Nanocomposites and nanomaterials

Features of photoacoustic transformation in multilayer silicon-based porous structures

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Crystalline silicon is a material of choice in nowadays devices of micro-, nano- and optoelectronics. Particularly, the use of nanostructured silicon allows efficient tuning of optical, electrical and thermal parameters of the material to succeed desirable properties. In such way, different silicon-based nanostructures are successfully applied as active elements of various devices.

Porous silicon is an interesting candidate as a constitute element of electronical devices. Particular, since his low thermal conductivity it can be applied as an efficient thermal isolator [1]. Moreover, there is a possibility to achieve photon and phonon trapping in porous silicon based multilayered structures [2].

In our report, we present the results of an experimental study of photoacoustic (PA) transformation in porous silicon based multilayered photonic Bragg mirrors. The Bragg mirrors were fabricated as a periodic system. The period of the system consists two layers with different porosities. The amplitude-frequency dependencies of the PA response were experimentally measured by the gas-microphone technique in classical configuration. The LEDs with different wavelengths were used as excitation sources. The experimental data was fitted with the use of mathematical model, which considers light propagation and absorption in a multilayered system. As a result, effective thermal conductivity of the multilayered periodic structures was evaluated as a function of period length and porosities.

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