First, the copper-epoxy interface is a region of mechanical impedance mismatch through which the wave must travel. The resulting ringup in this region degrades the wave and lends a finite rise time to an initial step stress wave. A volume average density for the grid region predicts approximately a 50 nanosecond risetime for the stress profile. Quartz gauge records have verified this prediction. Second, the periodicity of the grid creates a corrugated wave effect due to the differing velocities and impedances in the grid materials. This effect will diminish with propagation distance from the grid due to Huygen's principle and due to nonlinearity and viscosity of the Lucite. Mineev et al.[52] have shown that in metals at high pressures the perturbation amplitude (in this case several times the grid thickness) drops to a small amount in less than several times the period of the grid. It has been assumed that this problem does not significantly affect the experimental results.

A technique capable of virtually eliminating the problems associated with the solenoid grid was invented while this work was in progress. The method requires simply replacing the first region of Lucite in Figure 4.3 with an aluminum oxide ceramic. The stress wave then propagates through aluminum oxide, the copper-epoxy grid, and Lucite, respectively. The material characteristics which make this technique successful are the mechanical impedance similarities of aluminum oxide and copper on one hand and Lucite and epoxy on the other along with the similar shock velocities of copper and epoxy. This peculiar combination of properties essentially creates a single interface of a somewhat ragged nature. An experiment was performed in which two quartz gauges analyzed waveforms propagating through identical geometries with the exception that one contained a copper-epoxy grid while the other did not. The waveforms were identical. A similar set of circumstances exists at the interface containing the pickup coil. This explains why no deteriorating effects are observed due to it.

4.2.2. Equation of State

The state of strain in the YIG was obtained in two ways. First, by use of measured projectile velocities, calculations through the intermediate materials into the YIG were made. Second, quartz gauge techniques were used.[53] In each case, equation of state information for the various materials involved was required.

A linear elastic equation of state was assumed for the YIG. This information has been collected, along with other required physical properties of YIG, in Table 2.

An aluminum oxide ceramic, Wesgo 995,[54] was used as a projectile face material. It was assumed to be linear elastic. The equation of state parameters used were[55]

$$D = 1.03 \text{ cm}/\mu\text{s},$$

$$V_o = 0.2615 \text{ cc/g},$$

and (4.3)

$$Z = 3.939 \text{ mB}(\text{cm}/\mu\text{s})^{-1}.$$

The Lucite used was Rohm and Haas, Type G. The material, obtained in 30 mil sheets, had a specific volume of 0.847 cc/g. A cubic P - u relation,

$$P = 0.336u + 1.12u^2 + 5.11u^3, \tag{4.4}$$

was fit by the method of least squares to data by Liddiard[56] and Barker and Hollenbach[57] in the region of 0 to 60 kilobars. The units are megabars, centimeters, and microseconds.

The stress wave at the Lucite-YIG interface undergoes a reflection with a jump in stress. To calculate this final stress state requires