Protection against corrosion using cathodic protection

Procedure:

1-wheight two sheets of steel (dry and clean from oxide).

2-Immerse one sheet of steel in 200mL solution containing saturated ammonium chloride solution for 45minutes.

3- In the same time couple the other sheet with (dry clean from oxide) zinc sheet of the same dimension then immerse them in 200mL solution containing saturated ammonium chloride solution for 45minutes.

4-wash each sheet using distilled water then dry with filter paper.

5- Reweight the two sheets of steel.

Calculation:

Rate of corrosion= weight loss/ area.time (gm/cm_2.min)

R_1= (gm/cm_2.min)

Rp= (gm/cm_2.min)

Degree of protection= (R – Rp / R) . 100

Where:

R is rate of corrosion of unprotected sheet.

Rp is rate of corrosion of protected sheet.

Dissolved Oxygen

In the first step, Manganese(II) sulfate (at 48% of the total volume) is added to an environmental water sample. Next, Potassium iodide (15% in potassium hydroxide 70%) is added to create a pinkish-brown precipitate. In the alkaline solution, dissolved oxygen will oxidize manganese(II) ions to the tetravalent state.

$$2\ Mn(OH)_2(s) + O_2(aq) \rightarrow 2\ MnO(OH)_2(s)$$

$MnO(OH)_2$ appears as a brown precipitate. There is some confusion about whether the oxidised manganese is tetravalent or trivalent. Some sources claim that $Mn(OH)_3$ is the brown precipitate, but hydrated MnO_2 may also give the brown colour.

$$4\ Mn(OH)_2(s) + O_2(aq) + 2\ H_2O \rightarrow 4\ Mn(OH)_3(s)$$

The second part of the Winkler test reduces acidifies the solution. The precipitate will dissolve back into solution. The acid facilitates the coversion by the brown, Manganese-containing precipitate of the Iodide ion into elemental Iodine.

The $Mn(SO_4)_2$ formed by the acid converts the iodide ions into iodine, itself being reduced back to manganese(II) ions in an acidic medium.

$$Mn(SO_4)_2 + 2\ I^-(aq) \rightarrow Mn^{2+}(aq) + I_2(aq) + 2\ SO_4^{2-}(aq)$$

Thiosulfate solution is used, with a starch indicator, to titrate the iodine.

$$2\ S_2O_3^{2-}(aq) + I_2 \rightarrow S_4O_6^{2-}(aq) + 2\ I^-(aq)$$

[edit] Analysis

From the above stoichiometric equations, we can find that:

$$1\ \text{mole of}\ O_2 \rightarrow 2\ \text{moles of}\ MnO(OH)_2 \rightarrow 2\ \text{mole of}\ I_2 \rightarrow 4\ \text{mole of}\ S_2O_3^{2-}$$

Therefore, after determining the number of moles of iodine produced, we can work out the number of moles of oxygen molecules present in the original water sample. The oxygen content is usually presented as mg dm^{-3}.

Determination of the inhibition efficiency for corrosion inhibitors

Procedure:

1-wheight two sheets of steel (dry and clean from oxide).

2-Immerse one sheet of steel in 200mL solution containing (1 molar ferric chloride and 0.25 molar hydrochloric acid) for 30 minutes.

3-Immerse the other sheet of steel in 200mL solution containing (1 molar ferric chloride and 0.25 molar hydrochloric acid and 1% glycerol) for 30 minutes.

4-wash both sheets with distilled water then dry with filter paper.

5-reweight the two sheets of steel.

Calculation:

Rate of corrosion= weight loss/ area.time (gm/cm^2.min)

R_1= (gm/cm^2.min)

Rp= (gm/cm^2.min)

Degree of protection= (R – Rp / R). 100

Where:

R is rate of corrosion of uninhibited sheet (solution not contain inhibitor).

Rp is rate of corrosion of inhibited sheet (solution not contain inhibitor).

Protection against corrosion using passivation

Procedure:

1-wheight two sheets of steel (dry and clean from oxide).

2-passivate only one of them in 200ml of solution containing (20 g/L sodium hydroxide and 50 g/L potassium dichromate) for 15minutes at room temperature.

3-Immerse each sheet of steel in 200mL solution containing saturated ammonium chloride solution for 45minutes.

4-wash both sheets with distilled water then dry with filter paper.

5-reweight the two sheets of steel.

Calculation:

Rate of corrosion= weight loss/ area.time (gm/cm_2.min)

R_1= (gm/cm_2.min)

Rp= (gm/cm_2.min)

Degree of protection= (R – Rp / R) . 100

Where:

R is rate of corrosion of unpassivated sheet.

Rp is rate of corrosion of passivated sheet.