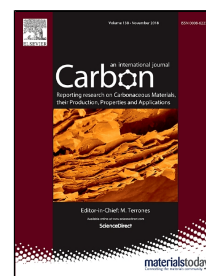


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Phonon anharmonicities in supported graphene

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**Phonon anharmonicities in supported graphene**

Egor A. Kolesov<sup>1</sup>, Mikhail S. Tivanov<sup>1,\*</sup>, Olga V. Korolik<sup>1</sup>, Olesya O. Kapitanova<sup>2</sup>, Hak Dong Cho<sup>3</sup>, Tae Won Kang<sup>3</sup>, and Gennady N. Panin<sup>3,4</sup>

<sup>1</sup>Belarusian State University, 4 Nezavisimosti Av., 220030 Minsk, Belarus

<sup>2</sup>Department of Chemistry, Moscow State University, Leninskie Gory, 1, b.3, 119991, Moscow, Russia

<sup>3</sup>Department of Physics, Quantum-Functional Semiconductor Research Center, Nano Information Technology Academy, Dongguk University, 3-26 Pildong, Junggu, 100-715, Seoul, Korea

<sup>4</sup>Institute for Microelectronics Technology & High Purity Materials, RAS, 142432 Chernogolovka, Moscow district, Russia

**Abstract**

The paper presents temperature-dependent Raman studies of anharmonic phonon properties of graphene as-grown on copper, transferred to copper, SiO<sub>2</sub>/Si, and Al<sub>2</sub>O<sub>3</sub>, as well as nitrogen-doped graphene on SiO<sub>2</sub>/Si. Different G and 2D peak position and linewidth temperature dependencies were obtained in the temperature range of 20-294 K, upon which anharmonic constants for 3- and 4-phonon processes were determined. Values of anharmonic constants obtained from G peak shift for undoped graphene on dielectric substrates were quantitatively close to both experimental results for unsupported graphene and theoretical predictions reported in the literature, while the values for graphene as-grown on copper were almost two orders of magnitude greater. The results were analyzed in terms of substrate effect on phonon properties of graphene. The present study is useful for taking into account anharmonic phonon effects in graphene when designing graphene-based nanoelectronic devices.

**1. Introduction**

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\* Corresponding author: e-mail [tivanov@bsu.by](mailto:tivanov@bsu.by); phone +375172095451; fax +375172095445.

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