Enhancement of the surface plasmon polariton resonances of a stack of thin films

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Abstract:

Metal-dielectric interfaces of thin films support surface plasmon polariton (SPP) resonances propagating along them. Precisely in a five layer glass-Au-SiO_2-Au-air system, the tuning of the thickness and of the laser wavelength and incident angle permit the enhancement of these SPP. In our calculation we use a simple model, based on the plan wave propagation of the light in the thin film and on Fresnel coefficients at the interface. To localize the maximum of the SPP resonances we calculate the dispersion either of the absorbed power of an oscillating dipole located in the dielectric (SiO_2) or of the system reflectance. At the chosen wavelength and wave number projection k_x corresponding to the SPP resonance maximum in the dispersion we calculate the electric field function of the coordinate normal to the interface. The characteristics of this field permit to characterize the nature of the SPP resonances: long or short range with respect to the propagation along the interface or wave guide. Varying the thickness of the thin film and the wavelength and k_x of the photon permits to find the maximum enhancement of the SPP resonances.

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