

## The Mechanical and Electrochemical Properties of DC-Electrodeposited Ni-Mn Alloy Coating with Low Internal Stress

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**Abstract :** The nickel-manganese (Ni-Mn) alloy coating prepared from DC electrodeposition process in sulphamate bath was studied. The effects of process parameters, such as current density and electrolyte composition, on the cathodic current efficiency, microstructure, internal stress and mechanical properties were investigated. Because of its crucial effect on the application to the electroforming of microelectronic components, the development of low internal stress coating with high leveling power was emphasized. It was found that both the coating's manganese content and the cathodic current efficiency increased with the raise in current density. In addition, the internal stress of the deposited coating showed compressive nature at low current densities while changed to tensile one at higher current densities. Moreover, the metallographic observation, X-ray diffraction measurement, transmission electron microscope (TEM) examination, and polarization curve measurement were conducted. It was found that the Ni-Mn coating consisted of nano-sized columnar grains and the maximum hardness of the coating was associated with (111) preferred orientation in the microstructure. The grain size was refined along with the increase in the manganese content of the coating, which accordingly, raised its hardness and mechanical tensile strength. In summary, the Ni-Mn coating prepared at lower current density of 1-2 A/dm<sup>2</sup> had low internal stress, high leveling power, and better corrosion resistance.

**Keywords :** Ni-Mn coating, DC plating, internal stress, leveling power

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