Atmospheric Corrosion Behaviour and Degradation of High-Strength Bolt in Marine and Industrial Atmosphere Environments

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The atmospheric corrosion behaviour and properties degradation law of 1Cr17Ni2 high-strength bolt exposed in marine and industrial atmosphere environments up to 36 months were investigated in virtue of scanning electron microscope (SEM), energy dispersive spectroscopy (EDS), X-ray diffractometer (XRD), potentiodynamic polarization curve (PPC), electrochemical impedance spectroscopy (EIS), optical microscope (OM), tensile strength test, double shear strength test and tension fatigue test. The test results showed that, compared with industrial atmosphere environment, high-strength bolt exhibited higher corrosion susceptibility in marine atmosphere environment. Lepidocrocite and goethite were the major constituents of the rust layer in two types of atmosphere environments, and chlorides and sulphates were detected in marine atmosphere environment and industrial atmosphere environment, respectively. Electrochemical corrosion analysis showed that the anti-corrosive properties of different parts were in this order: screw part > thread part > joint between thread and screw, resulting that the corrosion extent of the screw part was the lightest among three parts. The results of mechanical properties test indicated that the tension fatigue life decreased distinctly with the prolongation of the exposure time in two types of atmosphere environments, and the losses in tension fatigue life of 1Cr17Ni2 high-strength bolt exposed in marine atmosphere environment was much larger than that of 1Cr17Ni2 high-strength bolt exposed in industrial atmosphere environment. Tensile strength and double shear strength did not present visible decrease during the exposure time of 36 months.

Keywords: high-strength bolt; atmospheric corrosion; marine and industrial atmosphere environments; mechanical properties

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