§29. Study of Dust Transport in NAGDIS-T

Ohno, N., Yamada, T. (Nagoya Univ.),
Ashikawa, N., Masuzaki, S., Tomita, Y.

Dust particles have been found in magnetically confined fusion devices. These dust particles could be generated due to strong plasma-wall interaction, and be transported in fusion plasmas. Such dust particles would not pose serious problem on safety and operational issues in present devices, however, dust particles could be serious problem because dust formation in the next-step devices is expected to be enhanced due to long pulse operation. Dust accumulation inside the vacuum vessel contributes to huge tritium inventory. In addition, dust penetration into the core plasma could cause degradation of plasma performance.

In the previous LHD experiment, we used material probe system to introduce known dust particles into a plasma, and measure its transport with a high-speed camera. The dust particles were transported in almost same direction and were reflected at the camber wall.

In this report, we will report comprehensive study of dust transport in the toroidal divertor plasma simulator NAGDIS-T to compare the experimental results with those in the LHD.

We used spherical carbon particles whose radius is about 8 micron. Fig. 1 shows experimental setup of a dust feeder. We dropped dust particles from upper of vacuum vessel into the deuterium plasma. In order to reveal the motion of dust particles, we set containers in toroidal and radial directions to collect dust particles transported in a plasma. Fig. 2 shows radial distribution of mass of dust particles collected by containers located on bottom of the vacuum vessel. In comparison with the dust distribution in a plasma, vacuum, and atmosphere, it is found that dust particles are mainly transported outward (toward a low field side) in the deuterium plasma.

Fig. 3 shows Mach number profiles of poloidal plasma flow measured by Mach probe. The positive number means outward ion flow toward a low filed side. The sign of Mach number changes from positive to negative around the vertical position of 7 cm, where the electron density is maximum and the plasma potential is minimum. This experimental result indicates that plasma rotates poloidally at the center of the vertical position of 7 cm due to ***E*x*B*** drift. In upper region of the vacuum vessel from 0 to 7 cm, dust particles, introduced from the top, receive strong outward friction force due to ***E*x*B*** plasma flow, so dust particles are transported outward as shown in Fig. 2.

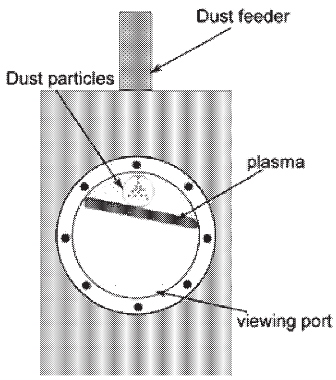

Fig. 1 Experimental setup of dust feeder.

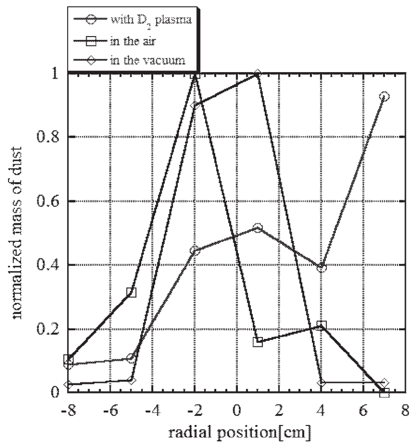

Fig. 2 Radial distribution of mass of dust particles collected at bottom of the vacuum vessel.

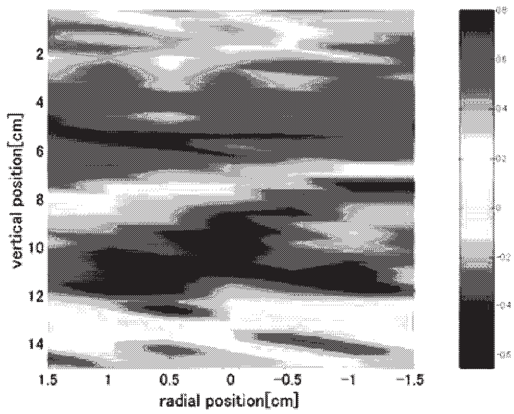

Fig. 3 Distribution of Mach number of poloidal ion flow.