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WHAT IS CORROSION?

Corrosion is the destructive attack of a material by reaction with its environment, thereby causing deterioration of the material.

With the aid of chemical reactions, briefly describe corrosion mechanisms

Corrosion mechanism in aqueous solution has been amply demonstrated. In atmospheric corrosion which also exemplifies uniform corrosion, a very thin layer of electrolyte is present. It is probably best demonstrated by putting a small drop of seawater on a piece of steel. On comparing the atmospheric corrosion with aqueous corrosion, the following differences are observed:

On a metal surface exposed to atmosphere, only a limited quantity of water and dissolved ions are present, whereas the access to oxygen present in the air is unlimited. Corrosion products are formed close to the metal surface, unlike the case in aqueous corrosion, and they may prevent further corrosion by acting as a physical barrier between the metal surface and environment, particularly if they are insoluble as in the case of copper or lead. The following is a simplified mechanism of aqueous corrosion of iron:

At the anodic areas, anodic reaction takes place: Fe→Fe2+ + 2e-

At the cathodic areas, reduction of oxygen takes place: O2 + 4H+ + 4e-→2H2O

Oxygen reduction in neutral or basic solution: 1∕2O2 + H2O +2e-→2OH-

Hydrogen evolution from acidic solution: 2H + 2e- → H2

Hydrogen evolution from neutral water: 2H2O + 2e- → H2 + 2OH-

3 EXAMPLES OF CATASTROPHIC CORROSION INCIDENTS IN HISTORY

(1.) 05/19/2015 Oil spills (Santa Barbara / California)

On one of the most biologically diverse coastlines in the United States, there was a discharge of 540 m3 of crude oil. Investigations indicated the presence of serious corrosion. In the lower quadrant of the pipeline, the thickness of which was reduced by 45% due to corrosion, there was crack propagation.

(2.) 08/19/2000 The explosion of a gas pipeline (New Mexico)

Near the city of Carlsbad, New Mexico, there was damage to the pipeline company El Paso Natural Gas Company. The released gas ignited and 12 people got killed. In the pipeline there was evidence of the existence of damage caused by corrosion.

(3.) 12/12/1999 Sinking of the tanker Erika (Bay of Biscay / France)

On 12 December 1999, the oil tanker Erika broke in two and sank in the Bay of Biscay. There were no casualties. However, the oil spill led to a great environmental disaster. The main cause of the accident was significant corrosion of the internal structure of the vessel.