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Attainment of High Density in DIII–D H–mode Plasmas,[1] M.A. MAHDAVI, R.J. LA HAYE, A.W. LEONARD, T.W. PETRIE, R.D. STAMBAUGH, W.P. WEST, General Atomics, R. MAINGI, L.R. BAYLOR, T.C. JERNIGAN, M.R. WADE, M. MURAKAMI, Oak Ridge National Laboratory, J.G. WATKINS, Sandia National Laboratories, J. CUTHBERTSON, University of California, San Diego — We report results of experiments designed to identify physical effects that define the tokamak n_e limit. Our results support the postulate that the n_e limit is defined by two generic groups of physical effects, power balance and MHD stability. Power balance limits of the core, boundary, and divertor plasmas result in a n_e limit that increases with heating power P, typically $n_e(\max) \propto P^{0.5}$. MHD modes, such as ballooning or neoclassical tearing, limit P from above (through transport) with $P_{\max} \propto I_P^2$. Thus the n_e limit increases with I_P. With typical H–mode density profiles, divertor and boundary plasmas dominate in the power balance. Using n_e profile control, by divertor pumping and pellet injection, we have increased the $\bar{n}_e$ relative to the edge values. As a result we have succeeded in increasing the H–mode n_e limit by a factor of two and up to the core radiative limit. Densities up to 1.5 times the Greenwald limit with $\tau_E \simeq 0.9 \times \tau_E$ (JET/DIII–D H–mode) have been obtained.

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