Abstract Submitted for the FWS14 Meeting of The American Physical Society

Plasma Formation and Evolution on the Surface of Aluminum, Copper, Titanium and Nickel Driven by a Mega-Ampere Current¹ KEVIN YATES, BRUNO BAUER, STEPHAN FUELLING, VLADIMIR IVANOV, AUSTIN ANDERSON, JEFFREY MEI, TREVOR HUTCHINSON, University of Nevada, Reno, THOMAS AWE, Sandia National Laboratory, REBECCA BAUER, Stanford University — An important question for both fundamental science as well as applications is what state of matter is produced when a metal conductor is pulsed by an intense current. Aluminum, copper, titanium and nickel mm-diameter rods have been driven by a 1-MA, 100-ns current pulse. The intense current produces megagauss surface magnetic fields that diffuse into the load, ohmically heating the metal to temperatures that cause multiple phase changes. Because the radius is much thicker than the skin depth, the magnetic field reaches a much higher value than around a thin-wire load. With the novel "barbell" load design, plasma formation in the region of interest due to contact arcing or electron avalanche is avoided, allowing for the study of ohmically heated loads. Work presented here will show first evidence of a magnetic field threshold for plasma formation in titanium, copper alloys 145 and 101, nickel alloy 200, and compare with previous work done with aluminum. Copper alloys 101 and 145, aluminum 6061, titanium grade II, and nickel alloy 200 form plasma when the surface magnetic field reaches 3.9, 3.2, 2.2, 2.2, and 2.5 megagauss, respectively.

¹Work partially supported by DOE grants DE-SC0008824, DE-FC52-06NA27616 and Sandia National Laboratories PO1457882.

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Date submitted: 10 Oct 2014

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