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Morphology and Rietveld analysis of nanostructured Co-Ni electrodeposited thin films obtained at different current densities

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Abstract

Co-Ni thin films were synthesized by electrodeposition on Cu substrate from chloride-sulphate bath containing thiourea as additive. The effects of applied current density ($J = 1, 2, 3$ and 4 A/dm^2) on the composition, morphology, microstructure and formation mechanism of deposited films were investigated by EDX, SEM and XRD techniques respectively. The EDX results indicate that the codeposition phenomenon of Co-Ni coatings can be illustrated as slightly anomalous electrodepositing behavior. The SEM micrographs show that the deposits are well adherent and exhibit a compact surface with a cauliflower-like appearance and changes from rough to smooth surface with the rise of current density. The structural investigation is performed through the Rietveld refinement of XRD patterns using MAUD program. The results reveal the formation of both HCP Co phase, FCC Co(Ni), HCP Co(Ni) and HCP Co(S) solid solutions (SS). The HCP SS formation mechanism is described by the diffusion of Ni and S atoms along c axis of HCP Co crystal lattice. The increase of current density causes a lattice distortion revealed by an increase of the lattice parameters of different

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