عنوان مقاله:

Modeling a high-performance broadband mid-infrared modulator using graphene-based hybrid plasmonic waveguide

محل انتشار:

مجله ی اینترفیس ها، فیلم های نازک و سیستم های کم ابعاد, دوره 5, شماره 2 (سال: 1401)

تعداد صفحات اصل مقاله: 11

نویسندگان:

محمدرضا جعفری - *Department of Condensed Matter, Faculty of Physics, Alzahra University, Tehran, Iran*

اکبر اسدی - *Department of Physics, Faculty of Science, Imam Khomeini Naval Academy, Nowshahr, Iran*

خلاصه مقاله:

A graphene-based-hybrid plasmonic waveguide (GHPW) with a unique geometric structure is designed for surface plasmon polariton guidance and modulation at the frequency area of ۱۰ to ۳۰ THz. The GHPW consists of a graphene layer in the middle, a high-density polyethylene (HDPE) gating layer, two interior dielectric delimiter layers, and two exteriors semi-cylinder Germanium substrates symmetrically embedded on both edges of the graphene. Because of the matchless semi-cylinder structure design, the electromagnetic wave interaction with graphene ultimate subwavelength SPPs strong confinement with long propagation length. Small normalized mode area of ~۱۰-۴ and long propagation length of ۱۰.۶۷-۲۸.۹۲ µm at Fermi energy of ۱.۰ eV is attained for SPPs modes propagation of the GHPW in the frequency bound of ۱۰-۳۰ THz and semi-cylinder radius R > ۴۵۰ nm, respectively. By controlling the graphene Fermi energy, it is found that the structure has a modulation depth higher than ۲۰ % for the frequency band of ۱۰-۳۰ THz and arrives at the peak of approximately ۱۰۰ % at a frequency greater than ۲۸.۷۵ THz. To benefit from the great broadband MIRpropagation and modulation efficiency, the GHPW may promise different MIR waveguides, modulators, .photonic, and optoelectronic devices

کلمات کلیدی:

Graphene, Plasmonic, Waveguide, Modulator, mid-infrared, Finite element method

لینک ثابت مقاله در پایگاه سیویلیکا: