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Temperature Measurements of Fusion Plasmas Produced by Laser-Irradiated D_2–^{3}He or CD_4–^{3}He Clustering Gases W. BANG, Los Alamos Natl Lab, T. DITMIRE, H. QUEVEDO, G. DYER, A.C. BERNSTEIN, M. DONOVAN, E. GAUL, UT Austin, M. BARBUI, A. BONASERA, K. HAGEL, J.B. NATOWITZ, Texas A&M — We report on experiments in which a mixture of D_2 or CD_4 clusters and ^{3}He gas was irradiated by a petawatt-laser pulse, generating nuclear fusion reactions such as D(d, ^{3}He)n, D(d, t)p, and ^{3}He(d, p)^{4}He. We measured the yields of fusion neutrons and protons from these reactions and found them to agree with yields based on a simple cylindrical plasma model. The plasma temperature was determined by two different methods. In the first, it was derived from time-of-flight data of deuterium ions ejected from exploding D_2 or CD_4 clusters. In the second, it was measured from the ratio of neutron yield to proton yield from D(d, ^{3}He)n and ^{3}He(d, p)^{4}He reactions, respectively. The temperatures determined by these two methods agree well, indicating (i) the ion energy distribution is not significantly distorted when ions travel in the disassembling plasma; (ii) the kinetic energy of deuterium ions, especially the hottest part responsible for nuclear fusion, is well described by a near-Maxwellian distribution.

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