Passivation Behavior of a Zr₆₀Cu₂₀Ni₈Al₇Hf₃Ti₂ Bulk Metallic Glass in Sulfuric Acid Solutions

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The passivation behavior of Zr₆₀Cu₂₀Ni₈Al₇Hf₃Ti₂ bulk metallic glass (BMG) in H₂SO₄ solutions were studied by electrochemical measurements and X-ray photoelectron spectroscopy. The influence of H₂SO₄ solutions concentration and temperature, heat treatment temperature and erosion on passivation behavior were analyzed. The corrosion resistance of Zr₆₀Cu₂₀Ni₈Al₇Hf₃Ti₂ bulk metallic glass decreases slightly with the increase of concentration and temperature of H₂SO₄ solutions. The Zr-based BMG exhibits excellent passivation ability in various H₂SO₄ solutions. The formed passive films in H₂SO₄ solutions possess the semiconductor characteristics depending of applied potential, and show n-type semiconductor in stable passivation region. The main component of passive films is ZrO₂ in competition with HfO₂ and Al₂O₃, and no Ni element, and the alloy surface whose passive film contains less Cu and more Al₂O₃ and less Cu, hence the alloy exhibits can have better corrosion resistance. Annealing which temperatures are lower than T_g were conducted. After the heat treatment, Zr-based BMG maintains amorphous structure, and the electrochemical behavior of Zr-based BMG does not show obvious difference. However, the heat treatment improves BMG' micro-hardness. Consequently, the Zr-based BMG after heat treatment has stronger erosion-corrosion resistance than the as-cast BGM.

Keywords: Bulk metallic glass; Corrosion resistance; Passive films; Heat treatment; XPS analysis; corrosion-eorsion

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