COMMISSIONING RESULTS OF 5 GHZ, 500 KW CW KLYSTRON PROTOTYPE FOR

KSTAR LHCD SYSTEM

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A 5 GHz lower hybrid current drive (LHCD) system, which is a possible frequency for an ITER current drive system, is being designed for current profile modification required in Advanced Tokamak (AT) and steady-state operation on KSTAR device [1]. A prototype (TETD E3762 RD0) of 500 kW CW klystron operating at 5 GHz has been developed by Toshiba Electron Tubes and Devices (TETD) for the steady-state RF source. In this prototype model, a multi-cell cavity is introduced to reduce the applied cavity voltage and Ohmic power loss, and the gun is designed with a triode system for optimization of the gain efficiency and beam controllability. The cathode high voltage is controlled by the thyristor switching system at the low voltage transformer unit. For anode voltage control, the voltage divider based on the FET switch and zener diodes circuit is used. We achieved the RF output power of 300 kW and 450 kW at pulse duration of 800 sec and 20 sec, respectively, using the water dummy loads during the commission of the prototype klystron (Fig. 1). The VSWR at the output of the klystron is 1.2. The temperature of the collector top surface was saturated at 83 °C and power loss at the tube body did not exceed 10 kW which is an interlock level for protection of the klystron. In this paper, the details of the klystron system and commissioning result will be presented. Also, the future in-situ test plan of the klystron and design characteristics of the KSTAR LHCD system will be presented.



Figure 1: Commissioning results of the 5 GHz, 500 kW CW klystron prototype (300 kW/800 s).

[1] S. Park et al., Fusion Eng. Design, 85, 2010, 197