

Galvanic Corrosion of Active Metals at Being Galvanized with Titanium in Concentrated Chloride Solution of Salt Producing Plant

Mikio Takemoto, Aoyama Gakuin University

Galvanic corrosion of cupro-nickel (CuNi) and Monel at being contacted with titanium (Ti) and titanium-palladium (Ti-P) alloy is problems in Japanese salt producing plants. Study aims to evaluate the corrosion damage of cupro-nickel and Monel at being galvanized with pure titanium and Ti-P alloys.

Polarization curves and galvanic current density of alloys, i.e, Ti-P, Ti, Inconel 600, dual phase stainless steel (Dp-3), super stainless steels, Monel, Cupro nickel, naval brass, brass, nickel and steel, were measured as a function of temperature and pressure (evacuation) of brine. Galvanic current densities were less affected by evacuation but affected by increasing temperature. Corrosion potential of Ti and TiP alloys gradually shifted to noble direction with time, while another active alloys showed stable potential after short immersion time. Ti, Ti-P, super stainless steels showed nobler potential than 0 Volt vs. Ag/AgCl electrode, while Monel and cupro-nickel showed steady potential at around -400 mV. Polarization measurement showed that WEL308, Monel, Cupro-nickel, naval brass and brass at being immersed condition are in the active region and showed rapid anodic dissolution.

CuNi and Monel showed potential shift less than 60mV at being contacted with Ti and Ti-P alloy, but large galvanic current density of about $60 \mu\text{A}/\text{cm}^2$. Corrosion rate of these alloys at galvanized with Ti-P alloy increased with the area ratio (S_c/S_a) of cathode to anode to a great extent. At S_c/S_a of 10, corrosion rate of CuNi reached 0.4mm/month while Monel showed three times smaller than that of CuNi. Galvanic corrosion rate in concentrated chloride solution at 85 C reached three times that in sea water at 25C. Due to quite small potential shift at being galvanized, effective countermeasure for mitigating the galvanic corrosion appears to be difficult except the cathodic protection using external electrode.