Researchers invent broad-band tunable terahertz absorber

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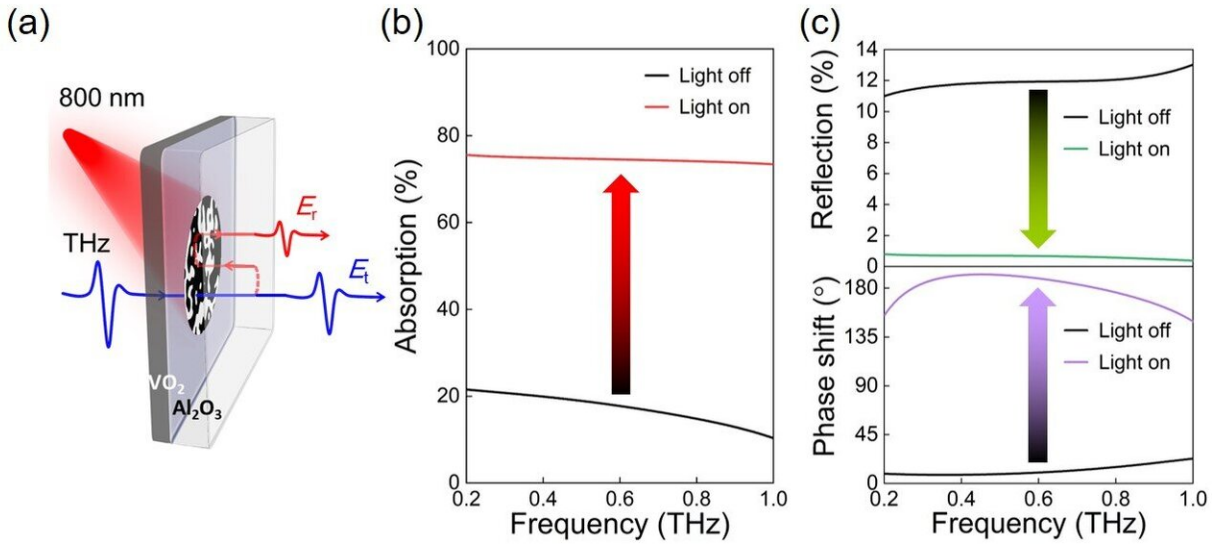

(a) Schematic of THz pulse propagation through the VO2 film on the Al2O3 substrate. (b) Measured the change of THz absorption of VO2 film with and without light. (c) Measured the change of THz reflection and reflection phase shift of VO2 film with and without light. Credit: REN Zhuang

Recently, a research team led by Prof. SHENG Zhigao from the High Magnetic Field Laboratory of the Hefei Institutes of Physical Science (HFIPS), along with collaborators in HFIPS and ShanghaiTech University, invented a broad-band tunable terahertz (THz) absorber based on a strongly correlated electron oxide material.

THz Absorbers have attracted the attention of many researchers with extensive application prospects in THz wave shielding, THz imaging, and THz sensitive thermal detecting. Therefore, the absorbers with not only strong absorption and broad-band absorption bandwidth, but also tunable characteristics are required.

By introducing a strongly correlated electron oxide material as a functional layer, the team realized the broad-band tunable THz spectrum properties in this strongly correlated electron device via multilayer dielectric structure design and light pump method.

The chosen strongly correlated electron material VO_2 was an excellent candidate for active THz modulation, as the conductivity, dielectric constant, as well as optical properties got a dramatic switching during the insulator-metal transition at TC = 340 K, and this transition could be tuned by temperature, electric field, and light.

By utilizing light pumping, more than 74% absorption modulation depth was achieved in this multilayer structure device. Furthermore, antireflection (the reflection is near zero) and broad-band π-phase shift of reflection THz waves were realized at a certain pump fluence.

This research, after a variety of tests and analyses, clarified the physical origin of these active THz multifunctional modulations.

More information: Zhuang Ren et al. Photoinduced Broad-band Tunable Terahertz Absorber Based on a VO2 Thin Film, *ACS Applied Materials & Interfaces* (2020). DOI: 10.1021/acsami.0c15297

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