Galvanic Corrosion Behaviors of A508-III/304L Couples in Boric Acid Solution

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doi: 10.20964/2020.04.40

Received: 22 November 2019 / *Accepted:* 14 January 2020 / *Published:* 10 March 2020

Alloy 508-III steel and 304L stainless steel are often used in pressure vessels found in nuclear power plants, and when both are exposed to boric acid, galvanic corrosion will occur and affect operational safety. The corrosion behavior and galvanic corrosion behavior after pairing these two metals in different boric acid solutions were studied by open circuit potential, polarization curve, AC impedance, zero-resistance ammeter, weight loss and SEM methods. The results showed that the differences in electrochemical properties between the two metals made A508-III act as the anode and 304L act as the cathode to form a galvanic couple that promoted the occurrence of galvanic corrosion. Compared with a single corrosive environment, the corrosion rate of A508-III was significantly accelerated under galvanic corrosion and the surface oxide composition also changed. An increase in the concentration of boric acid solution exacerbated galvanic corrosion. An excessive anodic area could slow down the galvanic corrosion current and quickly stabilize the corrosion. Ultimately, a galvanic corrosion model of A508-III and 304L in boric acid solution was described.

Keywords: galvanic corrosion; A508-III steel; 304L stainless steel; electrochemistry; zero-resistance ammeter method

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