

# Microstructural, morphological, mechanical and tribological characterization of nanocrystalline nickel and Ni-Co electrodeposited coatings

**Mohamed HAMIDOUCHE, Nafissa KHENNAFI-BENGHALEM**

**Abstract :** The nanocrystalline nickel and nickel-cobalt coatings were electrodeposited on an A60 steel substrate in a modified Watts bath. The observation of the coatings produced by scanning electron microscopy (SEM) showed that the nickel coatings have a granular structure whereas the Ni-Co alloy deposits have a lens-shaped structure with a considerable increase in the grains size of the Ni-Co alloy deposits. Analysis by profilometer confirms these results where we find that the surface roughness of nano-crystalline nickel coatings is less than that of Ni-Co alloy coatings. The results of XRD showed that the nickel coatings having an fcc phase structure while the Ni-Co coatings have a mixed phase structure hcp + fcc. . The study of micro-hardness of the coatings show that this latter follow the Hall Petch effect where nickel deposits which have the small grain size compared to that of the Ni-Co alloy show a higher microhardness to that of Ni-Co coatings. Pin on disk tribometric analysis under unlubricated conditions showed a great improvement of the wear resistance by the addition of cobalt on the nickel coatings, where the friction coefficient and the wear rates are reduced to very significant manner in the Ni-Co coatings compared with nickel coatings.

**Keywords :** Nickel coatings, Ni-Co coatings, microstructure, morphology, Micro-hardness, Tribological properties