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## Abrupt Reversal of Convective Flow of Carbon Impurity during Impurity-Hole Formation on LHD

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An extremely hollow carbon impurity profile (impurity-hole) has been observed associated with increase of ion temperature gradient in the discharges with ion-ITB on LHD. Simultaneous achievement of the impurity-hole and ion-ITB is favorable feature in nuclear fusion plasma, where both good energy confinement and ash exhaust are required.

The impurity-hole is characterized as small diffusion and large outward convection of impurities [1]. The outward convection observed in experiment contradicts to the prediction of neoclassical impurity transport and the convection velocity becomes larger as the magnetic axis shifted outward and the ion charge of Z is increased [2]. In this paper, the dynamic behaviors of the convection velocity of carbon impurity during the formation of impurity-hole are described.

(1) The dynamic impurity transport analysis shows that the abrupt (time scale of 30 ms) reversal of turbulent-driven convection flow of carbon impurity from inward to outward takes place at the formation. (2) The reversal starts at the position where the ion temperature gradient becomes steep and propagates toward the core and edge in the time scale of 100 ms while the ion temperature increases in the time scale of 300 ms.

[1] M.Yoshinuma, et al., Nucl.Fusion 49(2009)062002.

[2] K.Ida, et al., Phys.Plasmas 16(2009)056111.

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