Controlling light emission performance with hybrid phase-change plasmonic crystals (Conference Presentation)

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ABSTRACT

In this paper, we demonstrate a novel approach in which the lattice resonances are tunable in a hybrid plasmonic crystal incorporating the phase-change material Ge2Sb2Te5 (GST) as a 20-nm-thick layer sandwiched between a gold nanodisk array and a quartz substrate. Non-volatile tuning of lattice resonances over a range $\Delta\lambda$ of about 500 nm is achieved experimentally via intermediate phase states of the GST layer. This work demonstrates the efficacy and ease of resonance tuning via GST in the near infrared, suggesting the possibility to design broadband non-volatile tunable devices for optical modulation, switching, sensing and nonlinear optical devices.

Also, with different nanostructure designs, the constituent plasmonic resonators can be selectively excited, generating isolated near-field energy hot-spots with selective excitation under a monochromatic plane wave illumination. Unlike other proposed techniques, our method for energy hot-spot positioning is based on a quantitative control of the crystalline proportions of the phase-change thin film rather than the complicated manipulations of an incident light beam. This makes such a near-field energy controllable template much easier to be implemented. This near-field energy controllable system consists of gold nano-antennas with deep subwavelength spacing and an underlying GST thin layer. Such a hybrid plasmonic system is easy to be implemented and the nanoscale energy hot-spot can be positioned in a large field of view by extending the system with different plasmon resonators, suggesting a further step toward applications such as nano-imaging, bio-assay addressing and nano-circuitry.

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