Zinc coatings on steel

In relatively dry air a zinc oxide film is initially formed on zinc surfaces by reaction of zinc with atmospheric oxygen. In the presence of moisture, the zinc oxide film is quickly converted to zinc hydroxide and the carbon dioxide present in the air reacts to form insoluble basic zinc carbonate. Zinc owes its high degree of atmospheric corrosion resistance to the formation of such oxide films.

The more important factors which control the rate at which zinc corrodes during atmospheric exposure are relative humidity, rain fall, temperature and industrial or marine pollutants such as chlorides, ammonia, sulphur dioxide and dust.

The principals of galvanic corrosion are used to advantageous effect when protecting steel with a metallic coating of zinc, which is more active than the steel substrate.

Provided the coating is continuous and impervious, the zinc-coated steel's corrosion behaviour will be identical to that of the zinc coating. However, should the zinc coating become perforated or discontinuous as a result of mechanical damage (i.e. deep scratches or sheared edges) a steel/zinc galvanic couple will be created and in the presence of moisture, corrosion or dissolution of the zinc will occur.

The zinc will become the anode of the corrosion cell and its corrosion rate will be increased whilst the steel will become cathodic and its corrosion rate reduced. The steel is then said to be sacrificially or galvanically protected.