Enhanced Near-Infrared Fluorescent Sensing Using Metal-Dielectric-Metal Plasmonic Array

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Abstract: This work presents a numerical study of metal-dielectric-metal (MDM) plasmonic structure used to enhance a near-infrared fluorescent sensor. The MDM plasmonic structure consists of silver (Ag) subwavelength disk arrays on a thin silica (SiO2) spacing layer and 100-nm-thick-Ag film on a silicon (Si) substrate. The MDM plasmonic arrays with various structural parameters are designed and numerically investigated using the finite-difference time-domain (FDTD) method.

Results show that the optical properties of designed structures are slightly dependent on the height of the Ag disk and strongly dependent on the Ag disk diameter and SiO2 thickness. In the near-infrared wavelength range, the proposed MDM plasmonic array has low ohmic loss and shows the high fluorescent emitting enhancement and directivity of about 16 times and 625.0, respectively, thus making MDM plasmonic array an alternative approach for near-infrared fluorescence bioimaging and biosensing devices.

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