Abstract Submitted
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Vibrating nanowires in air: continuum uncertainties affecting drag force estimates in the transition regime of rarefied gas flow[1] RUSTOM B. BHILADVALA, MINGWEI LI, THERESA S. MAYER, The Pennsylania State University — Design of high resolution instruments using vibrating nanowires in air e.g. mass sensors for the sub-attogram ($< 10^{-18}$ gram) range, will require calculation (DSMC) of averaged and fluctuating drag forces at low Mach number ($M < 0.01$) in rarefied gas flow (Knudsen number $Kn > 0.001$). For corroboration of averaged force calculations, long, cantilevered nanowire (NW) oscillators, difficult to make by conventional electron-beam patterning of thin films, have been made by an alternate bottom-up assembly technique; averaged drag force has been measured in the range $0.2 < Kn < 200$ for $M = 0.004$. Similarity is examined using drag force data from our ∼300 nanometer diameter wires and from long wires with diameter in mm. For typical silicon and metal NWs, length scale selection, transition regime solutions with their matching to known steady and unsteady continuum solutions and the surprising unrealisability of the continuum Stokes regime (Reynolds number, $Re < 1$) will be addressed.

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