

corrosive environment, cracking can also be accelerated in the form of stress corrosion failure. The electrons reach the surface of the cathode material and neutralize positively charged hydrogen ions that have become attached to the cathode surface. Corrosion can also take the form of erosion in which the protective film, usually an oxide film, is removed by a rapidly moving atmosphere or medium. In the case of the ship, the bronze propeller acts as a cathode, the steel hull as an anode and the sea water as an electrolyte. Other metals revert to sulphides and oxides or carbonates. Direct oxidation corrosion is often seen in the scaling that takes place when a piece of metal is left in a furnace for a length of time. In this process, part or all of the metal becomes transformed from the metallic state to the ionic state and often forms a chemical compound in the electrolyte. In the corrosion of iron, each iron atom releases two electrons and then becomes a ferrous ion carrying two positive charges. Two of these ions will now become neutral atoms, and are released generally in the form of hydrogen gas. When this process is taking place, it can be observed that hydrogen bubbles are forming at the cathode only. Depolarization can also take place, for example, on the propellers of ships because of the movement through the water, which is the electrolyte. Severe corrosion can occur on the hull as a result of galvanic action. Both the hull and propeller become cathodic and consequently do not deteriorate. On the surface of some metals such as copper or aluminium, the corrosion product sometimes exists as a thin film that resists further corrosion. Metallic atoms form positive ions while non-metals form negative ones. An electrolyte is any solution that conducts electric current and contains negative or positive ions. Corrosion requires the presence of an electrolyte to allow metal ions to go into solution. The electrolyte may be fresh or salt water and acid or alkaline solutions of any concentration. This causes an increased corrosion rate of the anodic steel ship's hull. Pitting corrosion is localized and results in small holes on the surface of a metal caused by a concentration cell at that point. Cathodic protection is often used to protect steel ships hulls and buried steel pipelines.