Effect of Chamber Pressure on the Vibrational Properties of Micro- and Nano-Cantilevers

GAYATRI KESKAR, JAY GAILLARD, JONATHAN TAYLOR, MALCOLM SKOVE, APPARAO RAO, Clemson University — We have studied the nonlinear dynamics of micro- and nano-cantilevers under varying ambient conditions using the Harmonic Detection of Resonance technique (HDR)\(^1\). In our studies, a cantilever is either microstructure shaped like a diving board, or a cantilevered MWNT. In this work, we report the dependence of the amplitude and Q of a silicon microcantilever (300 µm long, 35 µm wide, 2 µm thick) on ambient pressure. An environment of air at a pressure of \(10^{-3}\) Torr gives a high quality factor of \(\sim 7000\). The response of higher harmonics of the ac voltage that drives the cantilever is also observed with varying chamber pressure. An investigation of the influence of ac and dc voltages on sensitivity shows very good agreement with a model calculation. The shift in the resonant frequency of cantilevers under different environments such as helium, air and argon at different pressures will be discussed. References: 1. J. Gaillard, M. J. Skove, R. Ciocan, and A. M. Rao, Rev. Sci. Instrum. 77, 073907 (2006). Contact Info: arao@clemson.edu

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