Shock Compression Experiments in Solids using High Explosives*

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(Received June 23, 1975)

Synopsis

Small-scale explosive plane wave generators, 40–78 mm in diameter, are developed to perform solid state experiments at shock pressures up to 1 Mbar. Techniques for determining the shock compression curve are described in detail, especially in the case where a phase transformation occurs at a high pressure.

I. Introduction

Since a shock compression technique was first applied to determine the equation of state for various metals at Los Alamos Scientific Laboratory[1], the technique has extensively been used as a standard method to generate ultrahigh dynamic pressures extending to a few Mbar and to measure the equation of state for condensed matters. Until now, various new techniques[2],[3] have been developed to perform basic solid state experiments, such as electrical resistivity[4] and optical absorption measurements[5]. Moreover, flash X-ray diffraction studies[6],[7] during shock compression have recently been attempted to show that the crystal is transformed to the hydrostatically compressed state in spite of the uniaxial shock compression.

The present authors have developed some small-size explosive devices for production of plane shock wave to perform 'university-scale' shock experiments at pressures up to 1 Mbar[8],[9],[10]. A small-size plane wave generator has been

* The **1642nd** report of the Research Institute for Iron, Steel and Other Metals.

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