Recent Progress of 2MW 140GHz ECRH system on HL-2A


Southwestern Institute of Physics, P.O. Box 432, Chengdu, China

Electron cyclotron heating (ECRH) and electron cyclotron current drive (ECCD) has been proven to be one of the most effective and promising methods for plasma heating and current profile control for present and future nuclear fusion research\[1\][2], also on HL-2A\[3\]. As the main heating method, until 2010, 3MW/68GHz ECRH system has been developed and upgraded on HL-2A.\[4\] The maximum output power of 2.5MW has been obtained with this system and H-mode discharge has been observed co-operation with the 1MW NBI system. In order to provide more capability of physics study for high-performance plasma, such as current profile control, neoclassical tearing modes suppression, transport study and so on, a new 2MW/140GHz/3s second-harmonic ECRH system with X-mode injection is on schedule on HL-2A.

The 140GHz ECRH system has been designed, which includes two 1MW/3s gyrotrons, two evacuated transmission line, a steerable launcher and relative power supplies and control system. A Pulse Step Modulation (PSM) power supply with capability of 80kV/100A has been developed for the cathode of the two gyrotrons. The evacuated transmission line consists of MOU, Φ63.5mm oversized corrugated circular waveguide run of 10m in length, miter bends, polarizer, bellow, DC break and switch. The quasi-optical launcher has the capability of two-dimensional beam scanning for narrow localized power deposition profile and can inject two 68GHz and two 140GHz wave beams into plasma together from the low-field side through one Φ350mm equatorial tokamak port. The scan range of poloidal direction is around 0°~10° for two 140GHz wave beams. The scan range of toroidal direction is 0°~15° for two beams (one 140GHz and one 68GHz) and -15°~0° for another two beams. Along with the beam injection direction control, the polarization and ellipticity of the beams could be controlled to launch the wave with the desired mode, pure O- or X-mode, into the plasma. Up to now, the factory test of two gyrotrons at 140GHz in short pulse has been finished at GYCOM. The manufacture of transmission lines has been completed and will be assembled at the beginning of this May. The alignment of launcher has been installed on HL-2A tokamak and calibration of the injection angle has been done. Moreover, all of the power supplies for gyrotrons, cooling and control system have been ready. The new ECRH system is expected to be fulfilled and operated on HL-2A in this June.

References