Pulsed Operation of a Compact Fusion Neutron Source Using a High-Voltage Pulse Generator Developed for Landmine Detection

Kunihito Yamauchi[1], Masato Watanabe[2], Akitoshi Okino[3],
Toshiyuki Kohno[4], Eiki Hotta[5], and Morimasa Yuura[6]

[1]Dept. of Energy Sciences, Tokyo Institute of Technology, Yokohama, Japan,
yamauchi@plasma.es.titech.ac.jp, [2]watanabe@es.titech.ac.jp, [3]aokino@es.titech.ac.jp,
[4]kohno@es.titech.ac.jp, [5]ehotta@es.titech.ac.jp
[6]Pulse Electronic Engineering Co.,Ltd., Noda, Chiba, Japan, yuura@peec.co.jp

Preliminary experimental results of pulsed neutron source based on discharge-type beam fusion called Inertial Electrostatic Confinement Fusion (IECF) for landmine detection are presented. In Japan, a research and development project for constructing the advanced anti-personnel landmine detection system by using IECF, which is effective not only for metal landmines but also for plastic ones, is now in progress. This project consists of some R&D topics, and one of them is R&D of a high-voltage pulse generator system specialized for landmine detection, which can be used in the severe environment such as that in Afghanistan. Thus the circuit configuration of pulse generator system was discussed, and a prototype of the system for landmine detection was designed and made in consideration of compactness, lightness, cooling performance and robustness. By using this prototype system, a conventional IECF device was operated as a preliminary experiment. As a result, it was confirmed that the proposed circuit configuration is suitable for landmine detection system, and the results follow the empirical law obtained by the previous experiments. The maximum neutron production rate of 2.0×10^8 n/s was obtained at a pulsed discharge of –51 kV, 7.3 A. With this result, the initial target neutron production rate of the project, 10^8 n/s, has been achieved and the system is found to be very promising because the performance of this prototype system is a half of that of the planned final system. Therefore, at the target pulsed discharge of –90 kV, 10 A, a neutron production rate of 10^9 n/s, which leads to the reduction of the detection time and the improvement of the identification accuracy, is expected to be achieved finally.

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