Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Deformation of Plasma-Facing Surfaces in the ZaP-HD Device[1]

ELEANOR FORBES, URI SHUMLAK, University of Washington — Experimental efforts at the University of Washington investigate the use of a sheared-flow-stabilized Z pinch as a platform for a compact fusion reactor. Developing the reactor design will require an understanding of the physical processes occurring at the interface between the plasma and the solid electrode. Recent experiments on the ZaP-HD Flow Z-Pinch Device have investigated the physics of energy transfer from the Z pinch to solid materials and the relationship between bulk plasma parameters and material deformation. Small, cylindrical targets of graphite and boron-nitride are placed on the Z pinch axis and exposed to a series of plasma pulses. Plasma ion temperatures are varied between 0.3 and 1.0 keV and total particle fluence to the targets from 10^{25} to 10^{26} m^{-2}. Target surfaces are analyzed with a scanning electron microscope and energy-dispersive x-ray spectroscopy. Stagnated plasma is found to limit the heat flux to the solid surfaces by slowing the diffusion of the magnetic field into the targets. The orientation of the solid surface to the plasma flow affects the surface topography seen in micrographs. These preliminary results provide a foundation for designing an electrode configuration for a higher-power sheared-flow-stabilized Z pinch device.

[1]Work supported in part by ARPA-e ALPHA and OPEN 2018 awards.

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Date submitted: 10 Jul 2020 Electronic form version 1.4