**Ultra-broadband absorption limit by MXene nano-thin film**

*University of Electronic Science and Technology of China, China*

**Tao Zhao**

**Email: forzhaotao@uestc.edu.cn**

Nano-thin films are capable of broadband and high absorption to electromagnetic waves, which is quite essential to optoelectronics, ie, photodetection. Terahertz (THz) technology is evolving rapidly but faces significant challenges. Various nano-thin films are utilized to maximize the bandwidth of the intrinsic absorption limit (50%) of THz waves, but the bandwidth is usually below 2 THz. Here, we report the realization of the intrinsic thin-film absorption limit in the entirety of 0.5-10 THz by ultrathin 10.2-nm-thick MXene assembling film. Such ultra-broadband absorption limit is attributed to the high concentration of free electrons (~1021 cm-3), short relaxation time (~10 fs), and unique intra- and inter-flakes electron transport properties in MXenes. Besides, we validate that the ultra-broadband THz absorption should be explained by alternating current impedance theory rather than classic direct current impedance matching. To reach the higher absorption limit (100%), photonic structures are needed. The potential of MXene nano-thin film with photonic structures is also explored in broadband perfect absorption.

**Short Bio:**

**Tao Zhao** recieved his PhD degree in Physical Electronics from University of Electronic Science and Technology of China, China. He is a associate Professor of University of Electronic Science and Technology of China, China. His current research interests include the THz properties of low dimensional materials, and their applications in THz sources, detectors, modulators, etc. He published more than 50 peer-reviewed papers, including Nature Photonics, Nature Communications, Small, Photonics Research.