Observations of spatial distributions after boron dropping to hydrogen/deuterium plasmas in LHD

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Hydrogen isotope trapping by boron is one of useful tools in fusion devices. The method using boron hydride gas, such as diborane (B_2H_6), is the standard wall conditioning in the magnetic confinement fusion devices. In general, the wall conditioning with diborane gas, namely boronization, is operated without magnetic fields.

In LHD, a new impurity powder dropper (IPD) system, which was developed in Princeton Plasma Physics Laboratory (PPPL), was installed and had experiments of real-time interactions between boron and hydrogen isotope plasmas [1]. One of the advantages of IPD is to be able to operate under magnetic fields. In future fusion devices, ITER and DEMO, have longer plasma durations and limited maintenance dates. And it is planned that the confinement magnetic fields have been kept for more than a week. Therefore, it is important that the plasma control method under the magnetic fields, such as IPD, for future fusion devices.

In boronization, oxygen, carbon and hydrogen isotopes are trapped in coated boron layers as chemical bonds on the plasma-facing walls [2]. In plasma experiments after the boron powder dropping by IPD, it was observed that a reduction of oxygen and hydrogen isotopes. Obtained data shows that coated boron layers on the plasma-facing areas by IPD experiments[3], and plasma parameters of boron impurities and hydrogen Balmer lines with a quick response when boron particles reached plasmas. But details of interactions between hydrogen isotopes and boron are not clear.

In this presentation, spatial distributions observed after boron dropping to hydrogen/deuterium plasmas are shown by spectroscopies, charge exchange spectroscopy and bolometer, so on. Based on the results, the progress of solid boron ionization and the reduction of hydrogen Balmer line intensities towards the wall recycling control are discussed.

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