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# EX/P3-27: Transition of Poloidal Viscosity by Electrode Biasing in the Large Helical Device

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The transitions to the improved confinement mode, which were accompanied with bifurcation phenomena characterized by a negative resistance, were clearly observed in various magnetic configurations on the Large Helical Device (LHD) by the electrode biasing. The configuration dependence of the transition condition and the radial resistivity qualitatively agreed with neoclassical theories.

The effects of the ion viscosity maximum on the transition to an improved confinement mode were experimentally investigated by the externally controlled J x B driving force for a poloidal rotation using the hot cathode biasing in Tohoku University Heliac (TU-Heliac) [1, 2]. Here, J and B are a biasing electrode current and a magnetic field. In steady state the J x B driving force balances with the ion viscous damping force and the friction to neutral particles. Then the local maximum in ion viscosity can be evaluated experimentally from the external driving force at the transition. The remaining problems in the biasing experiments on TU-Heliac were (1) to spread a ripple component in magnetic configuration, and (2) to improve a target plasma to a high-performance region. In LHD the effective helical ripple and viscosity maxima have wider region than those in TU-Heliac. The relation between a poloidal Mach number and ion viscosities in LHD predicted by the neoclassical theory [3] shows that viscosity maxima change drastically depending on the position of the magnetic axis that mainly changes the effective helical ripple. LHD can produce higher temperature plasmas at higher field than the plasma in TU-Heliac. We tried the biasing experiment in LHD, and reported the first observation of transition phenomena [4]. In this paper we report the difference of the transition condition in three configurations by the electrode biasing experiments in LHD and the radial electric field and the viscosity estimated from the neoclassical transport code FORTEC-3D [5] for a non-axisymmetric system.

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