Commissioning ICRF System and ICRF Assisted Discharge Cleaning at KSTAR

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KSTAR is the Korean national superconducting tokamak aiming at high beta operation based on AT scenarios, and ICRF is one of the essential tools to achieve this goal. The ICRF system also contributes to the first plasma experiments of KSTAR through discharge cleaning and assisting the discharge startup. The fabrication and HV test of the antenna and matching system were finished in 2006 and final installation of the antenna, matching system and the transmitter at KSTAR site was completed in 2007. In this presentation, installation processes of the ICRF system (with an emphasis on the quality assurance procedures of KSTAR), as well as results from the first RF discharge experiment for discharge cleaning in KSTAR, are outlined.

The antenna consists of four straps and presently two straps are fed via RDL and tuners. The Faraday shield profile of the installed antenna fits the magnetic surface of separatrix in the standard diverted plasmas of KSTAR. The antenna is protected at sides by two poloidal limiters covered with graphite tiles which intrude into the plasma past the shield by 10mm. The RF output from the transmitter is fed into two tuners via one coaxial transmission line whose length is about 80 m. The impedance matching is done by adjusting the two liquid stub-tuners whose matching conditions are checked with a network analyzer. Presently it is tuned at 30 MHz but it could be adjusted to other frequencies by changing the length of U-link at the resonant loop and the tuning position of the tuners.

The 2MW transmitter is a modified FMIT transmitter consisting of three amplifier stages. An amplitude-modulated 1mW frequency source drives a 500 watt solid-state wideband amplifier, which in turn drives three tuned tetrode amplifier stages. The tube employed in the final power amplifier is 4CM2500KG tetrode fabricated by CPI. Several failures of the tube during the factory acceptance test occurred before eventually achieving 1.9 MW for 300s at 33 MHz during commissioning on KSTAR site. The electrical efficiency is about 70%. This is a very encouraging result for the development of ICRF transmitter for ITER.

Antenna conditioning was carried out to improve the HV holding condition of the antenna installed on KSTAR and to check the EM interference with other equipments such as superconducting magnet monitoring system and other machine and/or plasma diagnostic systems. Discharge cleaning results using ICRF during 1st plasma events will be presented.