# §76. Study on Generation Mechanism of Particles in LHD

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Formation of dust particles due to interaction between hydrogen plasma and carbon wall has attracted a great deal of attention in the fusion research field. 1) Carbon dust particles pose two potential problems: those remained in a fusion device are dangerous, as they can contain a large amount of tritium; their existence in the device may also lead to deterioration of plasma confinement.

At present, the following three candidates have been proposed as the erosion mechanism of carbon wall due to the plasma interaction: [1] physical sputtering by incident hydrogen ions, [2] chemical-etching due to H atoms and, [3] embrittlement of the carbon wall surface and/or layer redeposited on it. While these processes have been believed to lead to formation of carbon dust particles, little is known about their formation mechanism.

Kyushu University group of us have already reported on the experimental results of dust particles formation due to the interaction between ECR hydrogen plasma and carbon wall. 2, 3) Here, we will describe the results regarding characterization of dust particles collected from LHD.

Size and shape of dust particles trapped were observed with TEM and SEM. Figures 1 (a) and (b) show the size distributions at the sampling location near the NBI injection port (1-O) and the location between the ports 1-O and 10-O. The particles are classified into two size groups: one is the small particle of size below 1 $\mu$m, the other is the large particles of size above 1 $\mu$m.The small particles exist in all locations, whereas the large ones do only in 6 locations out of 16 ones. The shape of small particles is nearly spherical suggesting their formation in gas phase, while that of the large ones is irregular. The size distribution of small ones is quite similar tothose of particles formed due to interaction between hydrogen plasma and carbon wall. 2, 3) The large particles have a rather flat size distribution, which is significantly different form the log normal one in ref. 1). Such flat distribution may be explained by that the large particles are mainly flakes originated from peeling off deposits on the reactor wall.

The dust particles collected in LHD have been analyzed with SEM, TEM, and EDX. They have been found to be composed of small and large size groups. The particles in small size group are of spherical shape in the size range of 5 nm-1 $\mu$m, and their major composition is C. Those in large size group are of irregular shape in the size range above 1 $\mu$m, and their major compositions are Fe, Mo and Cr. The features suggest that the small dust particles are formed in gas phase, whereas the large ones are caused by peeling off from deposits on the reactor wall.

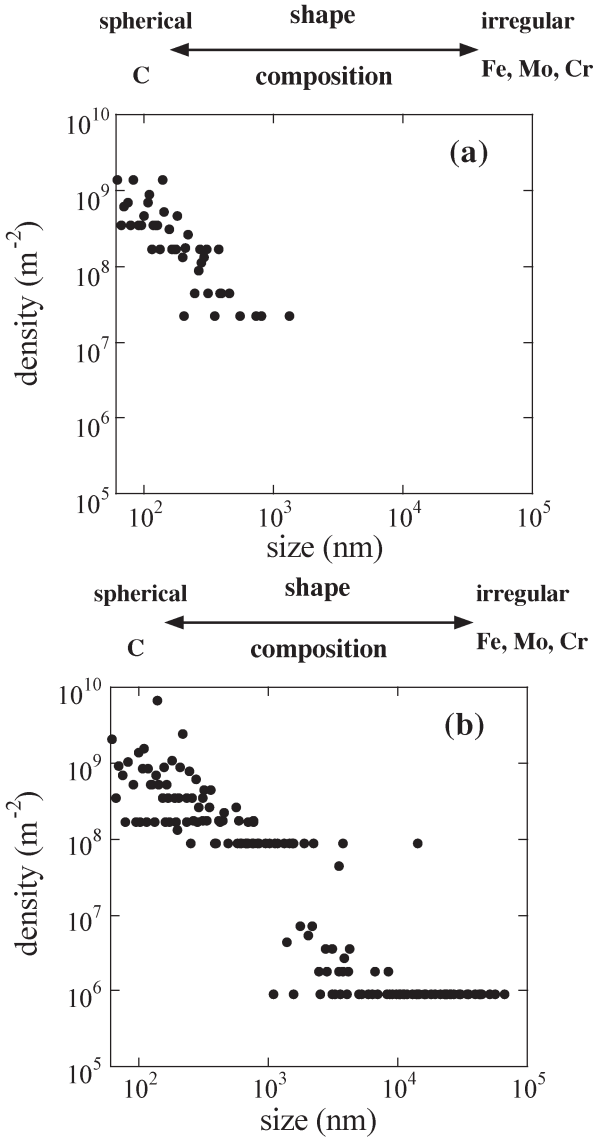


Fig. 1. Size distributions at two locations: (a) near NBI injection port (1-O); (b) between port 1-O and 10-O.

References

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