knowledge of the recentered Hugoniot in the Lucite. To obtain this recentered Hugoniot, a Mie-Grüneisen equation of state was assumed in the Lucite.[58] When referenced from the foot of the initial Hugoniot, this takes the form

$$P(V,E) = P(S_0,V) + \frac{\Gamma}{V}(E - E(S_0,V))$$

$$= \frac{\Gamma}{V}(E - E(S_0,V_0)) + P(S_0,V) + \frac{\Gamma}{V}\int_{V_0}^{V} P(S_0,V)\, dV.$$

Collecting the volume-dependent-only terms into an arbitrary function gives

$$P(V,E) = \frac{\Gamma}{V}(E - E(S_0,V_0)) + f(V). \tag{4.5}$$

The energy jump condition on the initial Hugoniot is

$$E - E(S_0,V_0) = \frac{1}{2} P_H^0(V_0 - V). \tag{4.6}$$

Equation (4.5) must hold in particular on the initial Hugoniot. Therefore, by eliminating the energy expression between Equation (4.5) and Equation (4.6), one obtains

$$P_H^0(V) = \frac{\Gamma}{2V} P_H^0(V)(V_0 - V) + f(V).$$

Solving this for $f(V)$ and substituting back into Equation (4.5) gives the required Mie-Grüneisen equation of state,

$$P(V,E) = \frac{\Gamma}{V}(E - E(S_0,V_0)) + P_H^0(V)\left(1 - \frac{\Gamma}{2V}(V_0 - V)\right).$$

The energy jump condition on the recentered Hugoniot is

$$E - E' = \frac{1}{2}(P_H - P')(V' - V),$$

where $P' = P_H^o(V')$ and (P',V') represent the reference state for the recentered Hugoniot. When combined with the energy jump condition on the initial Hugoniot, this gives

$$E - E(S_o,V_o) = \frac{1}{2}P'(V_o - V') + \frac{1}{2}(P_H + P')(V' - V).$$

Combining this with the Mie-Grüneisen equation of state gives the required pressure on the recentered Hugoniot.

$$P_H(V) = \frac{P_H^o(V)\left[1 - \frac{\Gamma}{2}\frac{V_o}{V}\left(1 - \frac{V}{V_o}\right)\right] + P'\,\frac{\Gamma}{2}\frac{V_o}{V}\left(1 - \frac{V'}{V_o}\right)}{1 - \frac{\Gamma}{2}\frac{V_o}{V}\left(\frac{V'}{V_o} - \frac{V}{V_o}\right)} \tag{4.7}$$

To facilitate the calculation, a quadratic $P - \eta$ relation, $\eta = 1 - V/V_o$, was fit to the initial Hugoniot data in the range 10 to 60 kilobars. The result,

$$P_H^o(\eta) = 0.0197 - 0.223\eta + 1.51\eta^2, \tag{4.8}$$

was not forced through the origin. This allowed a better fit to the data in the region of interest. The quantity Γ/V was assumed constant. The value of Γ_o is difficult to assess from the literature. Acoustical data[59] give $\Gamma_o = 5.13$ while thermodynamic data[60] predict Γ_o approximately equal to 0.9. A gross linear fit to $D - u$ data, using the relation[61]

$$\Gamma_o = 2\frac{dD}{du} - 1,$$

yields a value of $\Gamma_o \simeq 0.8$. For this work, strains using a value of $\Gamma_o = 1.0$ are quoted. In practice, pressures of about 22 kilobars and 44 kilobars were obtained in the Lucite. Predictions of strain for $\Gamma_o = 5.13$ are 1% and 4% lower, respectively.