§28. Flux of Dust Particles Collected by In-situ Sampling Method during Main Discharges

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Formation of dust particles due to plasma-wall interaction and their characteristics have attracted considerable interest in the fusion research field [1-4]. Those particles remained in a fusion device are dangerous, as they can contain a large amount of tritium and can explode violently; they may lead to deterioration of plasma confinement. Investigation of dust in fusion plasma research devices has been carried out mainly using the filtered vacuum collection method [1-5]. Here, we describe the results regarding characterization of dust particles collected in LHD by in-situ sampling method during main discharge plasmas of H_2 (about 150 s total duration assuming 2.5 s per shot, shot number 89593-89654, the 12th campaign in November, 2008) and their flux.

Dust particles are classified into three kinds: small spherical dust particles below 1 μm in size, agglomerates consisting of primary particles of 10 nm, and large dust particles above 1 μm in size and irregular in shape; this suggests that there are three formation mechanisms: CVD growth, agglomeration, and peeling from walls [5]. Figure 1 shows area number density of dust particles collected during the main discharges in the 12th campaign and their flux. There exist a large number of small dust particles below 2.5 μm in size. The area number density of dust particles increases from 4.0×10^5 m^{-2} to 7.6×10^6 m^{-2} with decreasing their size from 9 μm to 1 μm, leading to an increase in their flux from 3.0×10^3 $m^{-2}s^{-1}$ to 5.1×10^4 $m^{-2}s^{-1}$. The total flux during the main discharges is 1.5×10^5 $m^{-2}s^{-1}$. Figure 2 shows the ratio of total area of dust particles to observation area and their deposition rate. The ratio of total area of dust particles below 10 μm in size to observation area is 3.5×10^{-3}% just after the main discharges, and their deposition rate is 2.2×10^{-5}%s^{-1}. These results suggest that the walls of LHD are covered with dust particles completely after 1194 h total duration of main discharges. It should be noted that the time probably becomes shorter because the results obtained by the ex-situ sampling method show there are a large number of dust particles below 1 μm in size in LHD [5].

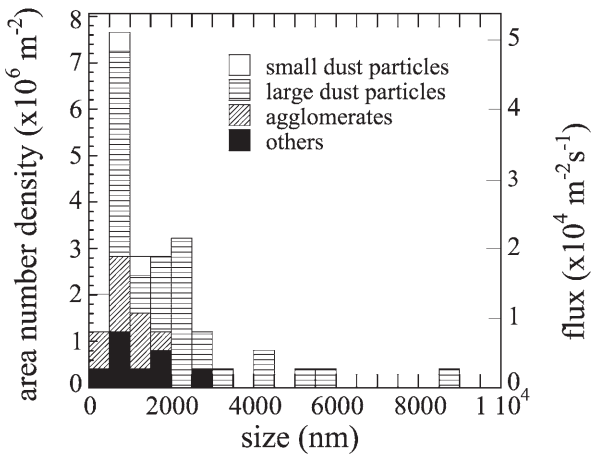

Fig. 1. Area number density of dust particles collected during the main discharges in the 12th campaign and their flux.

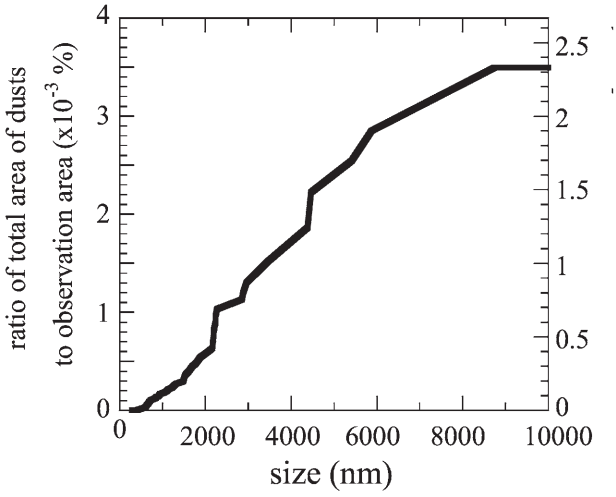

Fig. 2. Ratio of total area of dust particles to observation area and their deposition rate.

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5) Koga, K., et al.: Plamsa Fusion Res., **4** (2009).