# CORROSION EXPERIMENT-ADDITIONAL EXP.

**PART 4.2: CORROSION OF LEAD IN ACIDIC SOLUTION**

**4.2.1 AIM:** Measuring the corrosion rate of lead in acidic solution by Tafel Extrapolation Method

**4.2.2 THEORIC INFORMATION:**

In a corroded electrode, a cathodic reaction takes place simultaneously with the anodic reaction of the metal, depending on the environment. Thus, a mixed potential called 'corrosion potential (Ecorr)' is formed on the electrode surface as a result of the balance of two different reactions, one anodic and the other cathodic.

If an external current is applied to the electrode, the electrode potential takes on a value different from that at which no current is flowing. The change in electrode potential when current is applied is called 'polarization'. Experimentally obtained polarization curves can be used to determine the velocity of the metal in the electrolyte in question. For this purpose, two electrochemical methods are applied.

1- Tafel extrapolation method

2- Linear polarization method

Tafel ekstrapolasyon yöntemi:

Polarization (or current-potential) curves are curves plotted on a semi-logarithmic scale. After the applied external current reaches a certain value, there is a significant break in these curves and after this point the logarithm of the applied external current (E - log i) shows a linear change. This region where the logarithm of the current changes linearly is called the 'Tafel Region'.



Figure 4.2. Tafel region of the polarization curve

If the lines in the Tafel region are extrapolated to the corrosion potential, the cutoff gives the 'corrosion current density (icorr)' value. By substituting the corrosion current density value in the formula below, the corrosion rate is calculated in mm/year.

Corrosion rate = K × (icorr× EW) / d

K= constant number, 3.27x10-3 mm.g/µA.cm.year,

icorr= current density (A/cm2),

EW = equivalent weight of the sample,

d= density of the sample, g/cm3

**4.2.3 EXPERIMENTAL PROCEDURES**

**Equipment and Materials:** Potentiostat, lead sample, 1 M H2SO4 solution, 5-necked cell, lead counter electrodes, saturated calomel reference electrode, crocodile cable, dryer machine, glue gun, silicone.

**Experimental:**

Lead sample is washed and dried to remove dust and dirt on its surface. It is bonded with crocodile cable and covered with silicone except an active surface area of 1 cm2. 1 M H2SO4 solution is filled into the 5-necked cell. Saturated calomel electrode as reference electrode, lead electrodes as counter electrode and lead sample as working electrode are placed in the cell. With the help of a potentiostat, first, the open circuit potential (OCP) value of the system is measured. Then, the sample is scanned within the determined potential range, including the OCP value, to obtain a semi-logarithmic current-potential curve. The icor value obtained from this curve is substituted in the formula given above and the corrosion rate is calculated in mm/year.

**4.2.4 REQUIREMENTS:**

1. Write the anodic and cathodic reactions that took place in the experiment for the lead sample in H2SO4 solution.

2. Calculate the corrosion rate of the sample in mm/year with the help of the icor value obtained from the Tafel curve.

3. Convert the corrosion rate calculated in mm/year for lead into mpy and compare it with the corrosion rate calculated in mpy for the zinc sample.

**4.2.5 REFERENCES:**

* H. Yalçın, M. Gürü, “Elektrokimya ve Uygulamaları”, Palme Yayıncılık, Ankara, 2010.