which was not observed in the first work. Both measurements are consistent in the observation of a loss of splitting of the F band above the Hugoniot elastic limit such as would be caused by anisotropic compression. The loss of splitting corresponds to a reduction or loss of shear strength as observed in mechanical measurements (see section 3.4).

Gaffney and Ahrens [73G1] also measured an absorption spectrum for MgO at 46.5 GPa and found it to be featureless. They did find a greater opacity for the shocked material and upon unloading the opacity did not return to its preshock value. No evidence for color centers was found but, as observed by Kormer [68K5], electrons may be in excited states for the duration of the observation time.

The validity of interpretations of optical absorption spectra that neglect shock-induced defect structures is not clear. In particular, it appears that transparent dielectrics would be expected to undergo heterogeneous yielding and leave molten slip bands in the shock-loaded samples. The light beam would then be influenced by having traversed a highly heterogeneous path in addition to influences due to shock-induced defects. In spite of these difficulties in interpretation, the experimental capability seems well developed and persistent efforts should enable such complications to be evaluated.

Urtiew [74U1] has reported a loss of transparency in sapphire between 100 and 130 GPa, Kormer [68K5] reports a loss of transparency in LiF at 70 GPa and Chhabildas and Asay [79C2] have reported a loss of transparency in PMMA between 23 and 25 GPa where a polymorphic transition has been identified [78C2].

Observations of color centers synchronously with shock loading provides direct information on shock-induced defects. A provocative start on such work was reported by Yakusheva et al. [70Y1] who colored NaCl single crystals with ^{60}Co radiation then observed bleaching from yellow to white as shock waves of 3 and 18 GPa were passed through the samples. Such bleaching is thought to be connected with the shock-induced generation of large numbers of electron traps.

5.4. *Optical examination of recovered samples*

Previous sections of this review have emphasized the importance of shock-induced defects and pointed out that such defects are in transient states. Thus, examination of a shock-loaded sample minutes, hours or days after shock loading would not be expected to reflect defects as they existed at the time of shock loading. Nevertheless, their remanents are revealing and the formation of color centers from shock-induced point defects is of interest. Gager et al. [64G1] found the formation of 10^{14} and 10^{15} F-centers per gram of explosively-loaded MgO. Linde and Doran [66L2] report bleaching of F-centers in NaCl due to shock loading at 1.1 GPa. Additional exposure of shock-loaded crystals to white light and tungsten filament light caused further fast bleaching, broadening and formation of other bands. Such color center observations are promising as probes of shock-induced defects and the limited measurements to date indicate formation of shock-induced vacancies in high concentration.

6. Closing remarks

Shock compression of solids has now been a subject of scientific investigation for some thirty years. During this time the field has expanded from its original concentration on measurement of compressibility to the point where it now encompasses not only the wide ranging subject matter of this review, but also investigations of shock-induced phase transitions, mechanical behavior in both one- and two-dimensional motions, detonation phenomena, and a number of other topics. Great strides have been made in the development of experimental technique and instrumentation. Numerical methods have been devised for solving boundary and initial value problems involving most of the mechanical phenomena under investigation.

Studies of the response of solids to shock compression have led to a number of unique contributions associated with the large compressions and/or high temperatures achieved, the states of uniaxial strain produced, or the extreme rates of deformation encountered. At considerable risk of omission, we note several examples:

1. Discovery of the $\alpha \rightarrow \varepsilon$ phase transformation [55M1] and the $\alpha\gamma\varepsilon$ triple point [62J1] on the phase diagram for ion.
2. Direct synthesis of diamond from graphite [61D1].
3. Acquisition of numerous thermodynamic data at uniquely high compressions [77V1].
4. Calibration of standards for static-high-pressure measurements (see section 3.2.8).
5. Discovery of evidence for electronic transitions at large compression [67R3, 69A2].
6. Observation of an insulator-to-metal transition in iodine by mechanical measurement [77M6].
7. Measurement of physical properties under conditions of large uniaxial elastic strain. Examples include third- and fourth-order elastic constants [72G2, 72G3], second- and third-order piezoelectric constants [72G3, 77G6], shear deformation potentials in germanium (see section 4.9), and strain dependence of optical polarizability [79S4].
8. Investigation of mechanisms of inelastic deformation operative at high strain rate (see sections 3.3–3.7).
9. Observation of growth and decay of shock and acceleration waves [74N4].
10. Observation of shock-induced polarization of normal dielectrics (see section 4.5).

In addition to the specific results just cited, investigations of shock compression have inspired or supported research in a variety of other areas including theoretical determination of the thermodynamic properties of highly compressed matter and continuum-mechanical modeling of the behavior of viscoelastic, viscoplastic, composite, and porous solids at lower stresses. New concepts of fracture mechanics have been developed, new materials have been synthesized, and metallurgical phenomena including those encountered in explosive metalworking have been investigated. Conditions corresponding to those encountered in earth and planetary interiors and as a consequence of meteoritic impact have been reproduced for use in geophysical investigations.

The advent of gun technology has brought the shock-compression experiment from the explosive firing site into the laboratory, and has extended the range of accessible pressures. Recent developments in projectile acceleration and pulsed lasers promise further increase in the pressure attainable in a conventional laboratory environment to values where statistical models of the atom can be shown to be valid. When significant wave structure develops during compression to moderate pressures, or upon decompression, interpretation of experiments can be accomplished only if the relevant part of the stress or particle-velocity history is measured with good time resolution. Such measurements can be done routinely at low stress and have recently been made for pulses having