Nanofiber optic mechanical transducers for measuring molecular level displacements and forces

Donald J. Sirbuly

Department of NanoEngineering, University of California, San Diego, La Jolla, CA 92093, USA

The ability to observe, measure and manipulate individual molecular interactions is central to our understanding of complex chemical pathways and biological processes. Fine single molecule analyses of conformational changes, intramolecular distances, and/or adhesion forces are typically carried out by methods such as optical tweezers, Förster energy transfer schemes and other molecular ruler platforms. Since quantitative measurements at the molecular level continue to be at the core of biological and materials R&D, it will be crucial to develop novel sensing architectures that can be inserted directly into systems for *in situ* diagnostics and/or be engineered to spatially measure nanomechanical forces. In this talk, I will present some of our recent work on subwavelength optical waveguides and show how near-field light-matter interactions can be leveraged to provide feedback on molecular distance changes and forces.[1-2] Both dielectric-dielectric[3] and dielectric-plasmonic coupling effects will be discussed and how these can be used to design large area or single element force probes. The all-optical design of obtaining feedback makes these systems ideal for new force sensing devices, imaging technologies and high-throughput nanomechanical analysis.

(1) Yoon, I.; Baker, S. E.; Kim, K.; Wang, Y.; Esener, S. C.; Sirbuly, D. J. "Profiling the evanescent field of nanofiber waveguides using self-assembled polymer coatings" *Nanoscale* **2013**, *5*, 552-555.

(2) Yoon, I.; Baker, S. E.; Kim, K.; Fischer, N. O.; Heineck, D.; Wang, Y.; Esener, S. C.; Sirbuly, D. J. "Nanofiber near-field light-matter interactions for enhanced detection of molecular level displacements and dynamics" *Nano Lett.* **2013**, *13*, 1440-1445.

(3) Yoon, I.; Kim, K.; Baker, S. E.; Heineck, D.; Esener, S. C.; Sirbuly, D. J. "Stimulus-Responsive Light Coupling and Modulation with Nanofiber Waveguide Junctions" *Nano Lett.* **2012**, *12*, 1905-1911.