Report

05/03/05

1. **Pitting Corrosion:** Several papers discuss about pitting corrosion that takes place under the surface protective layer. Previously, protective layer used to be considered as a preventive measure to corrosion, but in fact it is detrimental to corrosion.

   Due to changes in water chemistry, temperature or flow rate, cracks generate on the protective layer. Water seeps through these cracks to the unprotected surface of the component that results in pitting corrosion that is localized in nature. Due to constricted water flow pH in these cavities is lower than the bulk water system, which in turn severely increases pitting corrosion rate. Sometimes, protective layer not only increases corrosion rate but also weakens the bonding between the protective layer and the component surface.

   Discussion on pitting corrosion dealt with various types of protective layers including Cu_2O. I haven't come across any literature that discusses CuO as a protective layer and pitting corrosion. [Ref: "Pitting Corrosion of Cooling Water System"- Mark A. Lisin, Thomas M. Larange]

2. **Control of Redox Potential (Y-axis) in Pourbaix Diagram:** Hydrogen injection in the water-cooling system reduces the redox potential of the system to a less corrosive region without altering the pH and conductivity. Although this paper provides data but does not discuss the mechanism and does not mention the final value of the redox potential after hydrogen injection. This process not only reduces corrosion rate but also reduces amount of deposits. [Ref: O. I. Martynova, thermal Engineering 36 (11) 1989]

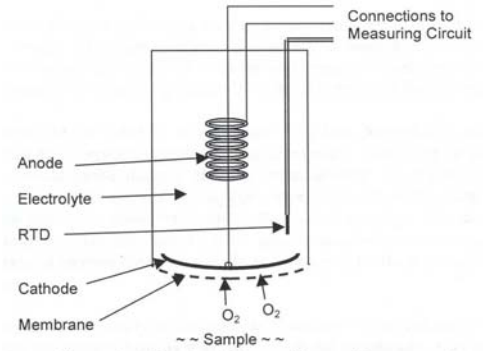
3. **Working Principal of Dissolved Oxygen Sensors:** These sensors are electrochemical devices. A noble metal (Gold or Silver) is used as anode and a reference electrode is used as cathode. There is a polymer membrane that separates the electrodes and electrolytes from the sample. Oxygen permeates through this membrane depending upon the partial pressure of the dissolved oxygen in the sample. The oxygen that permeates through the membrane reacts with the cathode, producing a current in direct proportion to the quantity of oxygen. The actual output is voltage. Thermisters (whose resistance value changes with temperature) converts current to voltage depending upon the temperature. Temperature compensation is done by thermister too. There are two reasons for temperature compensation:
   1. Permeability changes with temperature.
   2. Oxygen solubility changes with temperature.

   Cathodic Reaction:

   $$O_2 + 2H_2O + 4e^- \longrightarrow 4OH^-$$

   Anodic Reaction:

   $$2Pb + 4OH^- \longrightarrow 2PbO + 2H_2O + 4e^-$$



Schematic of Dissolved Oxygen Sensor