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Real-time Characterization of Hydrogel Rheological Properties Using Cantilever Sensors

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Abstract

Here, we report that high-order resonance in dynamic-mode cantilever sensors persists in hydrogels and enables the real-time characterization of hydrogel viscoelastic properties and the continuous monitoring of sol-gel phase transitions. Real-time tracking of piezoelectric-excited millimeter cantilever (PEMC) sensor high-order resonant frequency and corresponding phase angle and quality factor persisted in alginate hydrogel systems of higher concentration than those measurable by lower-order modes. This work contributes to the application of cantilever sensors as promising platforms for sensor-based characterization of gelation processes and hydrogel viscoelastic properties, and offers further understanding of the underlying fluid-structure interaction model.

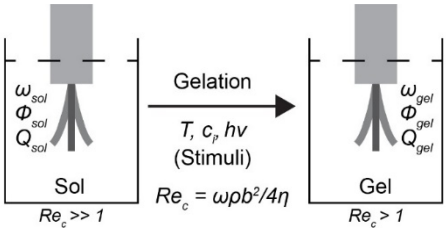

Figure: Schematic depicting the sensor-based sol-gel rheological characterization study and associated measurement principle (i.e., real-time monitoring of gelation processes via sensor signal tracking).

Biography

Ellen Cesewski graduated from University of Maryland with a Bachelor of Science degree in Materials Science and Engineering in 2015. She began at Virginia Tech in the fall of 2015, and is expected to defend her PhD in August of this year. She works in the Advanced Biosensing and Biomanufacturing Lab in the Department of Industrial and Systems Engineering with Dr. Blake Johnson. Her research focuses on online characterization and sensing of biomanufacturing processes through the use of cantilever sensors, microfluidic devices, and application of fundamental fluid-structure interaction models.