Optical properties of a semi-infinite medium consisting of graphene-based hyperbolic meta-materials with tilted optical axis

Sh Rezaei and S Roshan Entezar
Faculty of Physics, University of Tabriz, Tabriz, Iran
E-mail: sh.rezaei94@ms.tabrizu.ac.ir

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Abstract
In this paper, the optical properties of a semi-infinite medium composed of graphene-based hyperbolic meta-materials with the optical axis were tilted with respect to its boundary with air, by using the Maxwell equations; then the homogeneous effective medium approximation method was studied. The results showed that the orientation of the structure layers (geometric induced anisotropy) affected the magnetic transverse polarization spectra in the region, such that the structure exhibited the hyperbolic dispersion. Also, in the large frequency range, in which the medium had hyperbolic dispersion, due to the presence of graphene nanolayer, the transmission of the structure was vanished; by increasing tilt angle of layers with respect to the boundary, it was gradually decreased and finally disappeared.

Keywords: hyperbolic metamaterial – permittivity- permeability- transfer matrix

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