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Increase in compact toroid mass by accelerator-region ionization of high-Z noble gas on CTIX[1] ROBERT D. HORTON, DAVID Q. HWANG, FEI LIU, SEAN HONG, RUTH KLAUSER, RUSSELL W. EVANS, University of California, Davis, DEAN A. BUCHENAUER, Sandia National Laboratory, Livermore, CA — A promising technique for runaway electron (RE) mitigation in large-tokamak disruptions is the injection of compact toroid (CT) plasmas of high atomic number. With sufficient kinetic energy density, high-Z CTs can reach the tokamak magnetic axis where RE effects are strongest. At CT velocities of 100 km/s or more, penetration to the axis occurs on a sub-millisecond time scale. In addition to reducing avalanche RE production by collisions, high-Z CTs can cool RE by bremsstrahung effects. From theoretical calculations, using Xe ions, bremsstrahlung cooling exceeds the effect of collisions at RE energy above about 10 MeV, a value expected to be well exceeded in large tokamaks. Past experiments on the CTIX compact-toroid injector have demonstrated increased CT mass using snowplow accretion of puffed noble gas by an initial hydrogenic CT. These experiments will be continued using a higher ratio of accreted high-Z plasma to H plasma, to maximize CT kinetic energy density. Results will be compared with a 1D model using external circuit effects, coaxial railgun kinetics, and ionization. The model will be used to predict performance of CT injectors of greater energy, suitable for RE suppression on mid-sized tokamaks.

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