Abstract Submitted
for the APR08 Meeting of
The American Physical Society

The generation of warm dense matter according to numerical modeling of thick wire heating[1] VOLODYMYR MAKHIN, MILENA ANGELOVA, THOMAS AWE, BRUNO BAUER, IRVIN LINDEMUTH, IOANA PARASCHIV, RICHARD SIEMON, University of Nevada, Reno — Rad-MHD modeling with MHRDR gives insight into a UNR experiment where 900-kA with a 70-ns rise time is driven through a 1-mm-diameter aluminum rod. The skin depth is smaller than the rod radius, so the aluminum is compressed by the pinch effect. However, experimentally the surface of the rod expands radially, even while the current is increasing. Expansion is expected and observed in thin wires, where magnetic forces are small compared with the pressure generated by Ohmic heating, but expansion is somewhat surprising in thick-wire experiments because magnetic forces are so strong that compression of aluminum to over twice normal density is expected. Simulations show expansion in these experiments results when the resistivity allows a small imbalance between magnetic forces and the pressure gradient, which allows material to slip through the magnetic field. Predicting the expansion is a challenge, because the expanding aluminum is primarily in the regime of warm dense matter, in which the ion-ion coupling parameter is larger than unity, and electrical resistivity estimates are difficult. In these simulations SESAME tables are used that include resistivity estimates from recent experiments and quantum-molecular-dynamic computations.

[1]Work supported by DOE grants DE-FG02-04ER54752 and DE-FG02-06ER54892.

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Date submitted: 05 Feb 2008 Electronic form version 1.4