M T W T F S S
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YOUVA

PITTING CORROSION

A pit maybe described as a cavity or hole with the surface diameter about the same length as or less than the depth.

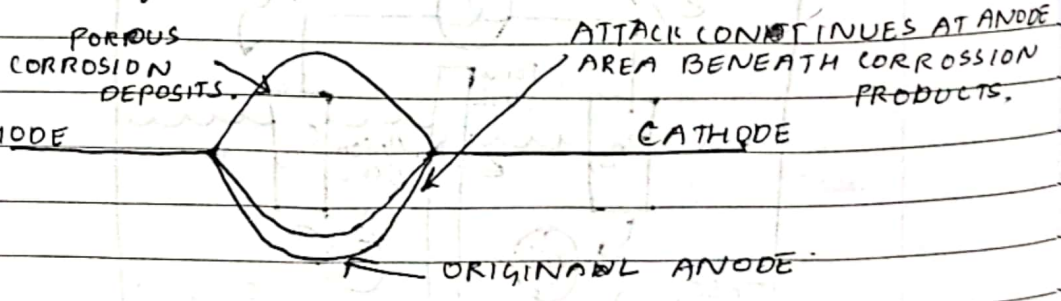
Important reasons are:

- Surface roughness or non uniform finish
- Scratches or cut edges.
- Local straining of metal, due to non uniform stress
- Depositions of extraneous matter such as sand, scale, water drop, dust etc.

29/11 Pitting is usually due to breakdown or cracking of the protective film on a metal at specific points.

Pitting corrosion is characterised by small anodic area and large cathodic area, resulting in accelerated corrosion at the anodic area.

It is an auto catalytic process, with the initially formed pit producing conditions which are both stimulating and necessary for the continuing activity of the pit.



It is a localised and intense form of corrosion and failure occurs with extreme suddenness.

STRESS CORROSION

Cracking of metal caused by the combined effect of a tensile stress and a specific corrosive environment on the metal. Here, the corrosive agents are highly specific and selective.

The metal atoms under stress possesses higher energy levels than the one with free form stress. The stressed part of the metal becomes more active than the stress free part.

Hence: Anode - stressed part.
Cathode - stress free part.
Stressed part undergoes corrosion

Eg: Season cracking of brass.
Caustic embrittlement of steel.

CAUSTIC EMBRITTLEMENT

- This is a dangerous and occurs in mild steel, exposed to alkaline solutions at high temp and stresses.
- Water fed into boilers may contain free alkali (lime soda process)

$$Na_2CO_{3(aq)} + H_2O \rightarrow 2NaOH + CO_{2(g)}$$

- Local stresses exist in metal sheets of boiler under rivets.

- Minute cracks develop on the metal sheets when the stress is relieved.
- This very dilute alkaline water flows into the minute hair cracks and crevices by capillary action.
- Inside the crack, the water evaporates and caustic soda conc builds up.
- This conc alkali dissolves iron as sodium ferroate in crevices/cracks, where the metal is stressed and the conc of alkali is much higher than that in the body of the liquid.
- The sodium ferroate decomposes, a short distance away from its point of formation.

$$3Na_2FeO_2 + 4H_2O \longrightarrow 6NaOH + Fe_3O_4 + H_2\uparrow$$

$$6Na_2FeO_2 + 6H_2O + O_2 \longrightarrow 12NaOH + 2Fe_3O_4$$

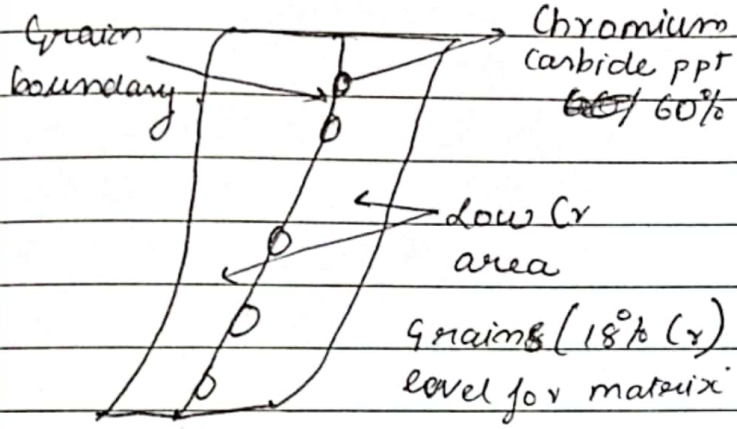
- NaOH is regenerated and magnetite is precipitated thereby enhancing further dissolution of iron.
- When iron changes to these oxides, metallic properties like malleability and ductility are lost.
- It becomes brittle. The brittleness is caused by caustic alkali.
- NaOH concentration cell forms between the stressed and unstressed part of the metal.

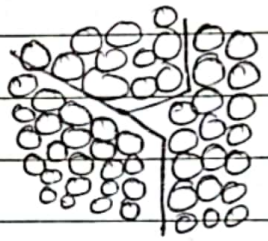
Iron | Conc NaOH : Dil NaOH | Iron.
(stressed) (unstressed)
ANODIC CATHODIC

Prevention:

- Na_2SO_4, tannin or lignin is added to water.
- Boiler can be constructed by welding the sheets to avoid local stress
- Caustic embrittlement is avoided by using demineralized water.

INTERGRANULAR CORROSION





FACTORS AFFECTING CORROSION

Primary factors (Factors related to the corroding metals):

- Nature of the metal
- Relative cathodic and anodic area.
- Hydrogen over voltage (HOV of cathode is high means corrosion rate is lesser).
- Nature of the corrosion product.

Secondary factors (Factors related to environment)

- Conc and nature of electrolyte
- pH of the medium.
- Temperature
- Polarization.