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GAMMA10 エンド部へのターゲットプレート挿入による コアプラズマでの高電位形成

High Potential Formation in Core Plasma due to Target Plate Insertion in End Region of GAMMA10

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It is known that potential and electric field are important for the core plasma confinement. One of the important issues of divertor study is core-edge coupling. In a mirror device, the relation between central plasma and end plasma seems to be similar to that between upstream of SOL and divertor region. We have studied relation between floating potential of target plate in the end region and the central plasma potential in the tandem mirror device GAMMA10.

GAMMA10 is a tandem mirror device with minimum-B anchor and mainly separated into four sections, from the central to the end. A tungsten target plate was inserted at 70 cm downstream from the west end coil. The radius of the target plate is 5 cm and the projected radius at the central cell (Rcc) is about 4.4 cm. The plasma was initiated by a plasma gun at the east end and sustained using ion cyclotron heating. Electron cyclotron heating at plug regions (plug-ECH) produces positive potential (i.e. plug potential) for the axial confinement.

The plasma potential was measured by using a gold neutral beam probe which was installed at the central cell of GAMMA10. The plug potential was evaluated from ion energy distribution of end loss analyzers which were installed at the east and west end regions. The west and east end loss analyzers measured at Rcc = 5.3 cm and Rcc = 4.4 cm, respectively.

When the target plate was inserted to the west end region, the core plasma potential significantly increased up to ~500 V at the low plug-ECH power (120 kW). This potential value corresponds to that of high power plug-ECH (250~380 kW) without the insertion of the target plate. And it was also observed that the high core plasma potential was formed with insertion of the target plate in the middle of the plug-ECH period as shown in Fig. 1. When the core plasma potential increased due to applying the plug-ECH with insertion of the target plate, the target plate potential was in the range of a potential value without the plug-ECH (-50 ~ -200 V) although the target potential was expected to become a very negative value (about -1500V) from analogy of behavior of the end plate potential, which was always a very negative value due to the plug-ECH. When the core plasma potential did not increase due to applying the plug-ECH with insertion of the target plate, the target plate potential was a very negative value (about -1500 V). Figure 2 shows z (magnetic lines direction) axial profiles of the time-averaged potential. It is found that the potential in the high potential period was higher than that of the low potential period in the whole plasma region. The increment of the potential was larger in the west region than in the east region.

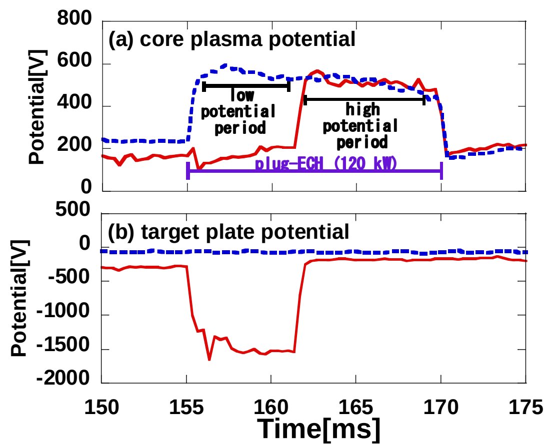

Fig. 1. Time evolutions of (a) core plasma potential, (b) target plate potential.

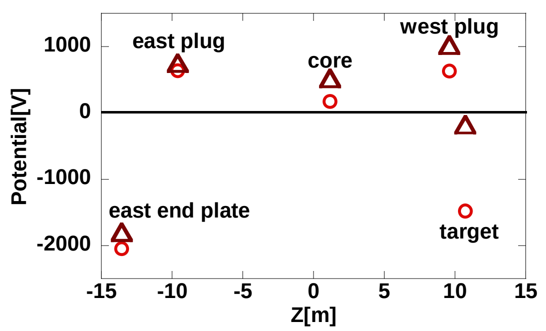

Fig. 2. Z axial profiles of the time-averaged potential at low potential period (circle) and high potential period (triangle) respectively. The low potential period and the high potential period are shown in Fig. 1(a).