

## Article



### Journal of Experimental and Theoretical Physics Letters

Publisher: MAIK Nauka/Interperiodica distributed exclusively by Springer Science+Business Media, Inc.

ISSN: 0021-3640 (Paper) 1090-6487 (Online)

DOI: 10.1134/1.1881731


Issue: Volume 81, Number 1

Date: January 2005

Pages: 30 - 33

## Condensed Matter

Resonant Raman scattering in GeSi/Si superlattices with GeSi quantum dots

A. G. Milekhin<sup>1</sup> , A. I. Nikiforov<sup>1</sup>, O. P. Pchelyakov<sup>1</sup>, A. G. Rodrigues<sup>2</sup>, J. C. Galzerani<sup>2</sup> and D. R. T. Zahn<sup>3</sup>

(1) Institute of Semiconductor Physics, Siberian Division, Russian Academy of Sciences, pr. Akademika Lavrent'eva 13, Novosibirsk, 630090, Russia

(2) Departamento de Fisica, Universidade Federal de Sao Carlos, C.P. 676 Sao Carlos, SP, Brasil

(3) Institut für Physik, Technische Universität Chemnitz, D 09107 Chemnitz, Germany

**Received:** 29 November 2004

**Abstract** The resonant Raman scattering in GeSi/Si structures with GeSi quantum dots has been analyzed. These structures were formed at various temperatures in the process of molecular-beam epitaxy. It has been shown that Raman scattering spectra recorded near resonances with the  $E_0$  and  $E_1$  electronic transitions exhibit the lines of Ge optical phonons whose frequencies differ significantly from the corresponding values in bulk germanium. In the structures grown at low temperatures (300–400°C), the phonon frequency decreases with increasing excitation energy. This behavior is attributed to Raman scattering, which is sensitive to the size of quantum dots, and shows that quantum dots are inhomogeneous in size. In the structures grown at a higher temperature (500°C), the opposite dependence of the frequency of Ge phonons on excitation energy is observed. This behavior is attributed to the competitive effect of internal mechanical stresses in quantum dots, the localization of optical photons, and the mixing of Ge and Si atoms in structures with a bimodal size distribution of quantum dots.

PACS numbers 63.22.+m - 78.67.Hc - 78.30.Am

Translated from Pis'ma v Zhurnal Éksperimental'no  $\bar{\text{T}}$ i Teoreticheskó  $\bar{\text{T}}$ Fiziki, Vol. 81, No. 1, 2005, pp. 33–36.

Original Russian Text Copyright © 2005 by Milekhin, Nikiforov, Pchelyakov, Rodrigues, Galzerani, Zahn.

 **A. G. Milekhin**

**Email:** [milekhin@thermo.isp.nsc.ru](mailto:milekhin@thermo.isp.nsc.ru)