ISGD7

7th International Symposium on Graphene Device
26 - 29 July, 2021 / WASHINGTON, D.C

New Result in Investigation and Application of Graphen Grown by Thermodestruction of the SiC Surface.

Aleksandr A. Lebedev 1,2, Valerii Yu. Davydov1, Sergei P. Lebedev1, Yuri N.Makarov 2,3
Alexander S. Usikov2,3, Sergey Novikov4,

1) Ioffe Institute, St. Petersburg, 194021 Russia, *E-Mail: shura.lebe@mail.ioffe.ru
2) ITMO University, Kronverkskii av. 49, St. Petersburg, 197101 Russia
3)Nitride Crystals Inc., 9702 Gayton Rd., Suite 320, Richmond, VA 23238, USA
4Aalto University, Micronova, Tietotie 3, FI-02150, Espoo, Finland

One of the most promising technologies for synthesis of graphene, which can produce a high-quality material and, at the same time, be integrated into industrial production process, is the thermal destruction of the surface of silicon carbide (SiC) substrates. The structural and electronic characteristics of epitaxial graphene films grown by thermal decomposition of the Si face of a semi-insulating 4H-SiC substrate in an argon environment have been studied by Raman spectroscopy, scanning probe microscopy, electron diffraction, core-level and angle-resolved photoemission spectroscopy, and near-edge X-ray absorption spectroscopy [1-2]. It is shown that the results of a complex study make it possible to optimize the growth parameters and develop a reliable technology for the growth of high-quality single-layer graphene films. The charge-carrier concentration in the graphene layer was within 7 × 1011–1 × 1012 cm–2, and the maximum mobility of electrons at room temperature approached 6000 cm2/(V・s)[3]. Also reported are the results of a study of the transport properties of these films and the parameters of gas and bio sensors formed on their basis. The performance test of graphene sensors on SiC as a gas sensor and biosensor was carried out. The gas sensor operation was checked using NO2 in low concentrations in dry air. NO2 concentration as low as 0.2 parts per billion (ppb) was easily detectable [4]. The biosensor operation was checked using an immunochemical system comprising fluorescein dye and monoclonal antifluorescein antibodies. The sensor detects fluorescein concentration on a level of 1–10 ng/mL and bovine serum albumin–fluorescein conjugate on a level of 1–5 ng/mL. The proposed devices have good prospects for different applications [5-6].

References.

1. N.V.Agrinskaya, A.A.Lebedev, S.P.Lebedev, M.A.Shakhov and E.Lahderanta, Characteristic features of the magnetoresistance related to structured defects in graphene on SiC (0001), Materials Research Express 6 (2019) 035603.
2. E.Lahderanta, et.al Low-temperature magnetotransport of grapheme on SiC (0001) in pulsed magnetic fields up to 30 T, J.Phys. Condens. Matter 32 (2020) 115704 (9pp).
3. Zh.Geng, B.Hahlein, M.Auge, A.A.Lebedev, V.Yu.Davydov, M.Kittler, J.Pezoldt, F.Schwice, Graphen nanoribbons for Electromic Devices, Annalen der Physik, (2017) 1700033

4. S.Novikov, N.Lebedeva, A.Satrapinski, J.Walden, V.Davydov, A.Lebedev, Graphene based sensor for environmental monitoring of NO2, Sensors and Actuators B: Chemical 236 (2016) 1054-1060.
5. A.Usikov, et al, Graphene/SiC dies for blood type sensing, Proceeding of the Estonian Academy of Sciences, 2019, 68, 2, 207–213 https://doi.org/10.3176/proc.2019.2.13
6. A.A.Lebedev, V.Yu. Davydov, S.N.Novikov, D.P.Litvin, Yu.N.Makarov, V.B.Klimovich, and M.P.Samoilovich, Graphen-Based Biosensors, Technical Physics Letters, 2016, V 42, N 7 p 727-730 (2016)