

CORROSION AND STEEL REINFORCEMENT

Corrosion Mechanisms

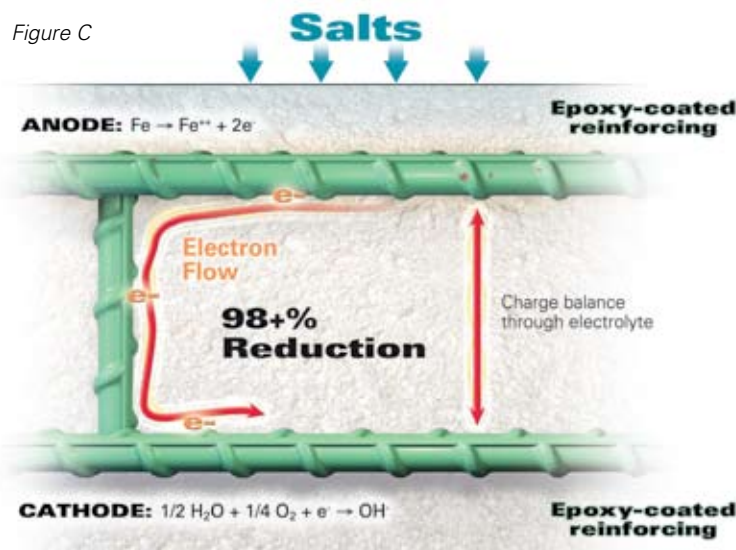
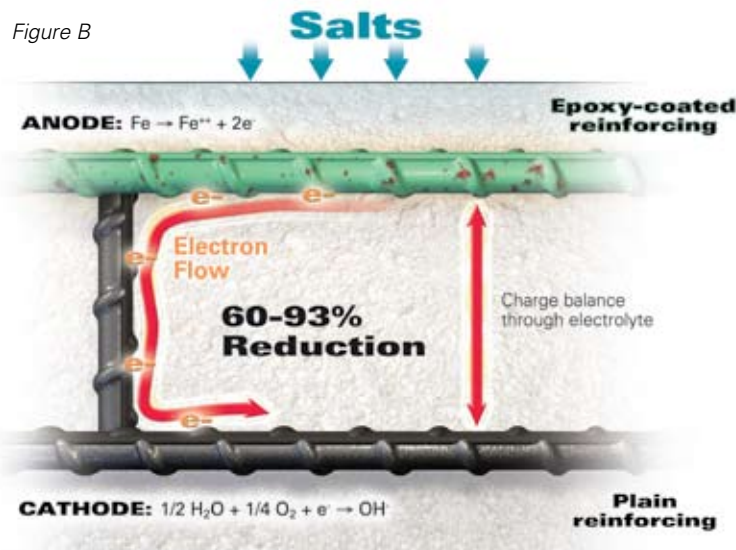
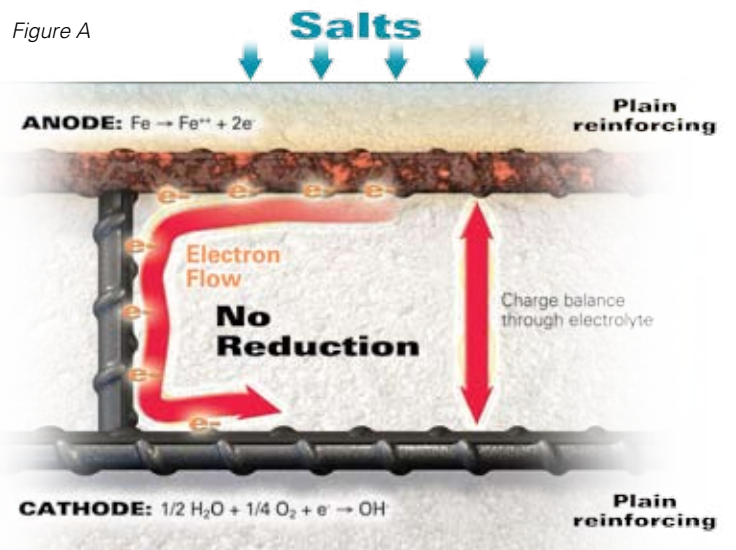
Steel placed into concrete develops a passive oxide film due to the high pH of the concrete. This passive film prevents further corrosion.

The film may be disrupted by carbonation of the cement paste, which reduces the pH, or through the ingress of chloride ions into the concrete, from either deicing salts or sea water.

For uncoated plain steel (Figure A), when the passive film on the steel is disrupted, corrosion initiates at the ANODE. At this location, iron ions form, releasing electrons. The electrons flow through the steel bars to the CATHODE. At the CATHODE, water and oxygen combine with the electrons to form hydroxide. In order to balance the charges, the iron ions and hydroxide flow through the electrolyte or liquid in the concrete. The iron ions react with oxygen to form corrosion products or rust, which crack the concrete.

Where epoxy-coated steel is used in the top mat only (Figure B), ANODES can only form at breaks or holes in the coating. Thus the total corrosion is significantly reduced and the concrete life extended. Laboratory tests have demonstrated 60-93 percent reduction in corrosion rates¹.

Where epoxy-coated steel is used in both mats (Figure C), ANODES may form at breaks or holes in the coating; however, CATHODE locations are also limited, reducing the ability for electrons to flow. Laboratory tests have demonstrated over 98 percent reduction in corrosion rates¹ even when damage is present.



¹ Lee, S.K. and Krauss, P.D., "Long-Term Performance of Epoxy-Coated Steel Reinforcing Steel in Heavy Salt-Contaminated Concrete," FHWA Report FHWA-HRT-04-090, 2004.