

Plasmon localization, giant EM field, and SERS in flexible metasurfaces

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We explore the optical properties of plasmon localization and local field enhancement in metal-plastic metasurface. The flexible metal-dielectric metasurfaces are made from modulated polycarbonate substrate coated by silver nanofilm [1]. Localization of an optical excitation is experimentally observed by near-field scanning optical microscopy within subwavelength areas in the regular open-resonator metasurface. The localized modes are seen as giant fluctuations of the local electric field spatially concentrated in hotspots, where the local field is much larger than the amplitude of the incident light. Local near-field spatial spectra consist of regularly distributed strong peaks. The maxima of the electric field are highly dependent on the sample structure. The form of the regularly distributed strong resonance peaks follows the topography obtained by atomic force microscopy. It is shown that strong electromagnetic field is concentrated in recesses where the silver film is typically thinner than on the bumps. This experimental observation is consistent with the results of computer simulations of a double-periodic metal-dielectric metasurface and the predictions of our analytical theory. It is found the silver nanofilm has strong adhesion to polycarbonate substrate. The metasurface is used as an effective SERS substrate.

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