peak compressive stresses as large as 100 GPa. Unfortunately, the value of such measurements has not been universally recognized and full exploitation of the available methods has yet to be achieved. The development of a true in-situ gauge having time-resolving capability of a few nanoseconds would greatly alleviate the difficulty presently encountered in interpreting wave profiles affected by their interaction with instrumentation or a stress-free surface. Abandonment of the idealized concept of a shock in favor of measurement and interpretation of structured waves opens the possibility of using rapid but continuous loading histories, provided suitable means of producing them are developed.

The problem of measuring the temperature of shock-compressed solids has a long history, but measurements of accuracy sufficient for the development of an equation of state have yet to be made. Such a measurement is of the highest value and any advance in this area most welcome. The apparent inhomogeneity of inelastic deformation suggests that the spatial variation of temperature must also be determined.

In addition to temperature measurement, other non-mechanical diagnostic methods are essential. X-ray diffraction patterns have been obtained for shock-compressed material by flash radiography, but it remains to develop the method to the point where it can be used routinely for investigation of either inelastic deformation mechanisms or structural phase transitions. The development of electrical, optical or other means of investigating the history of defect production during and immediately following passage of a stress pulse would greatly facilitate interpretation of a wide variety of other measurements. In most cases only a few (usually just one) of the available probes have been used to study a particular problem, but examination of past work shows that the most fruitful investigations have often been those in which various techniques have been brought to bear.

Many of the shock phenomena that have been observed remain open to interpretation and many, no doubt, remain to be discovered. At the upper extreme of the experimentally accessible range of compression, effects of the electronic shell structure of atoms on the compressibility of matter have been noted. Efforts to model these effects have been undertaken and, in some cases, are well advanced. Few experiments have been conducted, however, and work in this area seems both possible and useful.

The question of inelastic deformation mechanisms remains open. The well-defined and orderly macroscopic motion detected by instrumentation in current use does not extent to the microscale. On this level rapid inelastic deformation is characterized by the development of high concentrations of a wide variety of lattice defects and their effects are widely cited in this review. In some cases (not well delineated) states of matter unique to the shock-compression process are achieved and the interpretation of observations and the relation between matter in the shocked and quasi-statically compressed states is clouded. The interpretation of electrical and optical observations is particularly at issue. Because of their influence on interpretation of the entire range of shock-compression measurements, deformation mechanisms and defect production deserve priority attention and investigation by all available means. The strong influence of defects on electrical measurements suggests the latter as a probe in conjunction with careful time-resolved mechanical measurements involving both multiple-shock compression and decompression. Recently developed transverse-wave methods deserve full exploitation. Investigation of the structure and properties of material recovered after shock loading would also be helpful, but this work must be done under more carefully controlled conditions and using shorter duration stress pulses than has been customary and must be accompanied by time-resolved measurement of stress history. Examination of samples recovered after loading at various rates could prove informative.

Many shock-induced phase transformations have been observed, but the rapidity of their occurrence in comparison to the rates observed when they are produced by quasi-static compression, and the effect of shear stress, induced defects, and other peculiarities of the shock environment remain unexplained. Mechanisms of shock-induced conduction in dielectrics remain almost completely unexplored. An area combining complexities of mechanical behavior, phase transformation and electrical response is that of the response of ferroelectric ceramics to shock compression.

Investigations of the response of chemically-reactive media to shock compression (primarily detonation phenomena) have formed a branch of the subject under review since its earliest days, but most work has been concerned with the equation of state of the gaseous detonation products. Much less attention has been devoted to the growth of weak disturbances to steady detonation and few observations have been made of the structure of reactive waves. Considerable advance in this area could be expected to result from investigations in which refined theoretical models and numerical simulation of experiments are combined with time-resolved observations.

Most investigations of geophysical interest have involved the high pressures characteristic of deep-lying earth and planetary strata or meteoritic impact. Investigation of the complex behavior of both rock and soils at the lower stresses of interest in earthquake and mining problems is now possible and, indeed, results of such investigations are beginning to appear in the literature.

Finally, we note the often overlooked utility of the shock-compression method for examining mechanical, piezoelectric, dielectric, optical and other phenomena in the elastic range where its advantage lies with the precisely controlled states of uniaxial strain produced and the fact that the entire range of elastic responses is accessible. Work in this regime to study nonlinear transverse wave phenomena is to be encouraged.

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