Public Abstract
First Name:Biyan
Middle Name:
Last Name:Chen
Adviser's First Name:Shubhra
Adviser's Last Name:Gangopadhyay
Co-Adviser's First Name:Matthew
Co-Adviser's Last Name:Maschmann
Graduation Term:FS 2017
Department:Electrical Engineering
Degree:PhD
Title:PLASMONIC PLATFORM FOR SUPER-RESOLUTION IMAGING AND APPLICATIONS IN BIOLOGICAL AND NANOENERGETIC SYSTEMS

Plasmonics, taking advantages of coupling photons to free electrons in metals, enables prominent electromagnetic field enhancements by concentrating light into subwavelength scales, allowing super-resolution imaging, enhancement of fluorescence and photothermal heating. In this dissertation, a plasmonic grating platform prepared by nano-imprint lithography was introduced for imaging nanostructures, biological materials, and diagnostics of nanoenergetic systems. First, a glancing angle deposition technique was developed to combine periodic gratings with nano-protrusion for single molecule super-resolution imaging for dye-labeled DNA/RNA duplex in wide dye concentrations. The combination of the plasmonic probes and localization microscopy can resolve features as small as 65 nm. Then, the subwavelength nanoparticles with various shapes were studied by different super-resolution approaches. Further, the plasmonic grating microchips facilitate a robust *in-situ* diagnostic platform for the laser-induced photothermal heating and combustion of aluminum nanoparticles (Al NPs)-fluoropolymer nanoenergetic films. A fluorescence-based temperature sensor with temperature-sensitive dye was developed for dynamic thermal mapping at the nanoscale. The plasmonic grating enables visualization and initialization of localized nano-flames whose temperatures were obtained by two-color pyrometry. Scattering measurements enabled precise identification of individual Al NPs over a large field of view, leading to 3D reconstruction of combustion events.