

High-energy neutral particle measurements simulated alpha-particle diagnostics in Large Helical Device

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It is very important to investigate the confinement of alpha particle which is produced by the nuclear reaction in ITER. In Large Helical Device (LHD), it is possible to do the simulation experiment of the alpha particle heating by using the ion cyclotron resonance heating (ICH) because high-energy particle generated by ICH is well confined in the plasma. High-energy particles including alpha particle are emitted not only by the charge exchange but also by the instability on the Alfvén eigen mode. Their particles hit the plasma wall and damage it. Therefore the suitable method for measuring alpha particle should be established immediately. For this purpose, the time-of-flight neutral particle analyzer, the silicon surface barrier detector (SD-NPA) and the position sensitive detector (PSD) are installed in LHD. The neutral particles (mainly hydrogen), which are generated by the charge exchange between the high-energy ion and the background neutrals, can be observed by using them. However few neutral helium can be observed because alpha particle can emit only by double charge exchange process. Therefore we also introduce the pellet charge exchange system (PCX). The diagnostic pellet is injected to the plasma in order to obtain the charge exchange neutral particle, which is produced by the charge exchange reaction between the ablated pellet cloud and alpha particle or high-energetic particle. On the helium plasma in LHD, the neutral helium can be expected due to the double charge exchange. In this paper, I will mention the 3-dimensional particle distribution by the combination of their measurements. In experiments, large high-energy flux (hydrogen) can be observed near the resonance region of ICH by the vertical scanning of the SD-NPA. In similar configuration of the ICH, PCX has been done to obtain the radial distribution of the high-energy particle. The large flux can be also obtained at the resonance position in the radial direction. PCX has been done at the different resonance configuration of ICH. However the flux enhancement can not be observed. Through the experiments, we can make clear the 3-dimensional distribution of the high-energy particle. This means that the establishment of alpha particle measurement in ITER has been proceeded. Now we are also trying helium measurement.