Abstract

Appropriate selection of Cu based alloys for petrochemical, energy generation, desalination and piping applications in marine operating conditions is of utmost importance. Correlative investigation of the corrosion susceptibility of two Cu based alloys (C70600 CuNi and C26000 CuZn) was done with potentiodynamic polarization technique and open circuit potential analysis in 0.05 M H_2SO_4 solution at 0.5%, 1.5%, 2.5%, 3.5% and 4.5% NaCl concentration. The corrosion susceptibility of both alloys were generally similar at 0.5% (0.05 mm/y and 0.06 mm/y), and 1.5% (0.11 mm/y and 0.10 mm/y) Cl^- ion concentration. Beyond 1.5% concentration C70600 proves to be substantially more corrosion resistant with optimal corrosion rate value of 0.74 mm/y compared to 2.68 mm/y for C26000 at 4.5% NaCl concentration due to variation in the constituent of the oxide layer precipitated on C70600 alloy which differs from C26000. C70600 exhibited dominant cathodic passivation and subsequent corrosion deterioration resulting in visible cathodic potential displacement. C26000, despite its relatively higher corrosion susceptibility underwent metastable pitting activity proportional to the Cl^- ion concentration. Anodic passivation and selective dissolution of C26000 occurred following anodic polarization due to the presence of Zn in its outer matrix. Open circuit potential measurement shows Cl^- ion concentration significantly influences the thermodynamic stability, passivation and corrosion resistance of the Cu alloys. However plot characteristics and potential readings showed C70600 to be more corrosion resistant and thermodynamically stable coupled with significantly lower tendency to corrode.

Keywords

Copper
Zinc
Corrosion
Passivation
H_2SO_4
Seawater