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Interaction of plasmon-exciton in a columnar dielectric thin film with a structural defect excitonic thin film

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Abstract

In this research, the coupling of surface plasmon-polariton and surface exciton-polariton in a multilayer structure of metallic medium and columnar dielectric thin film with excitonic spacer in Kretschmann configuration theoretically is investigated; using transfer matrix method. The effect of structural parameters such as the length of columns of columnar thin film and the rise angle of them, the refractive index of prism, the void fractions of columnar thin film and the thickness of excitonic medium on coupling are studied. The results showed that the coupling becomes strength by decreasing the length of columns of dielectric medium and refractive index of prism. Also, by reducing the volume fraction of air in columnar thin film, the coupling becomes stronger as the thickness of the excitonic medium increases and the ultra- strong coupling was obtained at $fv=0.2$. The energy spectrum of plexciton branches in terms of detuning frequency indicates the anti-crossover behavior of plexciton modes, which includes the coupling strength of the modes from the medium to ultra-strong region.

Keywords: plexciton, Kretschmann configuration, transfer matrix method, strong coupling, Rabi splitting energy

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