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Mechanical Characterization of Gold Thin Films Based on Strip Bending and Nanoindentation Test for MEMS/NEMS Applications

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In this paper, we report the mechanical properties of micro/nanometer-thin gold films evaluated by a strip bending technique and a conventional nanoindentation test for micro-nano-electromechanical systems (MEMS/NEMS) applications. Nanometer-thin freestanding fixed gold strip specimens with different thicknesses of 200, 500 and 1000 nm have been prepared to observe the effect of size dependence on the mechanical properties. All the specimens are fabricated over the open window in silicon wafers using the metal lift-off and silicon deep etching processes. A strip bending test has been performed on the fabricated freestanding strip specimens using a commercial nanoindenter with a wedge-type indenter tip for applying a line load to the strip. A nanoindentation test has also been performed on the same gold films fixed on the silicon substrate using a nanoindenter with a continuous stiffness measurement (CSM) option. Experimental details of the strip bending test and the measured mechanical properties are introduced. In addition, the results are analyzed to validate the two measurement techniques.

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