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Fluorescence Enhancement and Single Molecule Fluorescence Detection on Nanogap Embedded Plasmonic Gratings fabricated using HD-DVD AVINASH PATHAK, SAGNIK BASURAY, JOSEPH MATHAI, DREW MENKE, KESHAB GANGOPADHYAY, PETER CORNISH, SHUBHRA GANGOPADHYAY, Univ of Missouri - Columbia — A novel method for producing silver plasmonic gratings for surface plasmon resonance (SPR) based coupling of light has been developed which utilizes soft lithography technique using PDMS stamping of grating from HDDVDs. Further, 20nm wide nano-gaps are formed on the stamp wherein an extreme field concentration occurs leading to enhancements of 118 times with respect to glass. The gratings with nanogaps were used for single molecule studies, with an immobilized layer of tagged DNA molecule. Enhancement with epifluorescence on gratings when compared to total internal reflection microscopy (TIRF) on quartz slides is up to 40 times on nanogaps. Further, single molecule Forster resonance energy transfer imaging used to study the dynamics of DNA performed on the gratings shows intensity enhancement by 10 times on nanogaps in comparison to TIRF on quartz. Finally, in order to improve the reproducibility of the nanogaps, a glancing angle deposition method (GLAD) is coupled with the existing technique in order to form nanogaps. We are thus also able to produce extremely sharp tip regions on these grating structures which further enhance the coupling efficiencies due to a field concentration within these hotspot regions. The layered structure is able to produce height dependent enhancement giving a 3-dimentional view of micromolar concentration of dye on the surface. In conclusion, a method of fabricating plasmonic substrates has been developed which can be utilized for sensing or observation of single molecule interactions using epifluorescence.

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