Research on the Corrosion Behavior of 14Cr12Ni3Mo2VN Stainless Steel in a NaCl Solution with Different pH

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Corrosion behaviors for 14Cr12Ni3Mo2VN martensitic stainless steels in chloride solutions with different pH values were investigated using an open circuit potential analysis, potentiodynamic polarization curve analysis, and Mott-Schottky analysis; furthermore, electrochemical impedance spectroscopy, scanning electron microscopy with energy dispersive spectroscopy and laser scanning confocal microscopy analyses were also conducted. The open circuit potential of the 14Cr12Ni3Mo2VN stainless steel in 100 mmol·L⁻¹ NaCl solution shifted from positive to negative with increasing pH, and the smallest electrochemical activity appeared at pH 9. With a reduction in the pH value from 9, the pitting potential and impedance value continuously decrease, and the main density N_d of the passivation film obviously increases. Additionally, the number of point defects inside the passivation film and the number of corrosion medium transmission channels increase. When the solution pH becomes alkaline, the passivation film of Cr has a strong tendency for hydroxylation and tends to exist in the form of hydroxide with poor protection, leading to a reduction in the corrosion resistance of the material. Fe, Cr, V and Mo in the corrosion pit selectively dissolve, which shows that Fe migrates to the solution in the form of ions, while Cr, V and Mo deposit in the pit in the form of oxides or hydroxides.

Keywords: pH value; Blades; Steam turbine; Electrochemistry; Corrosion

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