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MHD Modeling of Vacuum Contaminant Plasma in Pulsed Power Experiments[1] CHARLES ELLISON, WILLIAM A FARMER, KEITH R. LECHIEN, JAMES H. HAMMER, Lawrence Livermore Natl Lab, ROBERT L. MASTI, Virginia Tech, JEFFREY B. PARKER, KURT TUMMEL, Lawrence Livermore Natl Lab — Pulsed power facilities enable a variety of high energy density physics experiments. Modeling the interactions between the low density vacuum plasma that forms in the powerflow region and the high density target is challenging, especially in a single-fluid resistive MHD framework. We present a collection of improvements made to a resistive MHD code to better capture the vacuum contaminant plasma dynamics and its interaction with pulsed power targets. The macroscopic impact of kinetic microturbulence can be approximated through reduced models such as anomalous resistivity; care should be taken to propagate modified collision frequencies across collisional transport processes in the strongly magnetized plasma. Additionally, we emphasize the importance of energy balance in the vacuum region to prevent unphysical runaway heating; for instance, density floors should be enforced in an energy-conserving manner and discretizations of the diffusive heat flux from the vacuum to the target must behave well in the presence of material interfaces and the high temperature, low density, strongly magnetized vacuum contaminant plasma.

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