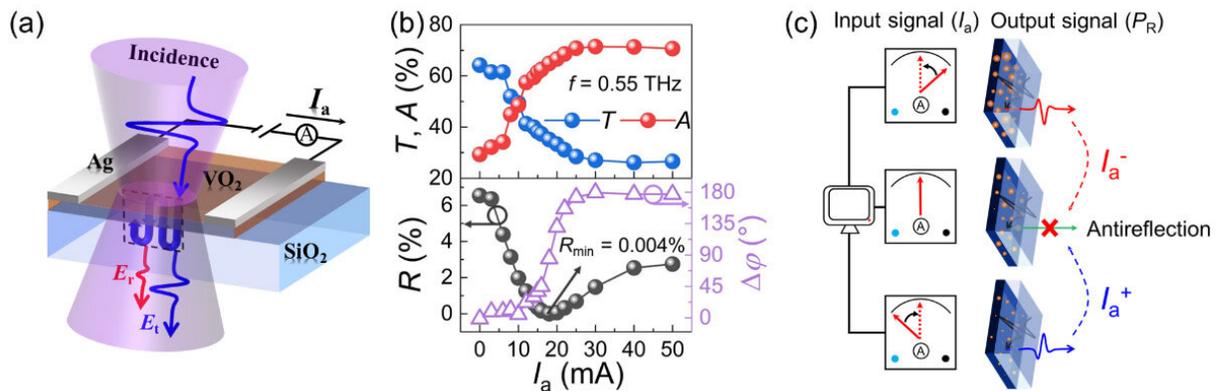


Scientists develop active and smart terahertz electro-optic modulator

August 23 2022, by Ren Zhuang and Zhao Weiwei



(a) Schematic diagram of active THz electro-optic modulator based on VO₂ film. (b) Experimental transmission (T), reflection (R), absorption (A) and reflection phase shift ($\Delta\varphi$) as a function of applied electric current at 0.55 THz. (c) Schematic diagram of smart THz manipulation. Credit: Ren Zhuang

Recently, a research group led by Prof. Sheng Zhigao from the High Magnetic Field Laboratory, Hefei Institutes of Physical Science (HFIPS) of Chinese Academy of Sciences (CAS) investigated an active and smart terahertz electro-optic modulator.

Their related results were published in *ACS Applied Materials & Interfaces*.

Terahertz (THz) technology has attracted considerable attention in recent years for its promising applications in the fields of imaging, communication, medicine, and security. These applications drive the urgent needs for high-performance THz devices. Among them, active and smart THz modulators were highly desired to realize smart THz beam scanning, automatic THz imaging and other smart applications.

In this study, the researchers proposed an active and smart THz electro-optic [modulator](#) based on VO₂ film. It stood out with many advantages.

Besides [transmission](#) and the absorption, it could electrically modulate the reflection and phase of THz waves.

By utilizing an [electric current](#) induced IMT in VO₂ film, the team achieved near-perfect antireflection (99.9% modulation depth) and 180° phase switching. By utilizing a feedback loop of "THz-electro-THz" geometry, they also realized smart electro-optic THz control in the VO₂ structure.

The desired THz amplitude could be achieved accurately no matter what the initial condition was and how the [external environment](#) changed.

This proposed electro-optic THz modulation method, taking advantage of strongly correlated electron material, opened up avenues for the realization of THz smart devices.

More information: Zhuang Ren et al, Active and Smart Terahertz Electro-Optic Modulator Based on VO₂ Structure, *ACS Applied Materials & Interfaces* (2022). [DOI: 10.1021/acsami.2c04736](https://doi.org/10.1021/acsami.2c04736)

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