НАЦІОНАЛЬНА АКАДЕМІЯ НАУК УКРАЇНИ

НАНОРОЗМІРНІ СИСТЕМИ

БУДОВА–ВЛАСТИВОСТІ–ТЕХНОЛОГІЇ

НАНСИС 2007

21–23 листопада 2007

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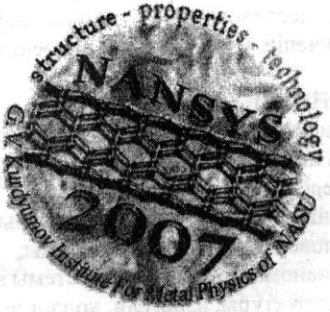

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The Investigation of Electronic Structure of Pristine ^{13}C Isotope Powder and Composites Based on ^{13}C Isotope for Neutron Target

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It was informed earlier [1] about research of structure and electronic properties of a carbon composite on the basis of an isotope ^{13}C with density about 0,7-0,8 g/cm^3. The aim of this work is to investigate the electronic properties of starting substance composed of ^{13}C isotope and composites with higher density (up to ~ 1,55 g/cm^3) on its basis, using the X-ray analysis, fluorescence spectroscopy, quantum chemistry calculation, microscopial investigation and conductivity measurements at low temperatures.The internal structure of the received material is represented extremely complex one and it is a combination of several sharply differing morphological forms of carbon. The analysis of the X-ray diffraction of the starting substance composed of ^{13}C shows to presence of graphite particles with 20Å and 40Å thickness in equal parts. The X-ray fluorescence CKα-spectra of graphite and the starting substance composed of ^{13}C were obtained. The density of C2π-state for the spectrum of substance composed of ^{13}C in comparison with the spectrum of graphite is increased. The theoretical CKα-spectra of graphite composite based on ^{13}C isotope agrees closely with experimental ones.

It is represented, that the temperature dependence of conductivity for a pristine isotope powder ^{13}C is given by $\Delta\sigma(T) - \ln T$ and it is connected with a small fragments graphene layers. The decisive contribution to this temperature dependence by the quantum correction is brought. These quantum corrections are connected with the mechanism of the two-dimensional electron-electron interaction at least up to temperature 50 K.The contribution of the quantum corrections connected with two-dimensional weak localization can be allocated also for an isotope composite with density 1.55 g/cm^3 at temperature close to helium one. The possible reason of deviation of the temperature dependence of the conductivity from logarithmic law to the linear dependence can be not zero probability for carriers transition between graphene layers. That is connected with high faulted graphene layers and more complex microstructure of a composite based on ^{13}C isotope. If the time of transitions between layers is less than the energy relaxation time then the three-dimensional Fermi-surface is formed [2]. The quantum corrections for such structure should be considered so, as well as for three-dimensional anisotropy conductors.

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1. A.I.Romanenko, O.B.Anikeeva et al, *^{13}C-Based Material for Neutron Targets,* Inorganic Materials, **41**, 531-539 (2005).
2. Г.М.Миньков, А.И.Пономарев, А.А.Шерстобитов и др., *Квантовые поправки к проводимости в естественной сверхрешетке $Nd_{2-X}Ce_XCuO_4$,* ФТТ, **47**, 1894-1900 (2005).