

Effect of hydrogen charging on the corrosion behavior of AlNbTiZr alloy in acidic environments

Chayang Dou^{1,2}, Hong Luo^{1,2}

¹National Materials Corrosion and Protection Data Center, Institute for Advanced Materials and Technology, University of Science and Technology Beijing, Beijing 100083, China

² Key Laboratory for Corrosion and Protection of The Ministry of Education (MOE), Beijing 100083, China

dl05251103@163.com

Abstract The effect of electrochemical hydrogen charging on the corrosion behavior of the AlNbTiZr high entropy alloy in a 0.5 M H₂SO₄ solution was investigated. The results revealed localized corrosion and cracks occurring after 120 h of charging, with failure analysis indicating transgranular cracking. Moreover, both the corrosion and passive current densities exhibited an increase with prolonged charging time from 0 h to 120 h. XPS analysis showed that the ratio of OH⁻ to O²⁻ within the passive film increased from 0.379 to 0.854 as the time extended to 120 h. This observation suggested that hydrogenation diminished the alloys' corrosion resistance.

Keywords High entropy alloy, Hydrogen charging, Corrosion, Passive film, XPS

Reference

- [1] P. Cui, Z. Bao, Y. Liu, F. Zhou, Z. Lai, Y. Zhou, J. Zhu, Corrosion behavior and mechanism of dual phase Fe_{1.125}Ni_{1.06}CrAl high entropy alloy, Corros. Sci. 201 (2022) 110276.
- [2] J.G. Yu, J.L. Luo, P.R. Norton, Electrochemical investigation of the effects of hydrogen on the stability of the passive film on iron, Electrochim. Acta 47 (2002) 1527–1536.
- [3] E. Pel´aez-Abell´an, L. Rocha-Sousa, W.D. Mller, A.C. Guastaldi, Electrochemical stability of anodic titanium oxide films grown at potentials higher than 3V in a simulated physiological solution, Corros. Sci. 49 (2007) 1645–1655.
- [4] D. Eliezer, E. Tal-Gutelmacher, C.E. Cross, T. Boellinghaus, Hydrogen trapping in β -21S titanium alloy, Mater. Sci. Eng. A 421 (2006) 200–207.