Abstract for an Invited Paper
for the SES09 Meeting of
The American Physical Society

Sensing Plasmon-Resonant Nanorods in Tissue with Optical Coherence Tomography

AMY OLDENBURG, University of North Carolina at Chapel Hill

Gold nanoparticles (GNPs) are of high interest for biomedical imaging and photothermal therapy due to their plasmon-resonant nature. However, their utility is limited by transport and targeting to the disease of interest after administration in the living body. Optical coherence tomography can image the distribution of GNPs on the micro- to meso-scale, leading toward a better understanding of these limiting factors. Plasmon-resonant nanorods provide strong optical absorption at near-infrared wavelengths, and are studied using an optical coherence tomography system based on a broadband laser centered at 800nm. The ability to sense GNPs against a biological tissue background is treated as a sensing problem with parameters including the nanorod volume and aspect ratio, optical detection metrics including extinction, a new backscattering albedo metric based on the ratio of backscattering to extinction, and spectroscopic analysis. A key element of this analysis is determining the native tissue optical response, optical signal noise, and spatial heterogeneity before addition of the GNPs. Experiments are performed in skin-like tissue phantoms where a sensitivity of 30ppm is found. Experiments in excised human mammary tumors reveal additional challenges for imaging in real tissues, and the results of various processing techniques are compared.