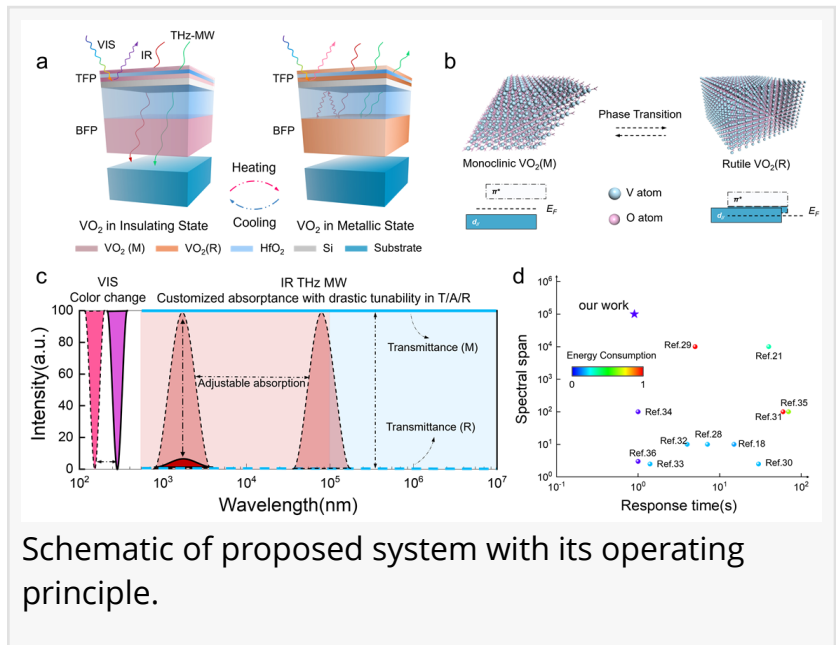


Tunable VO₂ Cavity Enables Multispectral Manipulation from Visible to Microwave Frequencies

CHINA, February 27, 2024

/EINPresswire.com/ -- [Optical materials](#)

capable of dynamically manipulating electromagnetic waves are an emerging field in optics. However, the multispectral manipulation based on these materials is challenging due to their ubiquitous wavelength dependence. Scientist in China and Singapore cascaded VO₂-based tunable optical cavities with selective-transparent layers, realizing the multispectral manipulation with reversible tunability covering wavelengths ranging from the visible to microwave regions. This work will provide a critical approach for expanding the multispectral manipulation ability of optical systems.



Optical materials capable of dynamically manipulating electromagnetic waves are an emerging field in memories, optical modulators, and thermal management. Recently, their multispectral design preliminarily attracts much attention, aiming to enhance their efficiency and integration of functionalities. However, the multispectral manipulation based on these materials is challenging due to their ubiquitous wavelength dependence restricting their capacity to narrow wavelengths.

In a new paper (<https://doi.org/10.1038/s41377-024-01400-w>) published in Light Science & Applications, a team of scientists, led by Professor Yao Li from Center for Composite Materials and Structure, Harbin Institute of Technology, 150001, Harbin, China, Professor Cheng-Wei Qiu from National University of Singapore, Department of Electrical & Computer Engineering, Singapore and co-workers cascade multiple tunable optical cavities with selective-transparent layers, enabling a universal approach to overcoming wavelength dependence and establishing a multispectral platform with highly integrated functions. Based on it, they demonstrate the

multispectral (ranging from 400 nm to 3 cm), fast response speed (0.9 s), and reversible manipulation based on a typical phase change material, vanadium dioxide (VO₂). The platform involves tandem VO₂-based Fabry-Pérot (F-P) cavities enabling the customization of optical responses at target bands independently. It can achieve broadband color-changing capacity in the visible region (a shift of ~60 nm in resonant wavelength) and is capable of freely switching between three typical optical models (transmittance, reflectance, and absorptance) in the infrared to microwave regions with drastic amplitude tunability exceeding 0.7. Moreover, the ultrafast phase transition of VO₂ enables faster response time of 0.9 s compared to electrochromic materials-based systems.

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