Electrodeposition of Zn-Ni-ZrO₂, Zn-Ni-Al₂O₃ and Zn-Ni-SiC Nanocomposite Coatings from an Alkaline Bath

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Zn-Ni-ZrO₂, Zn-Ni-Al₂O₃ and Zn-Ni-SiC nanocomposite coatings were obtained on mild steel substrate by electrodeposition technique from an alkaline bath. ZrO₂, Al₂O₃ and SiC nanoparticles were added to the bath with concentrations of 5 and 10 g dm⁻³. The effect of current density and particles concentration on the deposit composition, morphology, structure and microhardness was studied. The results show that the addition of nanoparticles to the plating solution does not affect significantly Zn-Ni electrodeposition process and alloy Ni percentage. X-ray diffraction patterns of the coatings show only the presence of cubic γ -phase Ni₅Zn₂₁. With ZrO₂ or Al₂O₃ nanoparticles, homogeneous and compact deposits with low grain size were obtained. On the contrary, SiC nanoparticles incorporation perturbs the growth of the alloy matrix by reducing γ -phase orientation. ZrO₂ and Al₂O₃ lead to an increase in the coating microhardness, whereas SiC leads to a decrease, due to the strong modification induced in the alloy structure.

Keywords: electrodeposition; Zn-Ni alloy; nanocomposite coatings; ceramic nanoparticles.

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