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EX/P4-12: ELM and Pedestal Structure Studies in KSTAR H-mode Plasmas

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The ELM and pedestal structure are studied in Korea Superconducting Tokamak Advanced Research (KSTAR) ELMy H-mode plasmas. KSTAR H-mode plasmas have three distinctive types of ELMs ; large type-I ELMs with low ELM frequency ($f_{\text{ELM}} = 10 - 50$ Hz) and good confinement ($H_{98}(y,2) = 0.9 - 1$), intermediated, possibly type-III, ELMs with high ELM frequency ($f_{\text{ELM}} = 50 - 250$ Hz) at a reduced confinement ($H_{98}(y,2) = 0.7 - 0.8$), and a mixed, large and small, ELM regime with good confinement ($H_{98}(y,2) \sim 1$). The NBI power scan shows that ELM frequency is increased with increasing input power for large ELMs, which is a typical behavior of type-I ELMs. Type-I ELMs are appeared in a wide range of NBI power, $0.8 \leq P_{\text{NBI}} \leq 1.5$ MW, but in a limited density range ($0.35 \leq n_e/n_G \leq 0.45$). Intermediate ELMs are observed in a wider density range, $0.35 \leq n_e/n_G \leq 0.55$, than for type-I ELMs and we suspect that these ELMs might be type-III considering that the confinement quality is degraded compared to type-I ELMs and the relatively lower n_e/n_G value compared to the type-II ELMs. Mixed ELMs often occur in late H-mode and the density range is also wider, $0.38 \leq n_e/n_G \leq 0.57$, than that of type-I ELMs. Pedestal profiles of electron temperature (T_e) from the ECE measurement and toroidal velocity (V_t) from the charge exchange spectroscopy (CES) measurement show continuous build up on the low field side (LFS) during the inter-ELM period for type-I ELMy H-mode. However, the recovery of Ti pedestal from the CES after the ELM crash does not occur until it finally rises back up at the last stage of the inter-ELM period, i.e. $> 80\%$ of the ELM cycle. The estimated electron pedestal collisionality, $\mu_e = q_{95} R \epsilon^{-1.5} \lambda_{ee}^{-1}$, is quite low, $\mu_e \sim 0.2 - 0.5$, for the type-I ELMy H-mode. An ideal MHD stability analysis for ELMy H-mode plasmas is also carried out by the ELITE code in order to investigate unstable domains for the ELM occurrence, as well as its sensitivity to a range of estimated/measured profiles. In this work, the experimental investigations of the characteristics of the ELM and the pedestal structure during the ELM in the KSTAR H-mode plasmas will be reported, and the preliminary results from the ideal MHD analysis for ELMy H-mode plasmas will be presented.

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