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**Optically induced metal-insulator transition in gold::vanadium dioxide hybrid structures** DAVON W. FERRARA, EVAN R. MACQUARRIE, JOYEETA NAG, Department of Physics and Astronomy, Vanderbilt University, ANTHONY KAYE, ITT Corporation, Advanced Engineering and Sciences, RICHARD F. HAGLUND, JR., Department of Physics and Astronomy, Vanderbilt University — Vanadium dioxide ($VO_2$) is a strongly-correlated electron material with a well-known semi-conducting to metallic phase transition that can be induced thermally, optically, or electrically. By coating lithographically prepared arrays of gold nanoparticles (NPs) of diameters up to 200 nm with 60 nm thick films of $VO_2$ via pulsed laser deposition, hybrid Au::$VO_2$ structures were created. Due to the sensitivity of the Au particle-plasmon resonance (PPR), a temperature dependent shift in the PPR can be generated by switching the $VO_2$ from one phase to another, creating a tunable plasmonic metamaterial. To study the low-power switching characteristics of these structures, transient absorption measurements were made using a chopped 780 nm pump laser, corresponding to the PPR resonance of the Au NPs, and 1550 nm CW probe. Additionally, pump-probe measurements were conducted on the structures using a Ti:sapphire oscillator with 100-fs pulses. Results show that the presence of Au NPs lowers the threshold laser power required to induce the phase transition. Finite element modeling was performed to better understand the complex thermodynamics of the structure.

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