Contribution ID: **32** Type: **Invited Lecturer**

Using phase-change materials for ultimate functional reconfiguration at far- and mid-infrared

Friday, 12 November 2021 15:05 (20 minutes)

Materials with metal-to-insulator phase transition occurring under the external biasing have an unprecedented potential in control of electromagnetic radiation in a wide frequency range from microwaves to the visible. The focus of this talk is numerical demonstration of how the space of material parameters is connected with the space of functionality at far- and mid-infrared frequencies. The preferable scenarios are those with ultimate functional reconfiguration achieved at small and moderate variations of the biasing parameter. Four classes of the structures are studied, which include three ones with thermally tunable (InSb, VO2) and one with electrically tunable (graphene) materials. First, the transmissive diffraction gratings fully or partially made of InSb are presented, in which switching between the dominant zero-order and first-negative-order transmission is achieved at far-infrared by varying temperature, T, just by 20-30 K. Second, we present the results of the study of scattering on core-shell microcylinders comprising InSb shells. Thermally tunable invisibility is demonstrated, at which various mechanisms of scattering cancellation can exist for different frequencies in the same structure, and switching between diverse scattering and invisibility regimes is possible by a T-variation of 20 to 40 K. Third, a-few-layer metasurfaces with VO2 meta-atoms and grids that are capable in polarization manipulation and related asymmetric transmission at far- and mid-infrared have been introduced. Fourth, heterostructures comprising graphene-hBN metamaterials and dielectric gratings are examined for the capability in the diffraction inspired asymmetric transmission and asymmetric absorption at far- and mid-infrared frequencies. The obtained results indicate a route to feasible multifunctional devices.

Topics

Primary author: SEREBRYANNIKOV, ANDRIY (Adam Mickiewicz University)

Presenter: SEREBRYANNIKOV, ANDRIY (Adam Mickiewicz University)

Session Classification: Afternoon Session