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ヘリオトロンJにおける径方向多チャンネルプローブを用いた周辺プラズマ計測

Edge Plasma Measurement with Radial Array Probe in Heliotron J

橋本紘平[1]，大島慎介[2]，中村祐司[1]，笠嶋慶純[1]，大谷芳明[1]，水内亨[2]，長﨑百伸[2]，岡田浩之[2]，南貴司[2]，小林進二[2]，山本聡[2]，木島滋[2]，史楠[2]，文野道尚[1]，西岡賢二[1]，野口直樹[1]，丸山正人[1]，L. Zang[1]，H. Y. Lee[1]，荒井翔平[1]，沙夢雨[1]，釱持尚輝[1]，永榮蓉子[1]，原田伴誉[1]，和多田泰士[1]，福島浩文[1]，杉本幸薫[1]，安田圭祐[1]，中村雄一[1]，佐野史道[2]
Kohei HASHIMOTO[1], Shinsuke OHSHIMA[2], Yuji NAKAMURA[2], Keijun KASAJIMA[1], et al.

京大エネ科[1]，京大エネ理工[2]
GSES Kyoto Univ.[1], IAE Kyoto Univ.[2]

Transport characteristics in magnetic confinement plasmas are strongly affected by micro- and macro-scopic plasma fluctuations caused by various instabilities. In particular, confinement property around plasma edge is of great significance for the higher plasma performance. Langmuir probes diagnostics are commonly used to measure local physical quantities such as electron temperature electron density and space potential of edge plasmas. However, the disturbance to the plasma caused by the interaction between plasma and probes can be a crucial problem, particularly, in a high temperature plasma. For this reason, reproducibility of the plasma conditions becomes worse in the probe experiment, and it is not favorable to obtain profile data through shot-by-shot experiment. In order to avoid such a problem, we designed a new radial array probe for the purpose of efficient profile measurement and experiments efficiently.

Newly designed radial array probe is shown in Fig.1. Carbon pins with 1 mm diameter are used as probe tips at the probe top. The distances of each pin are 2 mm. These pins can be used as the triple probe, and are also utilized for the evaluation of particle flux. At the probe side, tungsten pins with 2 mm in diameter are used as probe tips and the distances of each pin are 5.0 mm. All the probe pins are fixed and insulated by boron-nitride parts and the insulator is supported by the molybdenum structure. The probe head is covered with the carbon plate. The radial array pins are used for floating potential or ion saturation current measurement. Moreover, heat flux can be measured using a thermocouple embedded into the copper plate at the probe side.

A typical example of floating potential profile measured around last closed flux surface (LCFS) with the radial array probe is shown in Fig.2 (a). For comparison, the profile obtained by scanning the probe through shot-by-shot experiment was also shown in Fig.2 (b). The former profile was obtained in a single shot and the latter profile was obtained in ten shots of plasma discharges. It can be seen that the shapes of these profiles are very similar, suggesting that the profile measurement is certainly possible using the developed radial array probe. In this experiment the plasma density was comparatively low and the interaction can be negligible.

In the presentation, we will also discuss the details of the newly developed radial array probes and the analysis results for the profile and fluctuation data.

Fig. 1 Radial array probe

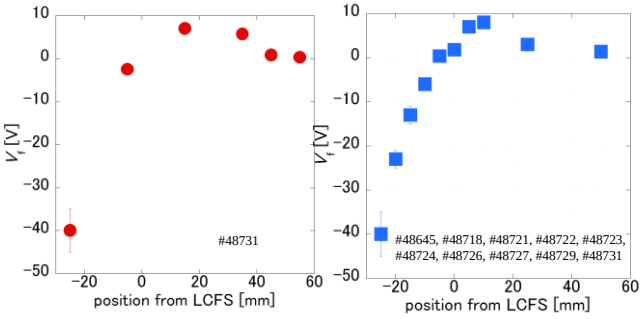

Fig. 2 Floating potential profile (a) obtained using the radial array probe in a single shot and (b) obtained in ten shots of plasma discharges