Analysis of internal transport barrier formation in tokamak and helical reactor plasmas

Y. Hori, K. Yamazaki, T. Oishi, H. Arimoto, T. Shoji

Nagoya University, Furo-cho, Chikusa-ku, Nagoya 464-8603, Japan

hori.yoshihito@f.mbox.nagoya-u.ac.jp

Fusion power output and required external heating power in fusion reactors strongly depend on the radial profile of temperature and density. Recently the reactor system analysis has been done, and the transport simulation studies have been carried out focusing on the dependence of fusion power on the density profile. These studies have been revealed that it is important to control core plasma density profile to optimize reactor operations. In general, higher output power is obtained by making temperature and density profiles peaked, and an optimized operation becomes possible. On the other hand, it is considered that an advanced operating method using reversed magnetic shear mode and higher poloidal beta mode with internal transport barrier (ITB) will be needed for confinement improvement and higher bootstrap current fraction in future reactors. It is expected that reliable operation with ITB enables an optimized operation to improve burning plasma confinement.

Here, ITB formation with an initial difference of the magnetic shear is examined by using 1.5 dimensions or 2.0 dimension equilibrium-transport codes (TOTAL code) of the tokamak and the helical fusion reactor. The transport model including the effect of *E*x*B* shear is adopted for the ITB formation, and the comparison with the experiment is done [1]. One of the important issues is relationship between the penetration length of the pellet injection and the ITB formation [2]. Therefore, the density control by the pellet injection is assumed in the simulation, and the effect of the core magnetic shear and the pellet injection to the formation of the ITB are analyzed.

Figure1 shows a radial profile of the electron temperature and density in the reversed shear of the tokamak reactor. ITB is formed around at magnetic shear *s*~0. The detailed simulation result and analysis will be shown in the poster. The case of helical reactor will be also shown.

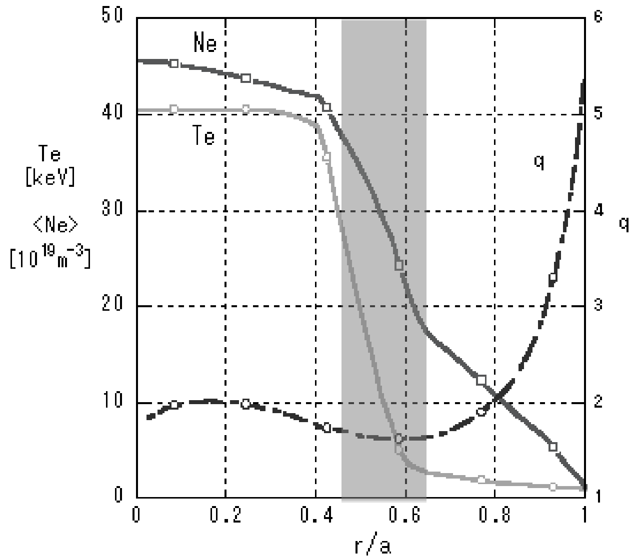

Fig.1 Radial profile of temperature *Te,* density *Ne* and safety factor *q* at steady state in the reversed shear case of tokamak reactor.

[1] J.Garcia, K.Yamazaki, J.Dies and J.Izquierdo, Phys. Rev. Lett. **96** (2006) 105007.
[2] Y.Higashiyama, K.Yamazaki, et al., J. Physics: Conference Series **123** (2008) 012032.