§7. Divertor Study of Toroidal and Mirror Field Configurations

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Divertor simulation experimental plans are being performed in GAMMA-10 in Tsukuba University, and it is important to study plasma behavior in such an open field configuration.

One of the authors previously proposed the tokamak-helical hybrid called TOKASTAR (Tokamak-Stellarator Hybrid) with mirror field divertor configuration to improve the magnetic local shear near the bad curvature region and divertor configuration. This is characterized by simple and compact coil systems with enough divertor space relevant to reactor designs. Based on this TOKASTAR concept, a miniature C (compact) -TOKASTAR machine (R ~ 35 mm) with a toroidal mode number N = 2 was constructed. The rotational transform of this compact helical configuration is rather small to confine hot ions, but can be utilized as a compact electron plasma machine for multi-purposes.

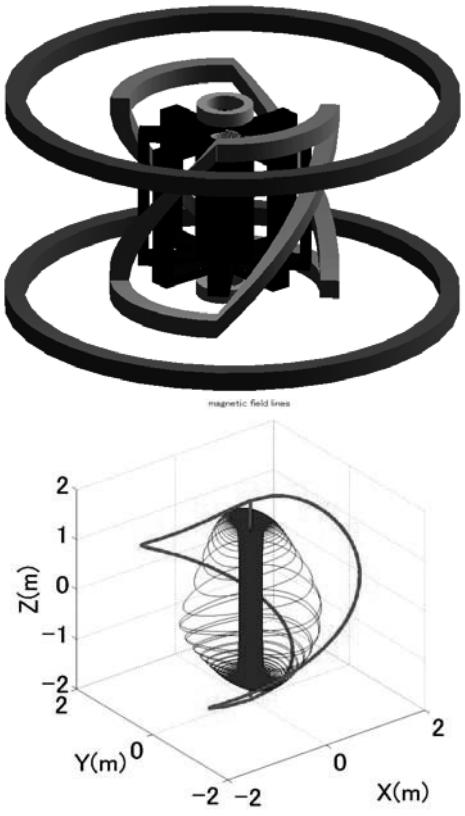

Fig.1 TOKASTAR coil configuration and magnetic field line structure.

The C-TOKASTAR has a pair of spherical winding helical coils and a pair of poloidal coils. Existence of magnetic surface and electron confinement property in C-TOKASTAR device were investigated by an electron-emission impedance method. We also constructed a slightly larger machine TOKSATAR-2 (Fig.1) with possible pure tokamak mode.

Up to now, experiments using TOKASTR-2 were carried out to focus on the new configuration research and tokamak stabilization[1-2].

Theoretically, using TOTAL (Toroidal Transport Analysis Linkage) code we carried out the impurity accumulation process in the core[3]. The divertor modeling and the edge plasma behavior are also carried out by the injection of high-Z impurity.

Figure 2 shows typical simulation results about the formation of radiative mantle in ITER plasmas. We found Kr impurity injection is optimal for this purpose in ITER.

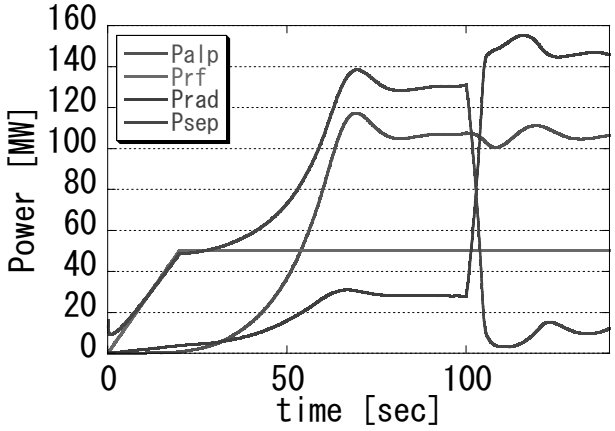

Fig.2 Formation of radiative mantle in ITER plasmas. Time history of global power balance quantities. Kr impurity injection starts at t = 100 sec.

1) K. Baba, K. Yamazaki, H. Arimoto, T. Oishi, M. Hasegawa, M. Suwabe and T. Shoji, Plasma and Fusion Research **6** (2011) 2402088
2) M. Hasegawa, K. Yamazaki, H. Arimoto, T. Oishi, K. Baba, M. Suwabe and T. Shoji, Plasma and Fusion Research **6** (2011) 2402141
3) Y. Hori, K. Yamazaki, T. Oishi, H. Arimoto and T. Shoji, Plasma and Fusion Research **6** (2011) 2403140