High Frequency Viscoelastic Characterization of Polymer Gels and Networks with the Quartz Crystal Microbalance

Kenneth R. Shull, Elizabeth J. Martin, Lauren F. Sturdy and Joshua Yeh

Department of Materials Science and Engineering, Northwestern University, Evanston, IL

847-467-1752, k-shull@northwestern.edu

We have used quartz crystal resonators to quantify the viscoelastic properties of glassy polymers, rubbery polymers and gels in the megahertz frequency regime. The ability of the measurement to track mechanical properties in real time is particular relevant in coatings applications, and has been utilized to investigate curing and aging of artists’ paints of relevance to the art conservation community. We have also used the method to obtain information about interfacial gels formed at the surfaces of Co-based metal alloys used in biomedical implants. The technique is based on deviations from the well-known Sauerbrey expression relating the resonant frequency of a quartz crystal to the inertial mass loading from a deposited film. By appropriately measuring the resonant frequency and bandwidth of different resonant harmonics of the crystal, we are able to independently obtain the storage and loss moduli of thin film coatings at a frequency of 15 MHz. We have recently begun to use this capability to refine methods for depositing thin film coacervate gels onto metallic surfaces in order to control the adhesive and frictional properties of these surfaces.