SCALING OF ELM AND H–MODE PEDESTAL CHARACTERISTICS IN ITER SHAPE DISCHARGES IN THE DIII–D TOKAMAK*

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The characteristics of ELMs and the H–mode pedestal were studied in discharges with the same shape and aspect ratio as proposed for ITER, with *q* varying from 3 to 6 and a range of densities, plasma currents, and toroidal fields. Both Type I and Type III ELMs were observed. For Type I ELMs the energy loss per ELM scaled to ITER was 26 MJ, with 80% of this energy arriving in the divertor distributed over approximately a factor of two larger area than the steady state heat flux. This result is near the ITER limit of 1 MJ/m^2/ELM to the divertor.

The energy loss per ELM for Type III ELMs is approximately a factor of five less than for Type I ELMs, so that TYpe III ELMs would be desirable for ITER if they could be obtained in a regime of high energy confinement compatible with ITER operation. Two regimes of Type III ELMs were observed. One regime was observed at low density below a critical edge pressure gradient, the second regime was observed at high density below a critical edge temperature. The low pressure gradient Type III ELM regime does not appear to be compatible with high energy confinement enhancement due to resulting lower H–mode pedestal height.

The energy confinement in ITER may depend critically on the height of the H–mode pedestal. The energy confinement enhancement factor in these ITER shape discharges was found to be strongly correlated with the height of the H–mode pedestal [H $\propto$ (pedestal height)$^{0.5}$ $B_t^{-0.7} I_p^{-0.2}$]. The width of the edge steep gradient region scaled more weakly with current than would be expected for a ρ_{POL} scaling (width $\propto$ $T_e^{-0.5} I_p^{-0.5}$). The edge pressure gradient in most cases is consistent with the first stable limit for ideal ballooning, however in some cases ballooning mode second stability or other stabilizing effects may allow a larger edge pressure gradient and associated energy confinement enhancement.

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