Prince Sattam bin Abdulaziz University
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Mechanical Engineering Department

ELECTROCHEMICAL CORROSION BEHAVIOR OF AMIG-WELDED STAINLESS STEEL

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Objective:

Study the effect of different fluxes on the corrosion resistance of 304 stainless steel MIG-AMIG welding.

Abstract:

This project explored the corrosion behavior of stainless steel welds in MIG-AMIG welds. Seven stainless steel samples welded with different fluxes were. A potentiostat instrument coupled with EC-Lab software facilitated the measurement of corrosion rates. The experiment aimed to identify the better fluxes with regard to corrosion resistance among the tested samples.

Experimental work

Electrochemical measurements used a Bio-Logic SP-200 potentiostat and EC-Lab software. A three-electrode cell with a working electrode (exposed area: 2 cm^2) and reference/counter electrodes was used in 3.5% NaCl solution. Open-Circuit Potential (OCP) measurement recorded the potential difference between the working and reference electrodes without applied current. Potentiodynamic polarization scans varied the potential and measured resulting current to assess corrosion behavior.

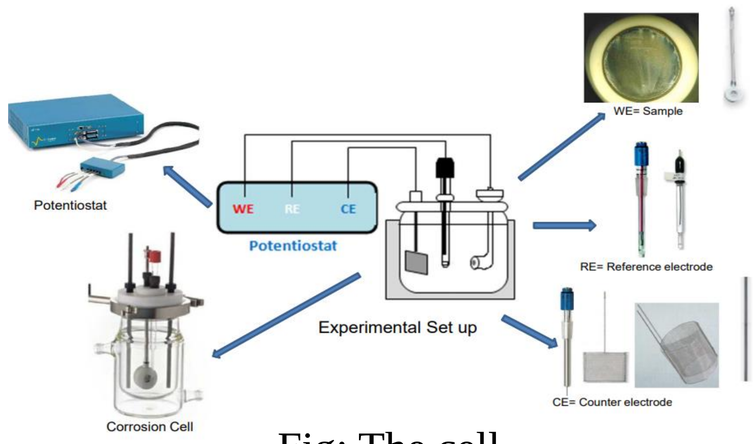

Fig: The cell

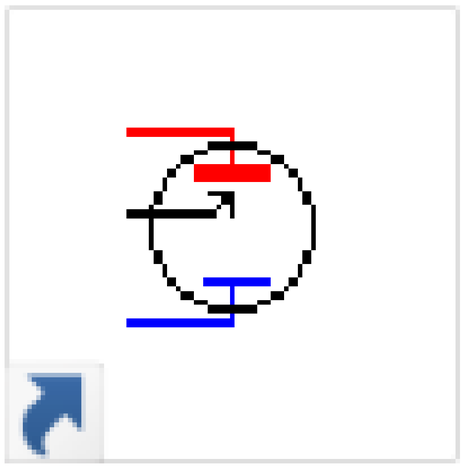

Fig: EC-Lab

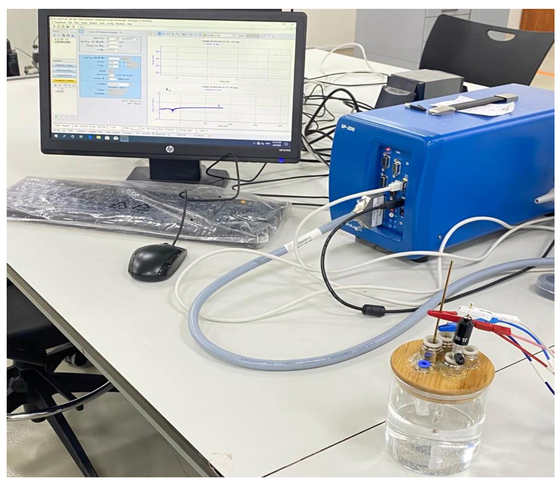

Fig: The system

Calculation of corrosion rate by the EC-lab software:

EC-Lab software's Tafel fit tool is used to calculate corrosion rate. The software displays the data relevant to the experiment. We then select the entire data set, which turns red indicating it's ready for Tafel fitting. After fitting and adjusting points for the best match, material properties and sample area are entered to obtain the final corrosion rate.

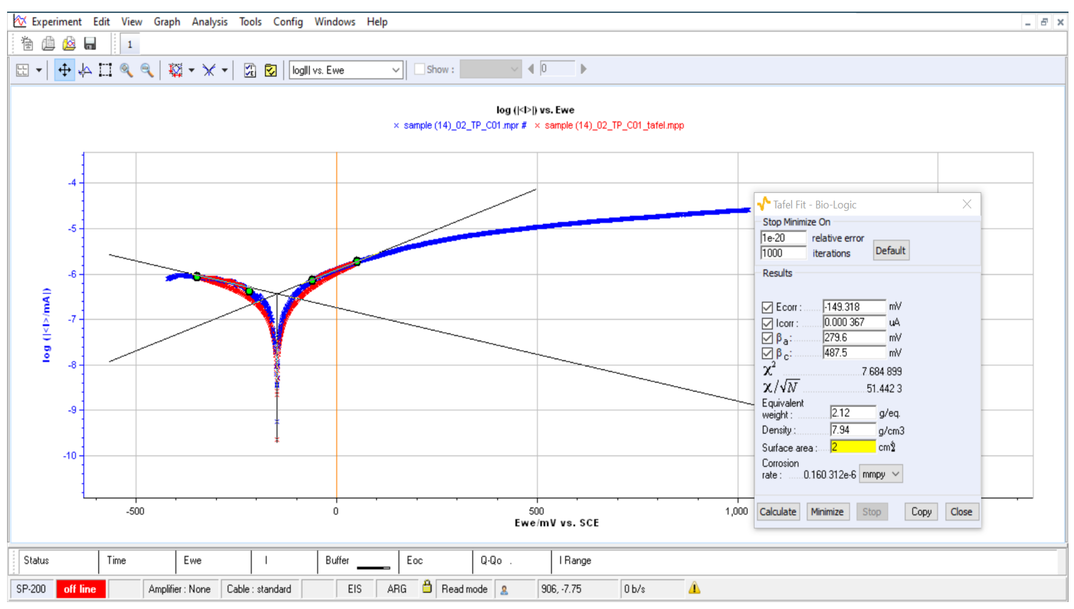

Fig: The software interface

Results (SS):

Sample	E_{Corr} (mV)	I_{Corr} (mA)	Corrosion Rate (mm/y)
MIG	-157.839	0.078	0.404717
SiO_2	-245.489	0.068	0.351958
TiO_2	-191.719	0.292	1.51135
Fe_2O_3	-161.668	0.311	1.60969
Mn_2O_3	-140.528	0.111	0.57452
Cr_2O_3	-141.296	0.138	0.714269
BM	-121.247	0.005	0.258793

Conclusion:

The results show a significant influence of different fluxes on the corrosion behavior of 304 SS welds. In Ecorr, the lowest value is the base metal compared to all welded samples, but when it is compared to MIG welding, the lowest values are Mn_2O_2 flux and Cr_2O_3 flux. The results show also the base metal has the lowest corrosion rate. On the other hand, all A-MIG samples have a corrosion rate higher than MIG except SiO_2. which has a lower corrosion rate (0.351958 mm/year) than MIG.