RESONANT ENHANCEMENT OF MOLECULAR EXCITATION INTENSITY IN INELASTIC ELECTRON SCATTERING SPECTRUM OWING TO INTERACTION WITH PLASMONS IN METALLIC NANOSHELL

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S u m m a r y

A quantum-mechanical model to calculate the electron energy-loss spectra (EELS) for the system of a closely located metallic nanoshell and a molecule has been developed. At the resonance between the molecular excitation and plasmon modes in the nanoshell, which can be provided by a proper choice of the ratio of the inner and outer nanoshell radii, the cross-section of inelastic electron scattering at the molecular excitation energy is shown to grow significantly, because the molecular transition borrows the oscillator strength from a plasmon. The enhancement of the inelastic electron scattering by the molecule makes it possible to observe molecular transitions with an electron microscope. The dependences of the EEL spectra on the relative arrangement of the molecule and the nanoshell, the ratio between the inner and outer nanoshell radii, and the scattering angle are plotted and analyzed.