Development and physics study of KSTAR

Kwan Chul Lee, S.W. Yoon, S.G. Lee, B.H. Park, Y.S. Bae, J.Y. Kim, Y.K. Oh, J.K. Kwak, M. Kwon and KSTAR team

National Fusion Research Institute, Daejeon 305-806, Korea

e-mail address : kclee@nfri.re.kr

The Korea Superconducting Tokamak Advanced Research (KSTAR) is one of the recently built global tokamak facilities with the purpose of long pulse plasma operation by a superconducting tokamak and the development of scientific and technical base for the commercial nuclear fusion reactor which helps ITER project as a pilot device. The heating system of KSTAR is upgraded with 3.5 MW neutral beam injection by adding an additional ion source, and newly installed 0.3 MW lower hybrid current drive which increased total RF heating power up to 3 MW. Additional diagnostic systems were installed including BES, VUV, MIR, second ECEI and modified Thomson scattering with a high power laser. RMP coil is upgraded with 4 kA capacity for the ELM mitigation study. By virtue of upgraded device capacity, plasma operations recorded high betaN/\i\i surpassed the n=1 no-wall limit and the H-mode flat top duration over 15 seconds at 600 kA and 3.5 seconds at 900 kA. ELM suppression by RMP was successfully performed using n=1 and n=2 configurations. 2-D and 3-D structure and movement measurement of ELMs by ECEI system is carried out for the first time in tokamak research. Summary of physics studies on KSTAR such as L to H transitions, toroidal rotation change by ECH and 3-D fields, ELM mitigation by SMBI, runaway electron suppression by MGI and rotation braking by RMP will be presented.

This work is supported by the Korean Ministry of Science, ICT and Future Planning under the KSTAR project.