Resonant optical reflection from AsSb–AlGaAs metamaterials and structures

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The optical reflection in periodic structures based on a semiconductor AlGaAs matrix containing two-dimensional arrays of plasmonic AsSb nanoinclusions was studied. The number of periods was 12 or 24. The spatial period was near 110 nm in both cases. In the experimental optical reflection spectra at normal incidence we observed resonant Bragg diffraction with the main peaks at wavelengths of 757 or 775 nm, depending on the spatial period of the nanostructure. The magnitudes of the resonance peaks reached 19 and 31% for the systems of 12 and 24 AsSb–AlGaAs layers, while the volume fraction of the nanoinclusions was much less than 1%. In the case of light incident at inclined angles, the Bragg-diffraction pattern shifted according to Wulff Bragg's law. Numerical calculations of the optical reflection spectra were performed using the transfer-matrix method by taking into account the spatial geometry of the structures and the resonance characteristics of the plasmonic AsSb layers.

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