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High Energy-Density Plasma Production from Plasma-Filled Rod-Pinch Diodes[1] J.W. SCHUMER, B.V. WEBER, D. MOSHER[2], J.P. APRUZESE, Plasma Physics Division, Naval Research Laboratory — The Plasma-Filled Rod-Pinch diode (PFRP) concentrates a 100-ns, 500-kA, >MeV electron-beam onto the tip of a tapered tungsten rod, generating a High Energy Density Plasma (HEDP). The HEDP (warm dense plasma) is created by deposition of a high-power-density (40 TW/cm^2) electron-beam into solid-density tungsten. The diode current and voltage has been shown to be controllably modified between 260 kA and 1.8 MV to 770 kA and 0.45 MV by increasing the initial plasma-fill density. At the time of peak energy density, analytic estimates using a 0-d self-similar MHD model predict a solid-density (20 g/cm^3) tungsten plasma with 25 eV temperature, 16 Mbar pressure, and 2.4 MJ/cm^3 thermal energy density prior to rapid plasma expansion (after about 10 ns). Temperature and ionization state increase after this time as the rod-tip rapidly expands. This PFRP approach may have advantages for HEDP research. Various applications include high-fluence flash radiography and the study of equation-of-state of materials. Current research results will be presented.

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[2]L-3 Communications, Reston, VA 20190

Joseph Schumer
Naval Research Laboratory

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