

Photonic Crystal with Electrical Properties: Ab-initio Calculation

Balabai R.M., Gritsulia D.Yu., Zdeschchyts A.V.

Kyryvi Rih National University, Kyryvi Rih, Ukraine

Photonic crystals are materials that are able to control the light, their unique properties inherent in orderly arranged structural elements of the crystal. Due to ordering of elements-lenses photonic crystals are called crystals.

University of Illinois researchers discovered a way to change the three-dimensional structure of a well-established semiconductor material to enable new optical properties while maintaining its very attractive electrical properties [1]. They epitaxy grew the GaAs crystal through the complex template.

In these computing experiments, we investigated the static dielectric function of two-dimensional (2-D) GaAs-based photonic crystal using its own software complex [2]. Our model photonic crystal includes the porous GaAs wire array (fig.1). In this structure, the dielectric constant is periodic in one plane (usually defined as the xy plane) and extends infinitely in the third direction (z direction). Electron response of solids to the impact of the electromagnetic field closely related to the structure of the energy bands. That is why we calculated the electronic spectrum of the model atomic systems, the spatial distributions of the valence electrons density and crossings of these spatial distributions, the distributions of the Coulomb potential and the static dielectric function.

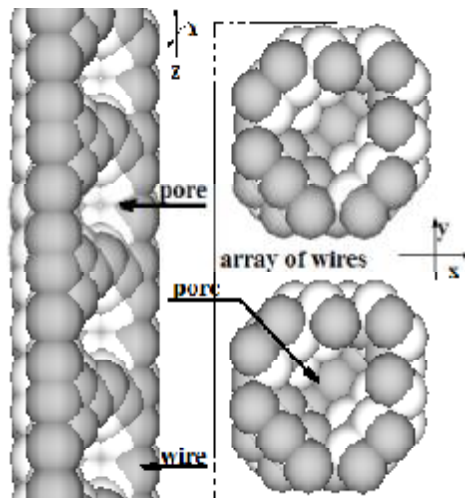


Fig.1. The model of photonic crystal, one includes the porous GaAs wire array.

1. Nelson E.C. et al. Epitaxial growth of three-dimensionally architected optoelectronic devices // *Nature Materials*. – 2011. – V.10. – P.676-681.
2. Balabai R.M. Electronic properties of functionalized graphene nanoribbons // *Ukr. J. Phys.* – 2013. – V. 58, № 4. – P.389-397.