Research on the Corrosion Behavior of 14Cr12Ni3Mo2VN Stainless Steel in Different Concentrations of NaCl Solution

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The corrosion behavior of 14Cr12Ni3Mo2VN martensitic stainless steel at different chloride ion concentrations was investigated by using the open circuit potential, electrochemical impedance spectroscopy, potentiodynamic polarization, Mott-Schottky curves, scanning electron microscopy, energy dispersive spectroscopy and laser scanning confocal microscopy. It was found that with increasing concentrations of Cl⁻, the open circuit potential constantly shifted in the negative direction, and the pitting potential, impedance value and protection potential of the passivation film all continuously decreased. Meanwhile, the main density N_d of a passivation film was obviously enhanced, and the number of point defects inside the passivation film and channels for corrosion medium transmission also increased. The corrosion resistance of the material continuously decreased with an increase in the concentration of Cl⁻, leading to an increase in the corrosion tendency of the steel. Fe and Cr in a corrosion pit selectively dissolved. Fe migrated out of the pit in the form of an ion, whereas Cr deposited in the form of an oxide in the corrosion pit. The corrosion pattern of the material surface changed from circular pitting to linear corrosion along the material surface with increasing chloride ion concentration, but the depth of the corrosion pit did not significantly increase.

Keywords: Stainless steel; Blade; Steam turbine; Electrochemistry; Corrosion

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