

Operation Results of the KSTAR Helium Refrigeration System

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Abstract - The “first plasma” (100 kA of controllable plasma current for 100 ms) of KSTAR has been successfully generated in July 2008. The major outstanding feature of KSTAR compared to most other Tokamaks is that all the magnet coils are superconducting (SC), which enables higher plasma current values for a longer time duration when the nominal operation status has been reached. However, to establish the operating condition for the SC coils, other cold components, such as thermal shields, coil-supporting structures, SC bus-lines, and current leads also must be maintained at proper cryogenic temperature levels. A helium refrigeration system (HRS) with an exergetic equivalent cooling power of 9 kW at 4.5 K has been installed for such purposes and successfully commissioned. In this proceeding, we will report on the operation results of the HRS during the first plasma campaign of KSTAR. Using the HRS, the 300-ton cold mass of KSTAR was cooled down from ambient to the operating temperature levels of each cold component. Stable and steady cryogenic conditions, proper for the generation of the “first plasma” have been maintained for three months, after which, all of the cold mass was warmed up again to ambient temperature.

Keywords - Fusion, Tokamak, superconducting magnets, helium refrigeration, supercritical helium, liquid helium.

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