Preliminary results of the first H-mode discharges in KSTAR

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Typical ELMy H-mode discharges have been achieved on KSTAR tokamak with combined auxiliary heating of NBI and ECRH. The required minimum power is about 1 MW (NBI+ECRH) at a density of 1.8e19 m^{-3} with highly elongated double-null shape. The poloidal beta is increased by factor of two after the transition and the H-mode is sustained for about 1 second maximum, which is an order of magnitude higher than the energy confinement time. H-mode is accessed in highly elongated double-null shape as clearly indicated by sudden increase of the line density & the poloidal beta. The estimated threshold power is in good agreement with the previous linear scaling with the low electron density ~ 1.8e19 m^{-3} (0.25 of Greenwald density). The back H-L transition is mainly triggered by poor controllability of plasma shape and therefore the small clearance from the wall. Though no detailed scan of additional power was performed, the transition is often synchronized with the large sawtooth crashes suggesting the marginal auxiliary power for H-mode access. Very slow transition (~50ms) time and the long dithering phase also support that the auxiliary power is near the threshold power. From initial analysis on the global confinement, the estimated energy confinement time is larger both for L- & H-modes by more than 50% than the global scaling[1] though its accuracy relies on the reliable calculations of the loss power & diamagnetic energy. The both measurements of CES & XICS show a clear increase of toroidal rotation velocity after L-H transition from 100 km/s to 150 km/s at the plasma center. Typically, H-mode transition is accompanied by small ELM(i), ELM-free(ii) and the relatively large ELM(iii) phases. During the ELMs, the drop in the line-averaged density is not so regular and no significant drop of WMHD is measured. Therefore, it is concluded that the energy loss due to the ELMs is negligible and within 2~3 % of WMHD.

[1] ITER Physics Expert Groups on Confinement and Transport and Confinement Modeling and Database 1999, *Nucl. Fusion,* **39** 2175