on the concrete.
- The pressure causes the concrete to crack and spell, allowing even greater access of corrode to the steel and accelerated deterioration of the structure.

While most attention is paid to rebar, all steel components are affected as well bridge decks, piers, pilings, and guardrails.

1.2 Detecting Technique Of Corrosion

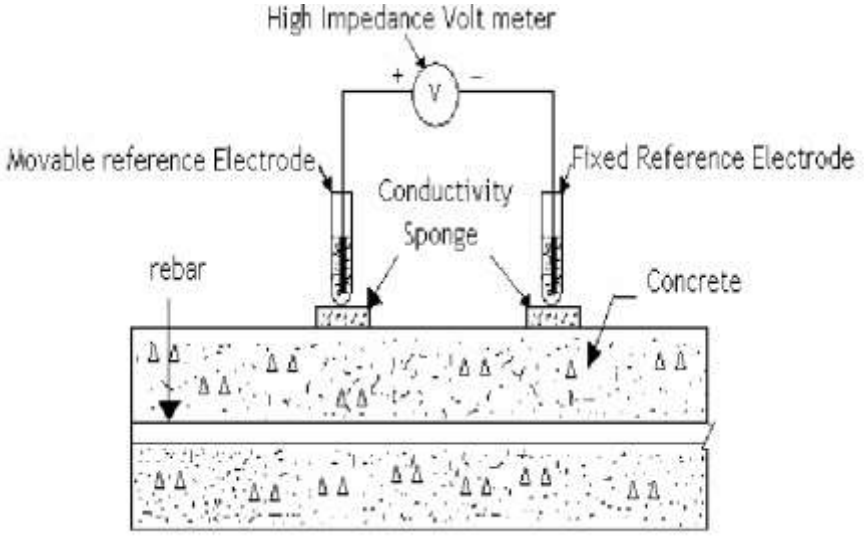
Open Circuit Potential (OCP) Measurement
The tendency of any metal to react with an environment is indicated by the potential it develops in contact with the environment. In reinforced concrete structures, concrete acts, as an electrolyte and the reinforcement will develop a potential depending on the concrete environment, which may vary from place to place. The schematic diagram for open circuit potential measurements is as shown in Fig.



Open circuit potential (OCP) measurement
The principle involved in this technique is essentially measurement of corrosion potential of rebar with respect to a standard reference electrode, such as saturated electrode (SCE), copper/copper sulfate electrode (CSE), silver/ silver chloride electrode etc. As per ASTM C 876 [6] standards, the probability of reinforcement corrosion.

Surface Potential Measurement

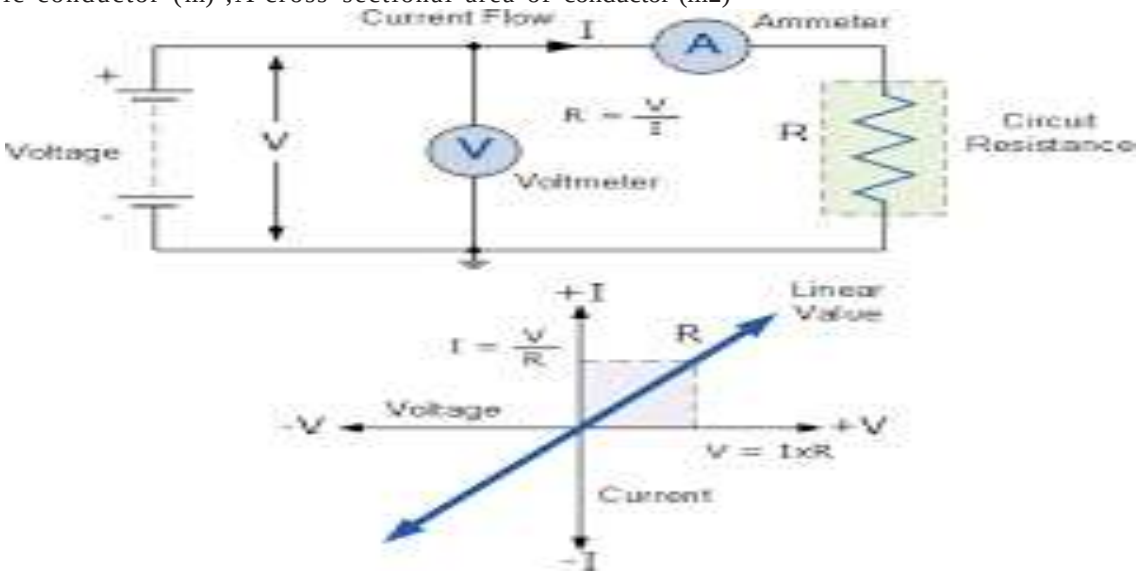
During corrosion process, an electric current flow between the cathodic and anodic sites through the concrete and this flow can be detected by measurement of potential drop in the concrete. Hence surface potential measurement is used as a non-destructive testing for identifying anodic and cathodic regions in concrete structure and indirectly detecting the probability of corrosion of rebar in concrete. Two reference electrodes are used for surface potential measurements as shown in Fig.2.



No electrical connection to the rebar is necessary in this technique. In this measurement, one electrode is kept fixed on the structure on a symmetrical point. The other electrode called moving electrode is moved along the structure on the nodal points of the grid as mentioned in OCP measurements. The potential of movable electrode, when placed at nodal points, is measured against the fixed electrode using a high impedance voltmeter. A more positive potential reading represents anodic area where corrosion is possible.

Electrical resistance measuring method (MER)Electrical resistance measuring method (M ER) Measuring the changes of electrical resistance of a metal sample is a method that can be applied for the non-destructive monitoring of the corrosion of steel reinforcement in concrete.19–24 The principle of this method is based on the fundamental theory regarding the relation of electrical resistance change onto the cross-section size of each conductor, in following Equation $R = \rho L/A$ **(Ω)**

where R is electrical resistance (W) , ρ resistivity of electric conductor (W mm2 m–1) L length of electric conductor (m) ,A cross-sectional area of conductor (m2)



2. RESULT

Measurements were undertaken by measuring the electrical resistance using the digital ohmmeter by measuring the electric current and voltage to calculate the resulting electrical resistance from these parallel measurements

Sr no	Resistance forEpoxy Coatedsteel bar (12mm)	Resistance for Uncoated steelbar (12mm)
1	0.17 Ωm	68.36 Ωm
2	0.15 Ωm	42.53 Ωm
3	0.13 Ωm	28.23 Ωm
4	0.10 Ωm	20.29 Ωm

3. CONCLUSIONS

The A great advantage of these methods is the fact that in the case when the reinforcements with known entrance electrical resistance are inserted into the structural element, we can relatively easily and inexpensively determine the status of other reinforcements, without the destructive interference with the concrete cover layer. From the obtained results it is possible to conclude that this monitoring method is useful for the quantity corrosion reinforcement evaluation. The determination of the actual state of steel bars is a major criterion in the Decision making process for consequent reinforced-concrete structures redevelopment. The numerical modeling of reinforcement corrosion confirms that already the small corrosion, namely the small percentage of corroded surface causes the formation of cracks with in the cross section near the reinforcement. The increase of corrosion products (rust) causes the connection of cracks from within to outside due to an increase of the radial tensile stresses. Those cracks weaken the bond between the concrete and the reinforcement and consecutive concrete cover dropping out.

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