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Effect of Rare-earth on Friction and Wear Properties of Laser Cladding Ni-Based Coatings on 6063Al

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Abstract

The Ni60 alloy cladding layers added with La_2O_3, Y_2O_3, CeO_2 were prepared on the surface of 6063Al using laser cladding technology. The effects of rare-earth oxides on the microstructure, hardness, friction and wear properties of laser cladding Ni-based coating were investigated by XRD, SEM, microhardness tester, friction and wear tester. The results showed that, the main phase composition of the cladding layers is β-NiAl (Cr), Al_3Ni, $AlNi_3$ and Al, and the Ni60 cladding layers added rare-earth oxides will produce chemical reaction that involved in the cladding process to form stable rare-earth compounds. Compared with Ni60 cladding layer without rare-earth, the micro-morphology of the Ni60 cladding layers added with La_2O_3, Y_2O_3 and CeO_2 respectively are preferable, which are more smooth and without obvious pores and cracks. The dendritic structures of Ni60 cladding layers are coarse, and there are many grain segregation in the local area, accompanied by a large number of pores, while the organization of Ni60 cladding layers added with rare-earth oxides are compact dendrite, and the grain are obviously refined. The hardness of the cladding layers from the surface to the substrate is gradually decreased with increasing depth of the cladding layer.Compared with Ni60 cladding layer without rare-earth, the wear properties of Ni60 cladding layers added with rare-earth La_2O_3, Y_2O_3 and CeO_2 respectively are improved.

Keywords: Laser cladding ; Rare-earth; Aluminum alloy; Friction and wear properties

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