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Dynamically Tunablevanadium Dioxide Metamaterials

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A large shift in the optical constants of phase-change vanadium dioxide (VO_2) enables active control of its transmission and reflection properties. When incorporated as a structural element of a metamaterial, such a dynamic control opens door to properties and functionality that are otherwise unavailable in nature materials, and to tunable and reconfigurable optical devices. In this talk, we present thermal and electrical tuning responses of two VO_2-integrated metamaterials. First, we realize a tunable infrared metasurface made of a plasmonic antenna array atop a VO_2 film backed with a reflecting metallic plane. By triggering the insulator-to-metal phase transition of VO_2, the metasurface resonance is shifted by 3.5% in frequency, which results in a reflectivity change of 30% in magnitude. Secondly, we fabricate a VO_2-integrated planar multilayer structure, which exhibits a broadband absorbance tuning. By mediating the effective impedance of the multilayered thin films with VO_2 phase transition, a tuning magnitude of more than 60% is measured for absorption over the wavelength ranges of 5-9.3 μm and 3.9-8.2 μm. Such tuning of resonance frequency and absorbance can be deployed for reconfigurable bolometric sensing, camouflaging and modulation of infrared radiations.

Biography:

Zhijun Liu, Ph.D., currently a Professor at University of Electronic Science and Technology of China. He obtained his Ph.D. from Princeton University in 2008. He then did his postdoctoral research at Brown university and University of California Los Angeles. Since 2013, he has been on faculty in the School of Optoelectronic Information at University of Electronic Science and technology of China. He was awarded National 1000 Young Talents Program of Chinaand Honorific Wallace Memorial Fellowship at Princeton University. His current interests are md-infrared and terahertz metamaterials and optoelectronics.