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Pressure Dependence of MEMS Oscillator Quality Factor[1]

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This paper details a study in which the pressure dependence of the quality factor and resonance frequency of a micro-electro-mechanical device is examined. The results obtained will aid in the understanding of the effects of slide film damping in various gasses on oscillators operating at micrometer length scales. The device utilized was a capacitively driven plate oscillator positioned 1.25μm above a silicon substrate. The dominant damping mechanism for this geometry is slide film damping from the gaseous film between the oscillating plate and substrate. The mechanical resonance of the device was characterized as a function of pressure from 6 mTorr to 1 atm in air. We observed three distinct damping regimes in the quality factor. In addition to the characterization performed in air, pressure dependences in helium and argon were also examined at pressure ranges of 6.5 mTorr to 5 Torr and 750mTorr to 760 Torr, respectively.

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