The chemistry of the ERPS system and why it prevents corrosion

Rust occurs in two forms:

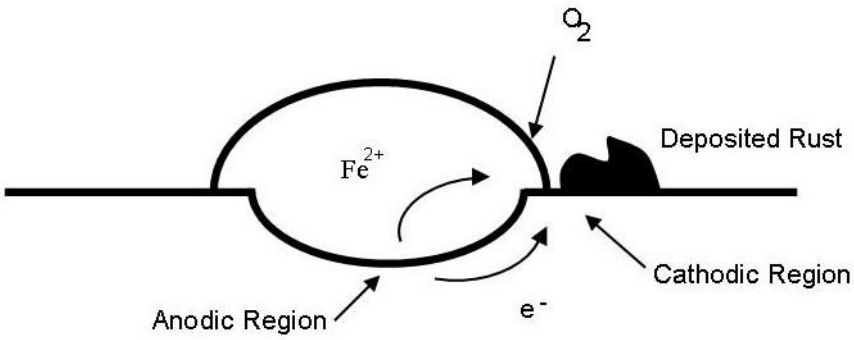
Surface Rust:

Surface rust occurs when bare metal is left in moist air. This type of rust is a direct reaction between oxygen, water in the air and the bare steel. In most cases it will be nothing more than a harmless surface coating.

Electrochemical Rust:

The second form of rust that occurs involves an electrochemical process, much like with a battery. Ferric ions are formed at some weak point in the metal eg. a crevice, dint or heat stressed area, etc. This becomes the anode or negative terminal of our battery and begins to pump electrons into the car body.

At a region remote to this where the water-air surface meets the metal, a second reaction occurs. The electrons from the anode are combined with oxygen in the air and water to produce hydroxide ions. These Hydroxide ions combine with the ferric ions produced earlier and solidify as rust. Because this form of rust favours removal of metal in pits, it is very destructive. Electrochemical rusting is responsible for eating holes into panels and causing rust to bubble underneath the paint.



Most people are familiar with Cathodic Corrosion protection. Where a metal object is exposed to an aggressive, aqueous environment, eg. a steel ship's hull in seawater, it is possible to prevent corrosion by placing a more reactive metal in the same solution as the metal to be protected.

If the two metals are connected together, the more reactive metal becomes the anodic region and the protected metal becomes the cathodic region. The sacrificial anode, as the more reactive metal is usually known, easily reacts with the corrosive solution and releases metal ions into solution and electrons into the surrounding metal. The electrons given off by the corroding anode arrive at the cathodic region and proceed to react with the metal ions in solution. Because a queue of electrons waiting to react are left on the surface of the cathodic region, the metal there is a lot less likely to release ions into solution.

It has been known for over a century that a sacrificial anode can be made of the same metal as the object it is to protect if a current is induced between them by an external power source. The basic point is that by either connecting a more reactive metal to a metallic object or by inducing a current into the object with an external power source, it becomes protected by the electrons waiting on the surface before drifting through the solution.

In an object that is not immersed completely in the corrosive solution eg. “free air structure” such cathodic systems, cannot help because the current needed to keep the electron densities on the surface of the metal cannot be transmitted through the solution and the circuit is broken. The ERPS system, with the assistance of the paint, induces the required charge capacitively and therefore is ideal for protecting vehicles and other “free air structures”.

The most common and destructive corrosion is due to small droplets of water forming in crevices creating rust bubbles and eating through the metal, greatly decreasing its structural strength. The only way to effectively prevent corrosion cathodically is to coat the entire surface in the more reactive metal, as is the case with galvanizing.

A common problem with cars is that the manufacturer often takes advantage of the properties of different metals for different functions on the car. Where two different metals come into contact the less reactive metal has a tendency to steal electrons from the more reactive metal. By positively charging the more reactive metal it becomes even more reactive and so wherever two dissimilar metals are in contact there is a higher tendency for corrosion to occur. Because the ERPS system effectively places an equal amount of negative charge on both metals, corrosion due to this electrolysis effect is dramatically reduced.