Potential profiles and transient response in H and D plasmas of the LHD

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In laboratory plasmas, the importance of electric fields is widely appreciated for plasma confinement mechanisms. The electric field provokes the diverse phenomena; L-H transition, internal transport barrier and flow are observed in toroidal plasmas. The electric field and fluctuation can be obtained from a plasma potential and its profile measured by a heavy ion beam probe (HIBP) in the Large Helical Device (LHD). The impurity hole observed in the LHD was discussed with neoclassical theory [1]. Since the deuterium plasma experiments started in the LHD, the hydrogen isotope effect has been studied for transport physics. The isotope effect on H and D was observed with an input power per electron density P/n_e in the formation of electron transport barrier (e-ITB). The threshold of P/n_e for D plasmas was lower than that for H plasmas. In this report, the isotope effect on the potential formation and transient phenomena has been explored in farther parameter of P/n_e ~2 by the HIBP.

In a hydrogen or deuterium plasma, the electron cyclotron heating (ECH) modulated at 25 Hz is injected to produce plasmas with and without e-ITB, while the HIBP measures the time evolution of plasma potential and spatial profile under a fixed discharge condition. Above the threshold of P/n_e ~2 for the e-ITB transition observed in the LHD, the H and D plasmas have no clear difference in the potential profiles except for the decay phase after the ECH is turned off. The electron temperature from electron cyclotron emission decays faster than the local plasma potential in the core region. Inside the foot of e-ITB, the electric field does not change with and without m-ECH. On the other hand, outside that of e-ITB, the electric field increases with the ECH. The results and discussion will be presented in detail.

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