$Ti_3C_2T_x$ MXene-Coated TPMS Structures for Lightweight, Absorption-Driven EMI Shielding

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Abstract

Harnessing the material characteristics along with the structural facets has been arising as an innovative solution to harvest enhanced capabilities of electromagnetic interference (EMI) shielding with elevated absorption and minimized reflection [1,2]. Two-dimensional (2D) materials, such as graphene and MXenes, exhibit multifunctionality due to their wide range of outstanding properties. Thus, they represent appropriate solutions for many technological challenges [3]. This is imperative to mitigate the detrimental influences of the electromagnetic waves (EMWs) generated by the surrounding communication and digital systems. In this work, the EMI shielding of $Ti_3C_2T_x$ MXene-coated polymeric triply periodic minimal surface (TPMS) structures was experimentally investigated. The influence of TPMS parameters such as geometry and periodicities on the EMI shielding performance over the X-band frequency domain was meticulously evaluated. Additionally, the gradient conductive TPMS structures were investigated to accomplish absorption-dominant shielding. $Ti_3C_2T_x$ MXene-coated TPMS lattices with electromagnetic interference shielding effectiveness (EMI SE) greater than 50 dB and power coefficient of absorptivity (A) more than 0.75 were achieved by optimizing the structure parameters along with the coating process. This work opens doors to precisely modulate the EMI shielding performance and manipulate the shielding mechanism.

References

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