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[ ] Theory [X] Experiment

**Fast Plasma Shutdowns By Massive Hydrogen, Noble and Mixed-Gas Injection in DIII-D,*** J.C. Wesley, M.A. Van Zeeland, T.E. Evans, D.A. Humphreys, A.W. Hyatt, P.B. Parks, E.J. Strait, W. Wu, *GA*, E.M. Hollmann, J.A. Boedo, V.A. Izzo, A.N. James, R.A. Moyer, D.L. Rudakov, J.H. Yu, *UCSD*, T.C. Jernigan, L.R. Baylor, S.K. Combs, *ORNL*, M. Groth, *LLNL* — Experiments conducted with hydrogenic, noble and mixed ($H_2$ + Ar and $D_2$ + Ne) gases injected into H-mode plasmas are described. Gas species, quantity, delivery rate and intrinsic and added impurities (mixtures) all affect the disruption mitigation attributes of the resulting fast plasma shutdowns. With sufficient quantity, effective mitigation is obtained for all species. Optimal results for disruption and runaway avalanche mitigation are with $3x10^{22}$ He delivery in ~2 ms. This yields a favorable combination of moderately-fast current quench, high free-electron densities, ~$2x10^{21}$ $m^{-3}$, gas assimilation fractions ~0.3 and avalanche suppression ratios, $n_e/n_{RB}$ ~ 0.1. Favorable scaling of assimilation with increasing quantity is seen for all low-$Z$ gases. The experiments provide validation data for emerging MHD/radiation simulation models and insight about design of injection systems for disruption and avalanche mitigation in ITER.

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