Scientists develop smart terahertz electro-optic modulator

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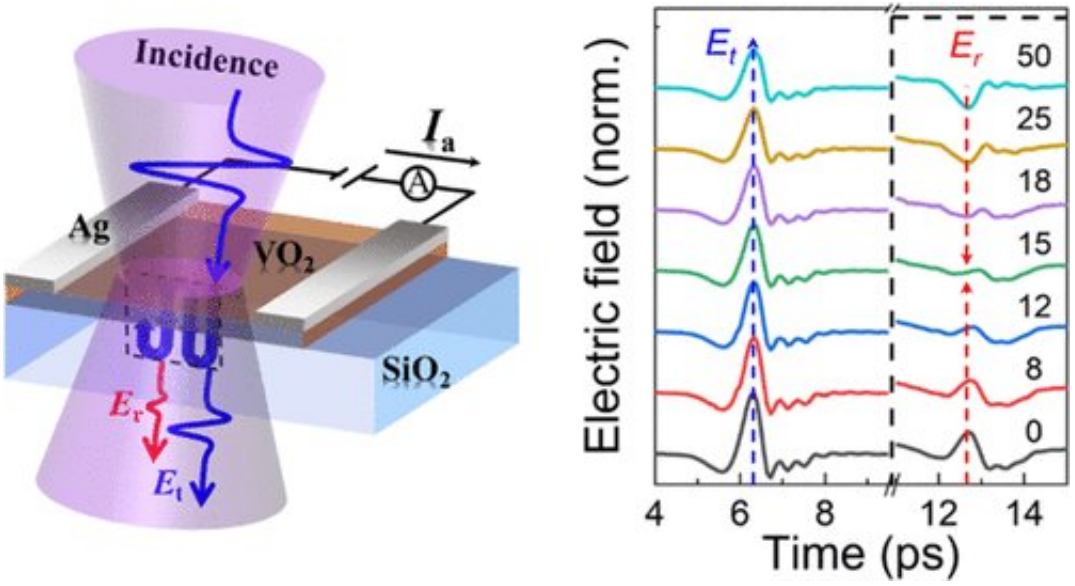

Graphical abstract. Credit: *ACS Applied Materials & Interfaces* (2022). DOI: 10.1021/acsami.2c04736

A research group led by Prof. Sheng Zhigao from the Hefei Institutes of Physical Science (HFIPS) of the Chinese Academy of Sciences (CAS) developed an active and smart Terahertz (THz) electro-optic modulator. Their results were published in *ACS Applied Materials & Interfaces*.

Terahertz technology has attracted extensive attention in recent years due to its wide applications in imaging, communication, medicine and security. These applications drive the urgent need for high-performance

THz devices. Active and smart THz modulators are an urgent requirement for intelligent THz beam scanning and automatic terahertz imaging.

In this study, the researchers proposed this active and smart THz electro-optic modulator based on vanadium dioxide (VO_2) film. In addition to transmission and absorption, it can also electrically modulate the reflection and phase of THz waves.

By using an electric-current-induced insulator-to-metal transition in the VO_2 film, the researchers achieved near-perfect antireflection (99.9% modulation depth) and 180° phase switching. Smart electro-optic THz control was realized in the VO_2 structure by using a "THz-electro-THz" geometry feedback loop.

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, using strongly correlated electron material, has 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 VO_2 Structure, *ACS Applied Materials & Interfaces* (2022). DOI: 10.1021/acsami.2c04736

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