Hydrogen isotope retention on dust particles in fusion devices

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Dust studies are important issues related to radioactive impurity accumulations into core plasmas and tritium retentions in thermonuclear fusion devices with magnetic confinements. Thus, for understanding characteristics of dust particles, their movements and surface analyses have been investigated in stellarator/heliotrons and tokamaks.

In particular, hydrogen isotope retentions on co-deposition layer and dust particles at shadow areas around divertor cassettes are investigated due to 1) high retention rates with deposited amorphous carbon and 2) a difficulty cleaning method in these regions. For the case of dust particles, a different estimation of retentions between dust and deposited bulk layer is needed, because an exposing total surface area of dusts to fueling gasses is larger than bulk layers and one of dust particles is removing from deposited layer on bulk target. But an observation of retention rate from a few amounts of dust particles is difficult.

The dust collections were carried out in LHD and JT-60U using a polycarbonate membrane filter, which is a polymer film with pores of 0.1 μm. A membrane filter is housing into holder and dust particles are deposited on these filters. For analysis of dust retention, additional metal sample targets, such as stainless steel (SS) 316 are housing into holder with filters

Atomic concentrations of deposited dust particles on targets were analyzed by X-ray Photoelectron Spectroscopy (XPS). For the collected dusts from the divertor target in LHD, mainly carbon intensities are observed by XPS. Hydrogen isotope retentions of dust particles are analyzed by the Thermal Desorption Spectroscopy (TDS). Retentions of dust particles were estimated using a difference between retained amounts of hydrogen from stainless steel targets with and without dust particles. From this analytical method, retention of dust particles can be included wide range particle size of dusts. In this paper, the hydrogen isotope retention on dust particles in JT-60U is also shown.