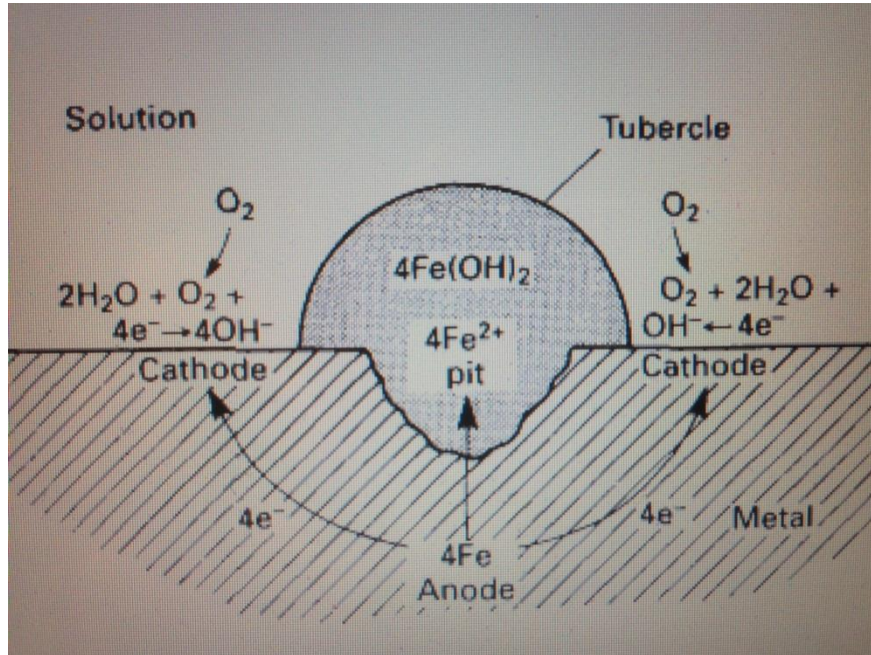


A Differential Aeration Cell consists of an oxygen concentration cell, the result of a potential difference caused by different amounts of oxygen dissolved at two locations.

A schematic of pit initiation and tubercle formation due to an oxygen concentration cell under a biological deposit.



Differential Aeration Cells also provide a condition for Sulphate-Reducing Bacteria such as Desulfobacter to grow.

Types:

Associated with corrosion of Stainless Steel; Pseudomonas; Sphaerotilus; Desulfovibrio

Bacteria that act on Carbon steel forming thick deposits of ferrous hydroxide;

Filamentous; Sphaerotilus; Crenothrix, Leptothrix

Stalk-forming; Gallionella

They oxidize ferrous ( $\text{Fe}^{2+}$ ) ions to ferric ( $\text{Fe}^{3+}$ ) ions. This oxidation results in thick deposits of ferric hydroxide.

Similar bacteria follow a similar mechanism with manganese; oxidize manganous ( $\text{Mn}^{2+}$ ) ions to manganic ( $\text{Mn}^{3+}$ ) ions.

Another corrosion mechanism is based on the by-products of the bacteria's metabolic process. Thiobacillus thiooxidans (a sulphur oxidizing bacteria) produces  $\text{H}_2\text{SO}_4$  ( $\text{H}_2\text{S} + 2\text{O}_2 \rightarrow \text{H}_2\text{SO}_4$ ). Acid metabolites excreted from the bacteria accelerate corrosion by dissolving oxides from the metal surface and accelerating the cathodic reaction rate.

Other bacteria can secrete HCL which dissolves the metal and produces a soluble salt  $\text{FeCl}_2$  and hydrogen gas  $\text{H}_2$ . ( $\text{Fe} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2$ ).