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Isentropic Compression Experiments on the PTS Facility: Numerical Design, Simulation and Analyses

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The most powerful pulse power generator in China - the 10MA PTS facility was used to compress Al samples to pressures over 100GPa. Tens of isentropic compression experiments (ICE) have been conducted at the time of this conference, among which two distinct loading profiles were designed to get different compression processes. A smoothly increasing current was applied to get a shockless and adiabatic compression. A bisection current with a mild start and a sharp increase was designed to make an artificial 'turn-point'in the velocity history, which is used to verify the numerical code. The current profile, as well as the sample thickness, is optimized by a 1D MHD code 'MIC1D' coupled with a Full Circuit Model for the PTS facility ('FCM-PTS'). The geometry of the stripline loads is designed with a 2D magnetic field analysis code, to ensure a one-dimensional, planar load condition. Experimental results show that MHD simulations with the circuit model are able to show the main process of the loading history, and help to analyze and elucidate the phenomena contributing to the compression. The loading process shows a satisfying planar quality with a maximum relative velocity variance of 2%, and the rotation in the axial and horizontal direction is no more than 0.8 degree. In the center 5mm width, the edge effect is prevented from influencing the measurement over the loading time scales. Velocity histories for samples with same thickness suggest that the loading identity is better than 1.5%.

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