Ion Transport in Core Electron Root Confinement Plasmas in Large Helical Device

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In helical systems, the improvement of the electron transport is commonly observed in core electron root confinement (CERC) plasmas [1]. The helical devices have non-axisymmetric magnetic field configuration, which induces neoclassical ripple transport. The neoclassical ion and electron fluxes are strongly dependent on the radial electric field (E_r), and the ambipolarity condition of these fluxes determines the value of E_r. The E_r has a great influence on the plasma properties related to both the ripple transport and the anomalous transport. As well in middle-sized helical devices such as CHS, W7-AS, and TJ-II, large positive E_r is observed in a core region when the central electrons are strongly heated with the ECRH in Large Helical Device (LHD), which is the world's largest superconducting helical device [2]. At the same time, the electron internal transport barrier (electron-ITB) with a steep gradient on the T_e profile is formed in the core region, in which the electron transport is improved in the neoclassical electron root with the positive E_r [3]. As a result, high T_e is achieved in this core electron root confinement (CERC) plasmas.

In the theoretical prediction, the ion transport should also be improved in the CERC plasmas. We have observed a T_i rise in the NBI plasmas by applying the centrally focused ECRH. In this case, the T_e profile shows the electron-ITB formation, in which the positive E_r is observed. The transport analyses show the improvement of the ion transport as well as the electron transport in the CERC plasmas. Therefore, the T_i-rise is thought to be ascribed to the ion transport improvement due to the neoclassical electron root. The plasma properties of the CERC plasmas, which are realized by applying the ECRH to the NBI plasmas, are presented with a view of the ion transport improvement.

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[2] O. Motojima, *et al.*, Phys. Plasmas **6** (1999) 1843.

[3] Y. Takeiri, *et al.*, Phys. Plasmas **10** (2003) 1788.