458
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Title:Active Focal Length Control of Terahertz Slitted Plane Lenses by Magnetoplasmons
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Abstract:Active plasmonic devices are mostly designed at visible frequencies. Here, we propose an active terahertz (THz) plasmonic lens tuned by an external magnetic field. Unlike other tunable devices where the tuning is achieved by changing the plasma frequency of materials, the proposed active lens is tuned by changing the cyclotron frequency through manipulating magnetoplasmons (MPs). We have theoretically investigated the dispersion relation of MPs of a semiconductor-insulator-semiconductor structure in the Voigt configuration and systematically designed several lenses realized with a doped semiconductor slab perforated with sub-wavelength slits. It is shown through finite-difference time-domain simulations that THz wave propagating through the designed structure can be focused to a small size spot via the control of MPs. The tuning range of the focal length under the applied magnetic field (up to 1 T) is similar to 3 lambda, about 50% of the original focal length. Various lenses, including one with two focal spots and a tunable lens for dipole source imaging, are realized for the proposed structure, demonstrating the flexibility of the design approach. The proposed tunable THz plasmonic lenses may find applications in THz science and technology such as THz imaging.
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