Plans for Lower Hybrid Current Drive Experiment using a Dielectric Loaded Waveguide Array Antenna in TST-2

T. Wakatsuki,[1] J. C. Wright,[2] S. Shiraiwa,[2] O. Meneghini,[2]
H. Kakuda,[1] Y. Takase,[1] A. Ejiri,[1] Y. Nagashima,[1] O. Watanabe,[1]
T. Yamaguchi,[1] T. Sakamoto,[1] K. Hanashima,[1] J. Hiratsuka,[1]
T. Ambo,[1] R. Shino,[1] and M. Sonehara[1]
[1]*The University of Tokyo, Kashiwa, Japan*
[2]*MIT Plasma Science and Fusion Center, Cambridge, MA, USA*

Plasma current start-up experiment using waves in the lower hybrid frequency range is being conducted on the TST-2 spherical tokamak, with the eventual goal of demonstrating the capability to achieve start-up and current ramp-up to 100 kA. At present, plasma current ramp-up to 12 kA has been achieved using an antenna designed to excite a traveling fast wave. Significant improvement is expected if the lower hybrid wave (LHW) could be excited directly. A new dielectric loaded waveguide array antenna is being designed for this purpose. The dielectric is alumina and the number of waveguides is four in the toroidal direction. The wave excitation efficiency of this antenna is investigated using a versatile FEM solver package, COMSOL. The wave excitation efficiency depends strongly on the electron density in front of the antenna and can become three times larger than that of the present antenna. Propagation and absorption of the LHW are calculated by iterating between the TORLH full wave code and the CQL3D Fokker-Planck code. Wave absorption is very weak for Maxwellian plasma, but becomes stronger with the development of quasilinear deformation of the distribution function.