Electrodeposition and Mechanical Properties of Ni-W Matrix Composite Coatings with Embedded Amorphous Boron Particles

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Hard nickel-tungsten/boron (Ni-W/B) composite coatings were designed and successfully prepared on the surface of low carbon steel by direct current electrodeposition. The effect of boron concentration in the solution on the amount of boron contents in the deposits and mechanical properties were investigated. SEM and EDS elemental mapping show a uniform dispersion of boron particles into the Ni-W matrix could be observed. ICP results reveal that high boron content (~21.7 wt.%) of composite coatings can be achieved at boron concentration of 5 g/L. High hardness of 1266 HK was obtained from the Ni-W/B composite coatings with higher boron contents. This method is much easier to obtain a high hardness of Ni-W/B coatings which is comparable to that of hard chromium plated coatings. Furthermore, the wear resistance is also enhanced for the Ni-W coatings with incorporation of boron particles.

Keywords: Composite coatings; Electrodeposition; Boron; Hardness; Wear resistance

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