IV. RESULTS OF EXPERIMENTS AND DISCUSSION

Impact experiments were performed on 19 silver foils. Care was taken to prepare the foils in a uniform and well-characterized manner, and the experiment was designed so as to ensure a state of uniaxial shock compression in the silver. Data output of the impact experiments was in the form of voltage-time profiles which were used to get the resistivity of silver under shock compression. After correcting for resistivity change due to shock temperature rise, the data were compared to resistivity expected under hydrostatic pressure; from this comparison, shock-generated point defect concentrations were determined (Fig. 4). Dislocation models for production of these defects were considered and a particular model of stress relaxation was developed to explain the results of the present work.

In some cases post-shot recovery and examination of foil pieces by optical and electron microscopy was possible. An annealing study of the resistivity was also done on one of the recovered foil pieces.

This chapter gives a detailed discussion of the above results as well as analysis of errors and possible spurious effects.

A. Summary of Impact Experiment Results

Data were obtained on the resistance changes in silver under shock compression in the pressure range from 27 to

119 kbar. Average initial temperature was 296.4 ± 0.7°K. The resistance change was found to be different for silver of two different purities; higher purity material had larger resistance changes. The resistance change also appeared to differ with annealing. Unannealed foils showed slightly higher resistance changes for a given shock pressure than did annealed foils of the same purity.

Shock results, after subtracting the resistivity changes due to shock temperature rise from the raw shock data (Sec. III.A.4), are significantly higher than hydrostatic results. The difference is attributed to generation of a high concentration of point defects by plastic deformation associated with uniaxial shock compression (see Table II). Both the amount of defects generated in all cases and the different amounts generated in different purity silver are difficult to understand. The higher defect resistivity observed in more pure silver is opposite to the results of quasi-static tensile deformation (Basinski and Saimoto, 1967).

Table I summarizes shot data. Experiments are presented in the order in which they were done. Shot number includes the year and the sequence number of the shot, in that year, for the facility. Foil type, state of anneal (A and UA signify annealed and unannealed, respectively), foil thickness, and resistance ratio follow. Resistance ratio is the ratio of foil resistance at liquid helium temperature and at room temperature, and gives a relative measure of impurity and imperfection content of the foils. Resistance ratios are also affected by scattering of