

Mechanical Properties Investigation of Electroplated Nickel Microstructure With Different Thickness

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ABSTRACT

Sputtering, CVD, and Electroplating were used to deposit structural and sacrificial layer in MEMS process. The internal structures of deposition thin film made by these methods are granular or porous, the orientations of crystallographic planes and morphology of the microstructure are different with bulk materials, the mechanical properties of the deposited thin film maybe different from those of the bulk material.

To investigate mechanical properties (Young's modulus, hardness, and CTE) of electroplated nickel microstructure with different thickness (4~16 μm) and different mean current density (5~20 mA/cm^2), some micro cantilever beams were made by Nickel Sulfamate base electrolyte. After fabricating, these samples were tested for investigation Young's modulus, hardness, and CTE.

Because of the variation of grain sizes, with same current density, at thick thickness with large grain, less grain boundaries, low Young's modulus, low hardness and high CTE are obtained whereas at thin thickness with small grain, more grain boundaries, high Young's modulus, high hardness and low CTE were electroplated.

With same thickness, at high current density with large grain, less grain boundaries, low Young's modulus, low hardness and high CTE are obtained whereas at low current density with small grain, more grain boundaries, high Young's modulus, high hardness and low CTE were electroplated.