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01213211 Materials Science for Engineers

Homework 4 (Corrosion)

<u>Instruction:</u> Use your handwriting to write answers.

1. An electrochemical cell consists of a copper standard half-cell and a zinc standard half-cell. Using the standard half-cell reactions given below, answer the following questions.

$$Ni_{(s)} \longrightarrow Ni^{2+}_{(aq)} + 2e^{-} \quad E^{0} = -0.250\ V$$

$$Al_{(s)} \longrightarrow Al^{3+}_{(aq)} + 3e^{-} \quad E^{0} = -1.662\ V$$

1.1. Oxidation reaction occurs at which electrode? Explain the reason for your answer.

Al เพราะมีค่า E° น้อยกว่า Ni

1.2. Reduction reaction occurs at which electrode? Explain the reason for your answer.

Ni เพราะมีค่า E° มากกว่า Al

1.3. Which electrode is gaining its mass and why?

Ni เพราะเกิด Reduction

1.4. Which electrode is losing mass and why?

Al เพราะเกิด oxidation จึงถูกกัดกร่อน

1.5. Which electrode is the cathode and which electrode is the anode and why?

Ni คือ Cathode เพราะเกิด Reduction

Al คือ Anode เพราะเกิด oxidation

1.6. What is the potential of this electrochemical cell?

-0.250 - (-1.662) = 1.412 EV

2. What are the 4 components that must be present in any corrosion cell?

1. Anodic (oxidation) reaction
2. Cathodic (reduction) reaction
3. Conducting electrolyte
4. Electron transfer

3. Using the Galvanic series given below, identify the corroding metal when two metals are touching each other in a corrosive environment.

3.1. Zinc and iron

Iron

3.2. Copper and Steel

Copper

3.3. Steel and magnesium

Steel

3.4. Aluminum alloys and Tin

Tin

3.5. Lead and 316 stainless steel

Passive ⇒ 316 stainless steel
Active ⇒ Lead