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DESIGN AND SPECTRAL ABSORPTION CHARACTERISTICS OF METAMATERIAL SOLAR ABSORBER BASED ON MXENE MATERIAL

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ABSTRACT. MXene material is one of the excellent photothermal materials due to its absorption ability of electromagnetic wave and photothermal conversion. In this paper, by means of surface microstructure optimization design, the broadband high absorption performance of the periodic $Ti_3C_2T_x$-SiO_2 and $Ti_3C_2T_x$-Al_2O_3-Ag metamaterial solar absorber has been achieved from 0.3 to 2.5 μm waveband. By investigating the distributions of electromagnetic field at the wavelengths corresponding to maximum absorption, the physical mechanism of high absorption is explored deeply, including photon dipole resonance (PDR), gap surface plasmon resonance (GSPR), local surface plasmon resonance (LSPR), magnetic polarization (MP) and the coupling resonance effect between them. The results show that the absorption spectra can be modulated by adjusting the thickness of the Al_2O_3 dielectric layer. Meanwhile, the MXene solar absorber designed in this paper is insensitive to polarization and incident angles, which has practical significance for realizing efficient utilization of solar energy.

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