however, limit the accuracy of some of the results for fast reactions which necessarily would involve trace quantities of the reactants. The deviations from constancy in the gas composition and its accurate determination, for example, is solely responsible for the general scatter of the results in the case of nitrogen and water mixtures. For oxygen mixtures where this problem did not exist, the scatter of the data is small and the accuracy of the relevant cross sections are higher (standard deviation = 10%). Thus, it is apparent that, for practical purposes, the technique which has been described is specially suited to ion–molecule reactions of cross sections less than approximately 100 Å². For faster reactions, the accuracy of composition determination is essential and probably requires the use of gas chromatographic equipment to supplement the analysis of the reactant gas.

ACKNOWLEDGMENTS

The author is indebted to Dr. W. Roth and Professor L. B. Loeb for their invaluable comments during the course of this work and to A. Friske for his assistance in experimental work.

THE JOURNAL OF CHEMICAL PHYSICS VOLUME 47, NUMBER 11 1 DECEMBER 1967

Compressibility of Solid Iodine*

R. Grover, A. S. Kusubov, and H. D. Stromberg
Lawrence Radiation Laboratory, University of California, Livermore, California

(Received 17 July 1967)

A large discrepancy exists between the recently published, static, x-ray-determined compressibility of solid iodine and previously published shock-wave compression data. In order to resolve this discrepancy, static piston displacement compression measurements have been made on iodine up to 40 kbars. The agreement of these measurements with shock data indicates that compressions calculated from x-ray data on iodine are in error.

In a recent paper on the compression of solid iodine at high pressures as measured by an x-ray method,[1] the existence of previously measured shock-compression data on iodine[2] was overlooked, and in consequence a striking disagreement with shock data was not realized. With the recent development of different, potentially more accurate experimental techniques of measuring P–V relations (x-ray[3] and ultrasonic methods[4]) it is important to evaluate the consistency of data from different techniques. In addition, these x-ray data raised serious questions about the interpretation of electrical conductivity measurements on shock-compressed iodine performed at this laboratory.[5] It is the purpose of this article to review the shock data, for the most part above 100 kbar, and to present new static compression data at lower pressures for the purpose of making a more complete evaluation of iodine compression data.

The data to be compared are summarized in Fig. 1. The room-temperature isotherm determined from x-ray density measurements lies considerably above the measured shock Hugoniot of iodine. It should be noted that x-ray densities for iodine were calculated from the shift of only two x-ray lines instead of the necessary three. However, the resultant uncertainty in the density determinations, according to Ref. 1, is likely to be less than the ±1% brackets drawn on the x-ray line. The shock data points show a larger than usual scatter in the P–V plot, but when they are displayed in the usual plot of the shock velocity U_s versus the velocity of the shocked material U_p, the relation is linear up to about 600 kbar. The raw shock data are contained in a report[6] issued by this laboratory and is a recalibrated version of the original data.[2] The Hugoniot curve in Fig. 1 is calculated from a least-squares fit to the velocity data and corresponds to the linear relation

$$U_s = 0.141 + 1.56U_p \qquad \text{(velocities in cm/}\mu\text{sec)} \quad (1)$$

for iodine at theoretical density, 4.95 g/cc. The relation (1) includes a correction for the 1% average porosity of the samples used in the shock-wave experiments. The shock speed (1) extrapolates to a value in excellent agreement with a bulk sound velocity of 0.140, calculated from measured longitudinal and transverse sound velocities, and is consistent with old values of the

* Worked performed under the auspices of the U.S. Atomic Energy Commission.

[1] R. W. Lynch and H. G. Drickamer, J. Chem. Phys. **45**, 1020 (1966).

[2] B. J. Alder and R. H. Christian, Phys. Rev. Letters **4**, 450 (1960).

[3] H. G. Drickamer, R. W. Lynch, R. L. Clendenen, and E. A. Perez-Albuerne, Solid State Phys. **19**, 135 (1966).

[4] O. L. Anderson, J. Phys. Chem. Solids **27**, 547 (1966).

[5] R. Grover (unpublished).

[6] *Compendium of Shock Wave Data*, M. van Thiel, Ed. (UCRL-50108, June 1966), distributed by C.F.S.T.I., Natl. Bur. Std. (U.S.), U.S. Dept. Commerce, Springfield, Va.