SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

NOVEL SENSING MECHANISMS FOR CHEMICAL AND BIO-SENSING USING WHISPERING GALLERY MODE MICRORESONATORS

PhD Preliminary Research Examination

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Abstract: Due to their ultra-high quality factor and small mode volume, whispering gallery mode (WGM) microresonators have proven to have exceptional sensing capabilities, with single particle level sensitivity to virions, proteins, and DNAs. However, current sensing mechanisms rely on measuring the changes in the transmission spectrum of the resonator, appearing as either shift, splitting, or broadening of the resonance mode, all of which measure the polarizability of adsorbed analytes. In this talk, I will present two new sensing mechanisms for WGM microresonators, based on surface-enhanced Raman spectroscopy (SERS) using WGMs and hydrogel swelling and shrinkage measured through WGMs.

Conventionally, metallic nanostructures are used for SERS, but recently there has been increasing interest in the enhancement of Raman scattering from dielectric substrates due to their improved stability and biocompatibility compared with metallic substrates. In combination with WGM sensing, this represents a promising sensing platform with both high sensitivity and specificity. Here, we demonstrate the enhanced Raman scattering from rhodamine 6G molecules coated on silica microspheres, excited through WGMs. A total Raman enhancement factor of 1.4×10^4 is observed.
We also report the measurement of gelation of polyacrylamide hydrogel using WGM resonators. This is the first report of using WGM resonators to continuously monitor a chemical reaction (i.e. gelation) in situ. The results from WGM sensing is compared with rheology, a well-established technique for hydrogel characterization. From the similarities and differences in the measured results from WGM and rheology, we suggest that whereas rheology measures the viscoelastic properties of the hydrogel, WGM resonators measure the hydrogel density indirectly through its refractive index. These two techniques used in combination can provide further insight into the gelation mechanism of hydrogels.

DATE: Wednesday, June 21, 2017
TIME: 10:00 a.m.
PLACE: Green Hall, Room 0120

Dissertation advisor:
Dr. Lan Yang

This seminar is in partial fulfillment
of the Doctor of Philosophy degree

Washington University in St. Louis
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