B. Error Analysis

Contribution to errors in the analysis are found in (1) determination of the shocked state (P,V,T), (2) recording and reading of foil resistance, and (3) assumptions for the model describing the temperature coefficient of resistivity as a function of pressure.

Errors in determination of the shock P-V state originate in the empirical Hugoniot curve and in projectile speed. Hugoniot data for silver has no values below 200 kbar. Hence, the portion of the curve used is an interpolation between the ambient state and data from 200 to 500 kbar. The Hugoniot curve used was from the Zharkov and Kalinen equation of state fit to shock data and to Bridgman's hydrostatic P-V data (Sec. III.B). Disagreement with the fit of Rice, McQueen and Walsh (1958) was 0.0005 and 0.002 in V/V_o at 40 and 120 kbar, respectively. Uncertainties in the projectile speed are about ± 0.002 mm/μsec. This uncertainty implies random uncertainty in the sapphire longitudinal stress state of ± 1 kbar.

The sapphire Hugoniot itself is well established below 120 kbar and should be accurate to within ± 0.5 kbar below 60 kbar and to within ± 1 kbar in the 60-120 kbar range. A fit by Ingram and Graham (1968) for the sapphire Hugoniot $P_x = 444u + 13.6u^2$ was used (u in mm/sec, P_x in kbar). (The Hugoniot data are for 0°, 60°, and 90° orientations relative to the c-axis.)

So the final pressure state in silver is accurate to within ± 1 kbar random errors and ± 0.5 to 1 kbar systematic

errors. The compressed volume state could be subject to a random error of ± 0.001 in V/V_o and a systematic error of up to ± 0.003.

It is worth noting that rough sapphire Hugoniot data were also obtained in the present work. In the sapphire-on-sapphire impacts, shock transit time through the impacted disc was monitored on the silver foil, voltage-time record. Transit time was marked by a 10 millivolt artifact blip on impact and the resistance change in the silver on shock arrival at the foil. The data have scatter reflecting the accuracy of the timing information. However, the data are consistent with the Hugoniot fit for sapphire of Ingram and Graham.

The ratio of shocked foil resistance to unshocked resistance is subject to errors in calibrating the voltage drop across the foil as recorded on an oscilloscope and in the reading of photos of oscilloscope traces. Also, current is not exactly constant--current droop amounts to about 0.15% per microsecond. The baseline for the voltage change was corrected for this current droop.

In the calibration procedure a digital voltmeter was used to monitor the amplitude of calibration voltage pulses recorded on oscilloscopes (Sec. II.G). Several times in the course of experimentation the accuracy of the digital voltmeter was checked against a potentiometer or against another high precision voltmeter; accuracy was within 0.2%.

Accuracy of reading a given photo record is quite good. By accident one record was unknowingly reread three weeks after