29aP64

アーク型水素負イオン源内壁温度計測と温度制御

Measurement and Control for Inner Wall Temperature in an Arc Discharge Type Hydrogen Negative Ion Source

池田勝則[1], 津守克嘉[1,2], 木崎雅志[1], 中野治久[1,2], 耿少飛[2], 神尾修治[1],
永岡賢一[1], 長壁正樹[1,2], 竹入康彦[1,2]

IKEDA Katsunori[1], TSUMORI Katsuyoshi[1,2], KISAKI Masashi[1], NAKANO Haruhisa[1,2], GENG Shaofei[2], KAMIO Shuji[1], NAGAOKA Kenichi[1], OSAKABE Masaki[1,2], TAKEIRI Yasuhiko[1,2]

核融合研[1], 総研大[2]
NIFS, SOKENDAI[1]

Control of Cs recycling is the key issue on the stable and high-power operation for a hydrogen negative ion source in a neutral beam injector (NBI) which is utilized on the heating and current drive in fusion devices. Figure 1 shows the schematic drawing of the arc discharge type negative hydrogen ion source in NIFS. We introduce Cs vapor from the back plate in the source. The plasma grid (PG) surface is coved thin Cs layer. Hydrogen negative ions are produced on the PG which become low work function caused by Cs layer. Surface condition for the PG and its temperature is important for the beam current and the stable beam operation especially in long pulse operation. However, most of the Cs atoms stick on the inner surface of arc chamber wall which is cooled by the water, this is the one of the reason the problem of increasing Cs consumption in the hydrogen negative ion source.

We installed a individual water circulator with temperature control system (CLH401: Yamato Scientific Co., Ltd.) and buffer tank in the cooling channel of arc discharge chamber as shown in Figure 1. We examined the behavior of Cs signal intensity and the production of H^- ions to change the temperature of cooling water. We also installed the measurement diagnostic for an inner wall temperature in the arc discharge source. The thermocouple is fixed on the inner wall surface by the molybdenum and stainless steel plates used a coil spring, which is performed to shut out direct heat flux into the thermocouple from arc discharge. Figure 2 shows the typical time trend of the inner surface temperature of H^- source. The time interval of the arc discharge is 3 minutes which same as the time interval of LHD operation. The temperature of cooling water is set from 40°C to 60°C. The inner surface temperature responded slowly (95°C ∼ 130°C) to the temperature of cooling water. We will discussed the response for Cs intensity and the time trend of Cs conditioning in the poster session.

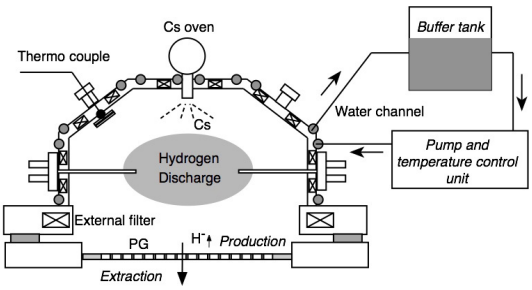

Figure 1: (a) Schematic drawing of H^- source, wall temperature diagnostic, and water channels.

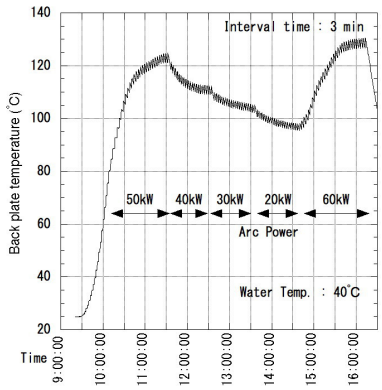

Figure 2: Time trend of inner wall temperature in several discharge power.