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Mechanical Property Characterization for Nanowires RUSTOM BHILADVALA, MINGWEI LI, THERESA MAYER, JAMES SIOSS, CHRISTINE KEATING, JOAN REDWING, The Pennsylvania State University — Understanding and predicting the behavior of NEMS (nanoelectromechanical systems) resonators made by assembling template-grown nanowires requires characterization of the elastic modulus and intrinsic damping for such materials. In this work, we present results of resonance measurements using cantilevers made by electroplating clamps which fully enclose one end of nanowires (NWs) made from Si, Rh and Au. Data from 16 such Si NWs made by the VLS (Vapor-Liquid-Solid) technique reveal a typical Q-factor of 5000, a geometric scaling ($\sim D/L^2$, diameter D, length L) of the frequency consistent with linear elastic beam theory, and a higher value of Young's modulus for single-crystal silicon than reported from experiments with thin-film Si resonators. The low scatter in the modulus data and the high value of Q are both indicative of low clamping losses. Similar-sized wires of polycrystalline Rh and Au made by electroplating, show net damping values (using Q-factor, mass and stiffness) for these materials to be close to each other and roughly 14 times that for silicon.

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