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Limitations in interpretation of Quartz Crystal Microbalance (QCM) beyond the rigid (Sauerbrey) to viscoelastic (lossy) transition CLINTON WIENER, ROBERT WEISS, University of Akron, CHRISTOPHER WHITE, National Institute of Standards and Technology, BRYAN VOGT, University of Akron — Since Sauerbrey's 1959 discovery of the mass-frequency relationship in quartz, the QCM has been utilized to probe deposited mass layers. The mass to frequency (imaginary component of the impedance) relationship breaks down when the added mass is not rigidly coupled to the sensor surface and viscous dissipation of the quartz occurs. This dissipation is important in the deposition of soft materials such as polymers or biological molecules. By using a viscoelastic model for frequency and dissipation; the mass, viscosity, and shear modulus can be accurately determined. Here, we demonstrate an additional breakdown in the coupling of the imaginary component of the impedance to the mass by simultaneous QCM-D and spectroscopic ellipsometry (SE) measurements by examination of the swelling behavior of thin physically crosslinked poly-n-isopropylacrylamide films. A film swollen beyond 3 times its dry thickness shows a frequency increase (mass loss) and dissipation increases (increasing lossy film character) on cooling, but SE results show increased swelling of the film. This behavior was found to be thickness invariant for dry thicknesses of 32 nm and greater. Modeling of this QCM-D data shows non-physical results. Scaling concepts associated with this high loss limit will be discussed.

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