

Electroless copper-phosphorus coatings with the addition of silicon carbide (SiC) particles

Abstract

Cu-P-silicon carbide (SiC) composite coatings were deposited by means of electroless plating. The effects of pH values, temperature, and different concentrations of sodium hypophosphite ($\text{NaH}_2\text{PO}_2 \cdot \text{H}_2\text{O}$), nickel sulfate ($\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$), sodium citrate ($\text{C}_6\text{H}_5\text{Na}_3\text{O}_7 \cdot 2\text{H}_2\text{O}$) and SiC on the deposition rate and coating compositions were evaluated, and the bath formulation for Cu-P-SiC composite coatings was optimised. The coating compositions were determined using energy-dispersive X-ray analysis (EDX). The corresponding optimal operating parameters for depositing Cu-P-SiC are as follows: pH 9; temperature, 90°C; $\text{NaH}_2\text{PO}_2 \cdot \text{H}_2\text{O}$ concentration, 125 g/L; $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$ concentration, 3.125 g/L; SiC concentration, 5 g/L; and $\text{C}_6\text{H}_5\text{Na}_3\text{O}_7 \cdot 2\text{H}_2\text{O}$ concentration, 50 g/L. The surface morphology of the coatings analysed by scanning electron microscopy (SEM) shows that Cu particles are uniformly distributed. The hardness and wear resistance of Cu-P composite coatings are improved with the addition of SiC particles and increase with the increase of SiC content.