Effect of Current Density on the Properties of Ni–CeO₂ Composite Coatings prepared using Magnetic Field-Assisted Jet Electrodeposition

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doi: 10.20964/2021.06.13

Received: 1 August 2020 / Accepted: 29 August 2020 / Published: 30 April 2021

Ni–CeO₂ composite coatings with excellent performance were prepared using jet electrodeposition while reducing the adverse effects of surface defects in the coating due to the agglomeration of nano-CeO₂ particles. In the jet electrodeposition process, a vertical magnetic field was introduced to prepare Ni–CeO₂ composite coatings at different current densities. With the help of scanning electron microscopy, energy dispersive spectroscopy, and microhardness measuring instrument, the surface morphology, structure, and composition of the coatings were studied, respectively. Further tests were conducted on the friction, wear, and corrosion resistances of the coatings to explore the effect of current density on the comprehensive performance of the composite coatings prepared under a vertical magnetic field. The results showed that under the action of the magnetohydrodynamic effect produced by the magnetic field, the particles in the composite coatings are arranged regularly, and with the increase in the current density, the microhardness, wear resistance, and corrosion resistance first increased and then decreased. The composite coating prepared under a processing current density of 20 A/dm² exhibited a good surface density and flatness, with the microhardness value reaching a maximum of 665.78 HV_{0.1}. Moreover, it exhibited the best wear and corrosion resistances.

Keywords: Magnetic field; Current density; Ni–CeO₂ composite coating; Wear resistance; Corrosion resistance

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