Effect of Aspect Ratio on H-mode and ELM Characteristics

K.E. THOME, G.M. BODNER, M.W. BONGARD, M.G. BURKE, R.J. FONCK, D.M. KRIETE, University of Wisconsin-Madison — The H-mode confinement regime is achieved at near-unity aspect ratio ($A \leq 1.2$) in the Pegasus Toroidal Experiment via high-field-side fueling and low edge recycling. Ohmic H-mode is attained in both limited and diverted magnetic topologies. This regime is characterized by: reduced $D_\alpha$ emissions; increased core rotation; increased central heating; formation of edge current and pressure pedestals; and measured energy confinement consistent with the ITER98pb($y,2$) scaling. The H-mode power threshold, $P_{LH}$, behaves quite differently at low-$A$ when compared with high-$A$ operations. $P_{LH}/P_{LH,ITP08}$ increases sharply as $A$ is lowered and no difference in $P_{LH}$ for limited and diverted plasmas is observed at $A \sim 1.2$. No minimum in $P_{LH}$ with density is observed. Some of these results are consistent with the FM$^3$ model for the L-H transition.$^2$ Two classes of ELMs have been observed. Small, Type III-like ELMs are present at low input power and have $n \leq 4$. At $P_{OH} >> P_{LH}$, they transition to large, Type-I-like ELMs with intermediate $5 < n < 15$. The Type III ELM magnetic structures behave opposite that of high-$A$ plasmas, with $n$ much higher, presumably due to the naturally higher $J/B$ peeling mode drive at low-$A$. Long-sought measurements of the $J_{edge}(R,t)$ pedestal collapse during an ELM event show a complex, multimodal pedestal collapse and the subsequent ejection of a current-carrying filament.

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$^2$Fundamenski et al., Nucl. Fusion 52, 062003 (2012.)

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