§41. Trial of Fast Neutral Particles and Neutron Measurement by a Synthetic Diamond Radiation Detector

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1.Introduction

Synthetic diamond radiation detectors aiming at fast neutral particles and neutron measurement in the LHD will be developed; synthesis of high-quality diamond and their characterization will be included. Energy distribution of fast ion in plasma is able to obtain from energy distribution measurement of fast neutral particles after the charge conversion reaction. In this research this measurement is a main objective. In addition, measurement of neutrons caused by tritium burning, simulating experiment of alpha particles confinement, is waiting as a future plan. This fiscal year, radiation detectors made of CVD diamond single crystals fabricated by a lift-off method were prepared. The CVD diamond single crystals were grown by Hokkaido University and National institute of advanced industrial science and technology (AIST), respectively.

2.Growth of diamond single crystals

Microwave assisted plasma CVD diamond growth reactors, i.e., ASTeX AX5250, were used in AIST and Hokkaido University, respectively. In AIST, CVD diamond single crystals were mainly growth aiming at large size and high-quality substrates for electric devices. A CVD diamond single crystal grown on a CVD diamond single crystal was used in this research. The grown CVD diamond single crystal was removed from the substrate using a lift-off method. In this method, a substrate was irradiated by carbon ions in advance. After crystal growth, the grown CVD diamond crystal was removed by electro chemical etching. Hokkaido University introduced this technique from AIST this time. A CVD diamond single crystal was grown on a HP/HT type Ib substrate. Radiation detectors were made of these CVD diamond single crystals. Electrodes, Al-Ti/Au, were fabricated by evaporation.

3. Experimental results and discussion

Fig.1 and 2 show response of these detectors for alpha particles. The detector made of CVD diamond grown at AIST had high energy resolution. In addition, the detector made of the CVD diamond grown at Hokkaido Univ. achieved energy spectroscopy for alpha particles. In the purpose of this development, a diamond radiation detector with a sensitive area of several mm2 is enough. In the next fisical year, a CVD diamond single crystal will be grown on a high quality diamond substrate. In addition, preliminary measurement on the LHD will be carried out.

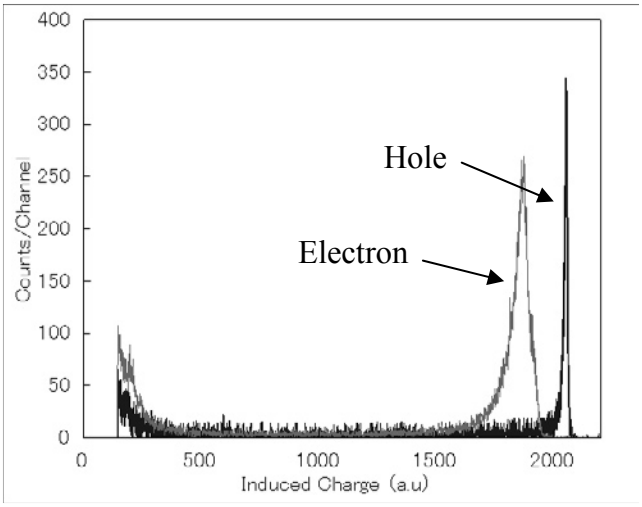

Fig.1 Examples of charge collection distribution for alpha particles obtained by a CVD single diamond crystal grown by AIST.

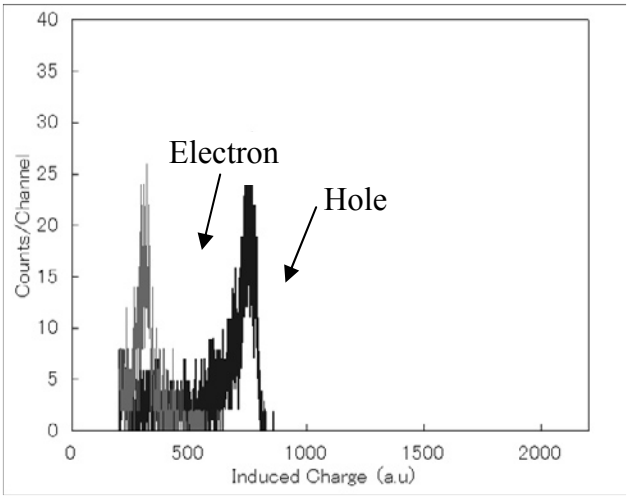

Fig.2 Examles of charge collection distribution for alpha particles obtained by a CVD single diamond crystal grwon on a HP/HT type Ib diamond in Hokkaido Univ.