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Polarization-insensitive and wide-angle MXene-TiN-based wideband absorber operating in the visible and near-infrared regime

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Abstract

This study proposes a simple design of a wideband metamaterial absorber (MMA) that functions in the visible and near-infrared range. The proposed absorber is composed of a multilayer structure with two-dimensional (2D) Ti_3C_2Tx (MXene) layer and top mounted structure of titanium nitride (TiN). It is observed that the proposed absorber absorbs above 85% of incident light in the visible and near-infrared regime, ranging from 400 to 1600 nm for the normal incidence of light. The results show that this significant absorption was produced by 2D nanostructure MXene and top-mounted TiN disk structure due to a wide range of localized surface plasmonic resonance (LSPR). It is noticed that the proposed absorber exhibits polarization-insensitivity and shows a similar absorption for transverse electric (TE) mode and transverse magnetic (TM) mode. Further, the LSPR is less sensitive to the obliquity incidence of the light, and demonstrates wide-range angular stability. High tunability and effective heat-light energy conversion are two benefits of employing MXene and high-performance plasmonic properties of TiN in creating the proposed wideband absorber; these characteristics make them ideal for various applications, including solar energy systems and filters.

Keywords Absorber · Metamaterials · MXene · Wideband

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