Optical Metrology of Nano-materials and Nano-assemblies for Quantitative Nano-biophotonics

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ABSTRACT

Recently, many novel molecular agents and probes have been developed for their use as sensors and proximal probes for the analysis of local nanoenvironment. For instance, the utility of these nanoscale materials including fluorescent nanocrystals (quantum dots or QDs), nanoshells, and nanotubes has been extended towards many bioimaging applications to achieve quantitative imaging contrast. The current challenge for the application of these novel probes for quantitative application is to characterize and model their unique optical and physico-chemical properties and to quantify how biochemical environments change these properties towards their use as reliable bioimaging and therapeutic agents. We have been developing and utilizing new measurement platforms and techniques to characterize and model the unique properties of these nanoscale materials in controlled and realistic environments for their applications as quantitative reagents, sensors, and detectors. To create controlled environments, several self-assembly techniques have been developed to engineer nanocomplexes of nanocrystals combined with biomolecules, nanoscale organisms, and other nanoscale materials. This approach is directly applicable to a variety of biological and biomedical studies including cellular diagnostics, repair, and modification, biological warfare agent detection, and drug research and development. This talk will present a brief overview of nano-biotechnology efforts in Biophysics group at NIST, developing optical and physico-chemical metrology of bio-conjugated nanocrystals at the single particle sensitivity, bioengineering and characterizing QD-virus complexes, and manufacturing and evaluating nanoscale molecular delivery systems self-assembled by bio-inspired processes.