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Control of plasmon modes of metallic nanoantenna arrays on metal-insulator transition material substrate using thermo-optical switching mechanism (G)

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We numerically study plasmonic and photonic mode properties of arrays of strip-like metallic nanoantenna on Vanadium dioxide (VO2) substrate. VO2 features a semiconductor to metal phase change characteristic below and above a critical temperature that leads to an abrupt change in the particle's optical properties. These VO2 optical variations lead to alter this martial from a relatively transparent semiconductor to an opaque metal in the infrared region. In this work, we implement of a number of steps to have self-consistent solution to the coupled electromagnetic (EM) and the heat transfer (HT) problem. Our results show that when the intensity of the incident laser light reaches to critical values the created photo-thermal energy in the proposed structure leads to a phase transition from semiconductor to metal in VO2 substrate. This phase transition drastically changes the plasmonic modes (cavity modes) dictated by the periodicity of the array as well as the extinction profile of the structure over a broad wavelength spectrum. The proposed nanostructure system may open up new avenues for highly tunable ultrafast devices.

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