COMPARISON OF EQUATION OF STATE (EOS) MODELS FOR ALUMINUM

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Hydro codes which simulate laser plasma interactions require the use of EOS models describing the thermodynamic properties of both electrons and ions. Since the generally accepted tabulations of EOS such as SESAME do not separate electron and ion functions, methods to do this have to be found. We have compared several such methods for Al using the corrected Thomas-Fermi (TFC) model for the electrons and one of several models for the ions. The ionic models used were (1) perfect gas law, (2) Gruneisen solid-perfect gas interpolation, (3) separation of the ionic portion from the SESAME table by weighting with the average ionization ($\bar{Z}$). $\bar{Z}$ is obtained from a comparison between TFC theory and the average atom ionization model. Results show good agreement between methods (2) and (3) and it would appear, therefore, that SESAME tables can be used in this manner in laser plasma codes.

REFERENCE:

1. Szichman, H., Krumbein, A. D. and Eliezer, S., Bull. Amer. Phys. Soc. 28, 1124 (1983) and IA-1390, 1983.

AN ANALYTICAL MODEL FOR CREATION AND DECAY OF STRONG SHOCK WAVES CAUSED BY A TRAPEZOIDAL LASER PULSE

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An analytical hydrodynamic model for the formation and decay of strong shock waves (0.1 - 10 TPa) was derived by using self-consistent and well-defined assumptions. A trapezoidal pressure profile, as a function of time, applied to the target surface was used as the initial condition. This model permits the calculation of the pressure, velocity and acceleration of the shock front as well as the calculation of the pressure gradient immediately behind the shock front, as functions of time and position.

This model was applied to laser-generated shock waves with maximum intensities of 5×10^{13} and 5×10^{14} W/cm^2. Good agreement with previous computer simulations of solid-laser interaction was obtained.