particularly valuable feature. For these experiments the most complete data were available from the quartz gauge at the rear of the specimen and the impact surface data were used to verify the rear surface data.

The stress-volume relation obtained is shown in Fig. 12. As is anticipated for a second-order phase transition, a well-defined change in compressibility is observed at 25 kbar. The cusp at 4 kbar is the Hugoniot elastic limit. In order to accurately determine the critical stress at the transition it was again essential to have the capability of achieving preselected impact velocities in the immediate vicinity of the transition

The results and their interpretation have been fully reported elsewhere [36]. In summary, however, it was possible to identify the sharp change in compressibility as a pressure induced ferromagnetic to paramagnetic transition with values in agreement with the extrapolation of previous lower pressure results. From the Ehrenfest relation, it was also possible to calculate the change of specific heat and thermal expansion at the transition from the measured change in compressibility and the pressure coefficient of Curie temperature.

Summary

The measurements described here were accomplished with various experimental arrangements chosen to obtain maximum utility from the capabilities, of the impact experiment. These capabilities taken individually are valuable and, more significantly, when combined, provide new experimental capability which is especially well suited for the study of the physical properties of solids under shock-wave loading. From a consideration of these measurements utilizing impact techniques and a comparison with measurements which seem possible with explosive loading experiments, the new experimental conditions which characterize impact experiments can be summarized as follows:

1 The impact experiment is a conceptually simple, easily repeated experiment which imparts well-defined input conditions to a specimen.

2 The impact experiment provides virtually continuous values of stress for application to a specimen.

3 By utilizing the symmetrical impact condition, experimental arrangements are possible which provide intimate connection between the measurement of the applied stress and the measurement of the stress induced physical property change.

4 The symmetrical impact condition and the velocity control permit more flexibility in choosing experimental arrangements which avoid the serious wave interaction problems inherent in free surface velocity experiments.

5 The lower limit of the stress range available for investigation is lowered to a few kilobars.

For the measurements performed to date the most useful and definitive data were obtained in the elastic range, which for brittle anisotropic materials extends to high stresses. Within the elastic range the one-dimensional strain configuration imposed by shock-wave compression allows determination of physical property changes resulting from large deformation along specific crystallographic directions. Unfortunately, except for compressibility determination, the experiments conducted for stresses in excess of the elastic limit have not yielded precise well-defined data. The desirable experimental conditions described above are also supplemented by practical considerations of safety and low electrical noise levels.

With these experimental conditions, it has been possible to measure physical properties under large compressions which complement measurements made under static high pressures. The measurements reported are extensive and diverse, and the techniques are well enough developed, such that it seems likely that impact techniques will play an increasingly important role in the study of the properties of solids under large compression.

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