Surface morphology and electrical properties of pulse electrodeposition of NiFe films on copper substrates in ultrasonic field.

ABSTRACT

NiFe films were pulse electrodeposited on conductive copper substrates under galvanostatic mode with and without the presence of an ultrasonic field at different pulse current magnitudes and duty cycles. The optimum deposition condition was found to be at a current magnitude of 40 mA and a duty cycle of 50.00% under ultrasonic treatment. This deposition condition has significantly reduced the surface roughness from 39.01 ±1.1 nm to 6.96 ±1.1 nm and the spherical grain size in the range from 579.40 nm - 623.30 nm to 29.00 nm - 46.90 nm. On the other hand, the resistivity was reduced to 19.86 μωcm from 54.00 μωcm as the Ni content increased from 76.08% to 80.12 % for achieving good stoichiometry for NiFe thin films. Through the optimization study, the deposition current is observed to be the dominant factor in determining the single phase deposition of NiFe film whereas ultrasonic field and duty cycle significantly reduces the surface roughness and the spherical grain size, all of which combine to reduce film resistivity.

Keyword: NiFe thin films; Electrochemical reactions; Electrode materials; Surface morphology; Surface roughness; Resistivity.