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Fano-like resonance and scattering in dielectric(core) metal(shell) composites embedded in active host matrices

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Abstract

We investigate light scattering by core–shell consisting of metal/dielectric composites considering spherical and cylindrical nanoinclusions, within the framework of the conventional Rayleigh approximation. By writing the electric potential distribution of the dielectric core, metal shell and host matrices in the core–shell composites, we have derived an analytical expression for the polarization of individual metal cover spherical and cylindrical inclusions, under long wave approximation. Moreover, we demonstrated that modeling the dielectric function of the dispersive core for both frequency dependent (the scattering cross-section) and frequency independent dielectric function of the core, one can tune Fano regions in the core–shell composites. We find that Fano-like resonances can occur at the same input volume fraction of the metal coated (p) provided the dielectric function of active host medium (e h) has negative values. Such Fano-like resonances are induced by interaction between dipolar modes of the inner core, and multipolar plasmon modes of the coated shell. These findings provide new and promising directions which are highly desirable in ultra-thin films, for designing selective solar cell absorber, sensing, lasing, nonlinear switching which have high contrast and low threshold.