Supporting Information

An integrated experimental and theoretical study on optical properties of uniform hairy noble metal nanoparticles

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There are two kinds of photonic transitions in the optical absorption process of materials: inter-band and intra-band transitions.[1-3] In general, an inter-band transition refers to an electron jumping from an occupied state in the valence band to an unoccupied state in the conduction band when the energy of exciting photon is high enough compared to the energy gap. In contrast, the intra-band transition involves an excited electron transition only within valence band or conduction band. In the case of Ag and Au, the band structure can be understood in terms of sp- and d-bands.[4] The sp-band resembles the free-electron dispersion and crosses the Fermi level. Optical transitions between the filled d-band and the empty states of the sp-band are inter-band excitations. Transitions within the sp-band are intra-band excitations.[2] The intra-band transition is induced by free carriers, and is, therefore, more significant in metals. The complex dielectric function is an important parameter for describing the interaction between materials and light. In the complex dielectric function, the portion of inter-band transition and intra-band transition can be described by the Lorentz model[3] and the Drude model[5], respectively.

References

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