

## SHOCK MITIGATION STUDIES OF SOLID FOAMS FOR Z-PINCH CHAMBER PROTECTION

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Inertial fusion energy (IFE) power plant designs require some kind of shock mitigation to protect the chamber walls from the repetitive energy-producing nuclear reactions. Some designs incorporate flowing liquid sheets or jets that serve the multiple purposes of heat transfer, fuel production, and shock mitigation. The Z-Pinch power plant design is a high-yield, scaled-up version of current experiments with a target release energy of 3 GJ (or higher) at a low repetition rate ( $\sim 0.1$  Hz) in a low pressure ( $< 20$  torr) environment.

Chamber protection schemes include both liquid (side walls and floor) and solid (conical recyclable transmission line at top of chamber) lithium-compound foams. In the present experiments, the solid foam is being modeled with an Al-6061 foam and the shock attenuation/mitigation properties are measured. A highly instrumented shock tube, is used to study the deformation and shock pressure front history for different porosity foams subjected to a Mach 6 shock wave. The Mach 6 shock was formed with helium gas at a pressure of approximately 5.15 MPa in the driver and SF<sub>6</sub> in the driven section at 25 kPa. The pressure ratio across the shock was approximately 38. Figure 1 shows a side view of two layers (each 10.2 cm thick) of 40 PPI foam stacked together with a uniform one inch grid (A) that is crushed by a factor of two after being subjected to the shock wave. It was found that, the smaller the cell size of the foam, the more deformation occurred, and a more substantial pressure mitigation was observed. These experiments serve as a data base for comparison to numerical simulations using the ALEGRA code.



Figure 1. A) Image of the 40 PPI aluminum foam loaded in shock tube before test. B) Image of post shock compression of the aluminum foam.