ELECTRONIC QALITI CVD DIAMOND SYNTHESIS FOR RADIATION HARD DEVICE AND IONIZING RADIATION DETECTORS [[1]](#footnote-1)\*)

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Synthetic diamond is a promising material for the design of ionizing radiation detectors, which are required for fusion facilities, space research, nuclear power plants and medicine. Diamond can be a base for creation of high-current electronics, unique electronic and optical devices able to operate at the high ionizing radiation environment, high temperature and chemical aggressive media conditions. The research of diamond material quality of various manufactures performed by “Project center ITER” proves that till this R&D the Element 6 company was the only supplier of electronic quality CVD diamond crystals. Nowadays it is obvious that wide diamond usage cause technological revolution in electronics, therefore it is extremely urgent to develop technology and domestic manufacturing of CVD diamond single crystals of the electronic quality.

In present work it is reported about performing of the CVD synthesis of homoepitaxial films on heavily boron doped (p-type) substrates at the ARDIS-300 installation. Three films (B21, B22 and B23) were synthesized on three substrates with a boron content of approximately 100 ppm, and film (B25) on the substrate with 20 ppm boron content. Film thicknesses were 40 m (B21), 110 m (B22), 60 m (B23 and B25).

Raman light scattering spectra were measured for the synthesized diamond films, the widths of the Raman peak were determined on a Raman spectrometer "InViaRamanMicroscope". Analysis showed that all samples are the single crystal diamonds with good structural perfection. The first-order Raman spectrum has simplest form containing a single line at frequency 1332,5 cm-1. The widths of the Raman peaks (**Δν**) of homoepitaxial films were: Δν=2.4 cm-1 (В21), Δν=2.2 cm-1 (В22), Δν=2.7 cm-1 (В23), and Δν=4.0 cm-1 (В25).

The electronic quality of the single-crystal diamond films synthesized on conductive substrates with a boron content of 100 ppm was investigated by measuring the collection efficiency of the charge generated by 241Am source of alpha particles with energy of 5.5 MeV. To carry out these studies, the 35 nm thick metal contacts were deposited to the sides of the synthesized diamond film and substrate, and the pulse height spectra of the created sensitive elements were measured under irradiation with alpha particles. The measured pulse height spectra were compared with ones of a reference diamond detector made of an Element 6 sensitive element which have full charge collection. CVD single crystals of diamonds B21, B22, and B23 demonstrated charge collection efficiency of 94%, 88%, and 87% and an energy resolution by the width of the alpha peak in the pulse height spectrum - 3.9%, 4.2%, and 4.2%, respectively. Therefore synthesized diamond films can be effectively used as sensitive elements of spectrometric detectors of ionizing radiation.

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/E/ru/II-Rodionov.docx) [↑](#footnote-ref-1)