The corrosion behavior and passive film properties of the cast and annealed AlCoCrFeNi$_{2.1}$ eutectic high-entropy alloy in sulfuric acid solution

Yu Fu[1,2,3,*], Hong Luo[1], Xinren Chen[2], J. Manoj Prabhakar[2], Xuefei Wang[1], Hongxu Cheng[1], Cuiwei Du[1,*], Songqing Hu[3], Xiaogang Li[1]

[1]Beijing Advanced Innovation Center for Materials Genome Engineering, University of Science and Technology Beijing, 100083 Beijing, China

[2]Max Planck Institute for Sustainable Materials, Max-Planck-Str. 1, 40237 Düsseldorf, Germany

[3]School of Materials Science and Engineering, China University of Petroleum (East China), 266580 Qingdao, China

18810068865@163.com (Y. Fu), dcw@ustb.edu.cn (C.W. Du).

Abstract The effect of microstructure on the corrosion behavior and film properties of strengthened AlCoCrFeNi$_{2.1}$ eutectic high-entropy alloy (EHEA) was investigated. Annealing of the 80% cold-rolled AlCoCrFeNi$_{2.1}$ EHEA at 650-1200 ℃ effectively improved the stable passive region to 930 mV, and decreased the passive current density by 25% to 3.5 μA/cm^2 compared with the cast alloy in 0.1 M H_2SO_4 solution. The improved corrosion resistance of the annealed AlCoCrFeNi$_{2.1}$ EHEA was attributed to the increasing oxides proportion and thickness of passive film and the reduced composition difference between FCC and B2 phases. The B2 phase in lamellae suffered the severest corrosion.

Keywords High-entropy alloy; Corrosion behavior; Passive film; AES; XPS