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Bending Characterization of Electroplated Nickel Microbeams

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In this study, we aim to investigate the mechanical behavior of an electroplated nickel film using the bending micromachined cantilever approach. The bending test, including quasi-static, reloading, and time-dependent creep was performed using a nanoindentation loading system. The mechanical properties of Young's modulus and yielding strength were determined through bending testing, and the experimental average values are 191 GPa and 0.79 GPa, respectively. In addition, by measuring the load-deflection of a microcantilever under various stress levels with a constant temperature, the bending creep behavior of the electroplated nickel film was determined and characterized. Experimental results show that when bending stress is smaller than the measured yielding strength, the relation between stress and strain rates can be expressed as $(d\varepsilon/dt) = 0.0016e^{2.5(\sigma)}$. These test results can provide the basis for the design optimization of nickel microstructure. Thus, the performance and reliability of MEMS/IC devices can be predicted and improved.

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