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Two-Dimensional Control over Gradient Index in a VO_2 Memory Metamaterial MICHAEL GOLDFLAM, University of California San Diego, TOM DRISCOLL, UCSD and Duke University, DANIEL BARNAS, University of California San Diego, MATTHEW ROYAL, TALMAGE TYLER, NAN JOKERST, DAVID SMITH, Duke University, GIWAN SEO, University of Science and Technology, BONG-JUN KIM, ETRI, HYUN-TAK KIM, ETRI and UST, DIMITRI BASOV, University of California San Diego — We have demonstrated the creation of spatial gradients in the optical properties of a metamaterial device through tuning of a vanadium dioxide layer that interacts with an array of split ring resonators (SRR). Application of a transient electrical pulse across the metamaterial-VO_2 system leaves persistent changes in the properties of the metamaterial due to the hysteresis of the insulator-to-metal transition in VO_2. Through modification of contact geometry, pulse shape, and pulse duration, we have shown increased control over such devices allowing for independent tuning of individual sections of our hybrid VO_2-SRR device through the application of several transient voltage pulses. The characteristics of the gradients resulting from the voltage pulses were measured using infrared transmission spectroscopy. We observed a 15% variation in the magnitude of transmission with spatial scales on the order of one wavelength at the resonance frequency. Thus we have demonstrated the viability of similar tunable metamaterial devices for uses in communications and beam steering.

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