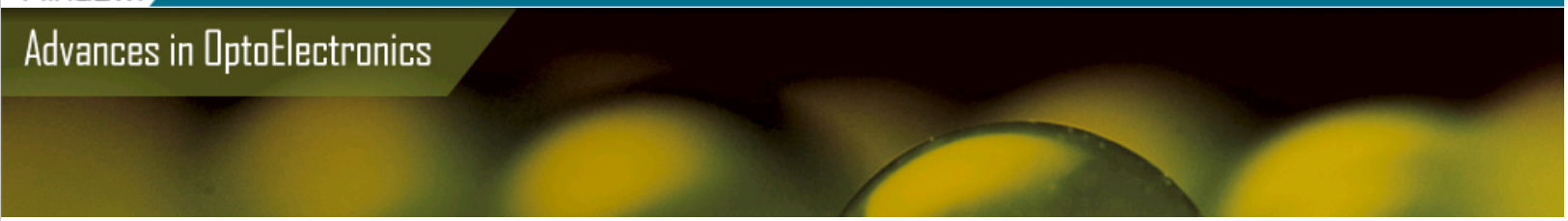

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Review Article

Using a Semiconductor-to-Metal Transition to Control Optical Transmission through Subwavelength Hole Arrays

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Abstract

We describe a simple configuration in which the extraordinary optical transmission effect through subwavelength hole arrays in noble-metal films can be switched by the semiconductor-to-metal transition in an underlying thin film of vanadium dioxide. In these experiments, the transition is brought about by thermal heating of the bilayer film. The surprising reverse hysteretic behavior of the transmission through the subwavelength holes in the vanadium oxide suggest that this modulation is accomplished by a dielectric-matching condition rather than plasmon coupling through the bilayer film. The results of this switching, including the wavelength dependence, are qualitatively reproduced by a transfer matrix model. The prospects for effecting a similar modulation on a much faster time scale by using ultrafast laser pulses to trigger the semiconductor-to-metal transition are also discussed.