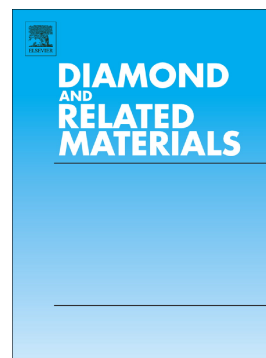


Accepted Manuscript

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PII: S0925-9635(17)30429-6
DOI: doi:[10.1016/j.diamond.2017.10.007](https://doi.org/10.1016/j.diamond.2017.10.007)
Reference: DIAMAT 6955
To appear in: *Diamond & Related Materials*
Received date: 8 August 2017
Revised date: 10 October 2017
Accepted date: 17 October 2017

Please cite this article as: B.A. Danilchenko, E.A. Voitsihovska, I.S. Rogutski, R.M. Rudenko, I.Y. Uvarova, I.I. Yaskovets , Low-temperature annealing of radiation-induced defects in carbon nanotube bundles. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Diamat(2017), doi:[10.1016/j.diamond.2017.10.007](https://doi.org/10.1016/j.diamond.2017.10.007)

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Low-temperature annealing of radiation-induced defects in carbon nanotube bundles

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The annealing of radiation-induced defects in carbon nanotube bundles below room temperature has been investigated experimentally. Significant feature of this study is that electron irradiation (with an energy 1 MeV and fluence up to 10^{16} el/cm²) was carried out at liquid helium temperature. A detailed analysis of the resistance change over a wide temperature range (7 – 300 K) enables us to prove partial annealing of irradiation-induced defects at moderate temperatures. It is shown that such an annealing follows a first-order reaction in whole investigated temperature range. While at temperatures below 40 K, annealing is nonactivation, tunneling process; at higher temperatures (100 – 300 K) it becomes activated, with activation energy of ~ 0.05 eV. The value of discovered activation energy is close to the migration energy of interstitial carbon atom in graphite. Probably, observed annealing of radiation-induced defects in carbon nanotube bundles is also caused by the migration of interstitial carbon atoms between single nanotubes below room temperature.

1. INTRODUCTION

Carbon nanotubes (CNT), due to their unique features of quasi one-dimensional electronic transfer, seem to be promising materials for modern nanoelectronic [1]. Their electronic structure, and hence conductivity, strongly depends both on defects (topological, vacancies, substitutional impurity, etc.), and adsorbents of any type [2]. Therefore, defects introduction of known type and concentration can lead to a controllable modification of CNT properties [3, 4]. Chemical functionalization and high-energy irradiation, including irradiation in various gas media [5 – 7], are commonly used for this purpose. Possible effects of ion and electron irradiation on the properties of CNT networks are presented elsewhere [8 – 10].

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