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The Tin stabilization effect on the microstructure, corrosion and wear resistance of electroless NiB coatings

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Abstract

The effect of tin chloride on bath stabilization and properties of electroless Nickel-Boron (NiB) coatings was investigated. NiB coatings were synthesized by electroless deposition using $SnCl_2$ stabilizer. Sn was codeposited in the coating generating a novel NiB-Sn alloy. The deposition of NiB-Sn occurred in an aqueous bath containing a reducible metal salt ($NiCl_2$), reducing agent ($NaBH_4$) and complexing agent ($C_2H_4(NH_2)_2$). The pH was controlled at pH 12±1 in order to avoid bath destabilization. The stabilizer properties of $SnCl_2$ were proved by the fact that the plating completely stops at high concentrations. It has been found in the present work that the $SnCl_2$ not only stabilizes electroless nickel baths but also enhances the plating rate. The deposition was performed with three different concentrations of $SnCl_2$ (0.05 g/L, 0.1 g/L and 0.2 g/L). The morphological features are modified as a function of concentration. Coatings with finer cauliflower structure and more homogeneous thickness are reached with the increase of stabilizer concentration. The corrosion behavior was increased with the Sn presence in the surface. Results for samples with 0.1g/L of $SnCl_2$ show hardness (842 hk_{50}) wear behavior (Ws 0.11 $\mu m^2/N$) and first damage by scratch test (Lc 30 N) results comparable to those presented by traditional NiB coatings.

Keywords: electroless plating; Nickel-boron ; stabilizer ; tin.