The effect of microstructure on local corrosion behavior of ultra-high strength stainless steel 10Cr13Co13Mo5Ni3W1VE

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Abstract 10Cr13Co13Mo5Ni3W1VE(S280)martensitic ultra-high strength stainless steel is widely used in aircraft landing gear as a key bearing material and other fields.[1] In this paper, the evolution of microstructure of S280 was analyzed by X-ray diffraction (XRD), transmission electron microscopy(TEM) and backscattered electron diffraction (EBSD) test methods under the aging conditions of 200℃, 400℃ and 500℃. The corrosion resistance and structural composition of passive films were evaluated by electrochemical testing method, X-ray photo-electron spectroscopy (XPS), and the relationship between the stability characteristics of passive films and the microstructure of materials was systematically studied. The results show that fine dispersed precipitates are distributed in the martensitic slats at aging temperature 200℃, 400℃ and 500℃. As the aging temperature increased, the precipitated phase increased, and no significant residual austenite or reverse austenite precipitated. At the film forming potential ($0.1V_{SCE}$~$0.85V_{SCE}$), the passive film exhibits p-type semiconductor properties in borate buffer with pH=8.5, showing a double-layer film structure, the outer layer is composed of loose porous Fe/Cr hydroxide, and the inner layer is composed of dense Cr/Fe oxide. The composition is mainly Cr_2O_3. Through electrochemical impedance test and Mott-Schottky analysis, it is proved that S280 has the best corrosion resistance at 200℃, and its corrosion resistance is influenced by grain boundary characteristics and element segregation caused by precipitated phase.

Keywords Ultra-high strength stainless steel S280; Microstructure; Passive film; Local corrosion

Reference

[1] Marques A, Souza R A, Pinto G A M, et al. Evaluation of the softening mechanisms of AISI 4340 structural steel using hot torsion test [J]. Journal of Materials Research and Technology, 2020, 9(5): 10886-900.