

## Public Abstract

First Name:Kunal

Middle Name:

Last Name:Bhatnagar

Adviser's First Name:Shubhra

Adviser's Last Name:Gangopadhyay

Co-Adviser's First Name:Venumadhav

Co-Adviser's Last Name:Korampally

Graduation Term:SP 2012

Department:Electrical Engineering

Degree:MS

Title:Nanogap Embedded Silver Gratings for Surface Plasmon Enhanced Fluorescence

Plasmonic nanostructures have been extensively used in the past few decades for applications in sub-wavelength optics, data storage, optoelectronic circuits, microscopy and bio-photonics. The enhanced electromagnetic field produced at the metal and dielectric interface by the excitation of surface plasmons via incident radiation can be used for signal enhancement in fluorescence and surface enhanced Raman scattering studies. Novel plasmonic structures have shown to provide very efficient and extreme light concentration at the nano-scale in recent years. The enhanced electric field produced within a few hundred nanometers of these surfaces can be used to excite fluorophores in the surrounding environment. Fluorescence based bio-detection and bio-imaging are two of the most important tools in the life sciences and improving the qualities and capabilities of fluorescence based detectors and imaging equipment remains a big challenge for industry manufacturers. We report a novel fabrication technique for producing nano-gap embedded periodic grating substrates on the nanoscale using a store bought HD-DVD and conventional soft lithography procedures. Polymethylsilsequioxane (PMSSQ) polymer is used as the ink for the micro-contact printing process with PDMS stamps obtained from the inexpensive HD-DVDs as master molds. Fluorescence enhancement factors of up to 118 times were observed with these silver nanostructures in conjugation with Rhodamine-590 fluorescent dye. These substrates are ideal candidates for a robust and inexpensive optical system with applications such as low-level fluorescence based analyte detection, single molecule imaging, and surface enhanced Raman studies. Preliminary results in single molecule experiments have also been obtained by imaging individual 3 nm and 20 nm dye-doped nanoparticles attached to the silver plasmonic gratings using epi-fluorescence microscopy.