124
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Title:Broadband and subwavelength terahertz modulators using tunable plasmonic crystals with semiconductor rods
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Abstract:We theoretically investigate terahertz modulators based on tunable two-dimensional plasmonic crystals with semiconductor rods. When the electric field is normal to the rods, the localized surface plasmon resonances appear at terahertz frequencies. The tuning of the resonances is achieved by a modulation of free charge carrier concentration in the rods. This leads to the spectral shifts of the resonances and modulated transmissions. The resonances are below the Bragg photonic band gap leading to the subwavelength thickness of the modulators. Due to the plasmonic nature of the resonances, their spectral shifts are much larger than the shifts of the Bragg photonic band gaps. This enables the design of broadband terahertz modulators with faster modulation and lower power consumption than in the modulation of the Bragg photonic band gaps. In order to achieve modulation of photonic band gaps for both polarizations at the same time, it is possible to overlap the photonic band gap due to localized surface plasmon resonances when the electric field is normal to the rods and the photonic band gap due to negative effective permittivity when the electric field is parallel to the rods.
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Inspec controlled terms:carrier density - modulators - permittivity - photonic band gap - plasmonics - power consumption - rods (structures) - semiconductor materials - surface plasmon resonance
Uncontrolled terms:semiconductor rods - tunable two-dimensional plasmonic crystals - localized surface plasmon resonances - terahertz frequencies - free charge carrier concentration - spectral shifts - lower power consumption - Bragg photonic band gaps - negative effective permittivity - subwavelength terahertz modulators - broadband terahertz modulators
Inspec classification codes:A7320M Collective excitations (surface states) - A7820P Photonic band gap (condensed matter) - A7720 Dielectric permittivity - B1250 Modulators, demodulators, discriminators and mixers
Treatment:Practical (PRA); Theoretical or Mathematical (THR)

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