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Graphene-based photonic crystals¹ ROMAN YA. KEZERASHVILI, OLEG L. BERMAN, VLADIMIR S. BOYKO, Physics Department, New York City College of Technology, City University of New York — A novel type of photonic crystals formed by embedding a periodic array graphene and dielectric material into a background dielectric medium is discussed. One-dimensional (1D) photonic crystal formed by an array of periodically located stacks of alternating graphene and dielectric stripes, while the two-dimensional (2D) one is formed by constituent stacks of alternating graphene and dielectric discs. The electromagnetic wave propagation in 1D crystal analyzed in the framework of the Kronig-Penney model. The frequency band structure of 1D graphene-based photonic crystal is obtained analytically as a function of the filling factor and the thickness of the dielectric between graphene stripes. The photonic frequency corresponding to the electromagnetic wave localized by a defect that breaks the symmetry of the system is obtained. For 2D crystal the photonic band structure and transmittance are calculated. The graphene-based photonic crystals can be used effectively as the frequency filters and waveguides for the far infrared region of electromagnetic spectrum. Due to substantial suppression of absorption of low-frequency radiation in doped graphene the damping and skin effect in the photonic crystal are also suppressed. The advantages of the graphene-based photonic crystal are discussed.

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