PHYSICS AND CHEMISTRY OF SOLIDS UNDER HIGH PRESSURE
DELFT, THE NETHERLANDS

FAR INFRARED SPECTROSCOPY AT HIGH PRESSURES*

John R. Ferraro

Argonne National Laboratory, Argonne, Illinois

ABSTRACT

The use of far infrared (FIR) spectroscopy at high pressures has had a rapid development since 1966. This development will be traced, and useful applications of the technique will be demonstrated. Instrumental difficulties will be discussed.

The applications of the technique have developed along four paths:

(1) The measurement of the pressure dependencies of the optical long-wave phonons in ionic, ~~or~~ pseudo-ionic and mixed crystals has been made. Examples of the solids used are the alkali

---

*Based on work performed under the auspices of the U. S. Atomic Energy Commission.

metal halides, alkaline earth metal halides, ZnS, ZnSe, ZnTe, CdS, CdSe, CdTe, and $KCl_{1-x}Br_x$, $ZnS_{1-x}S_x$, $CdS_{1-x}Se_x$. The Grüneisen parameters for the long wavelength optic mode phonons for these solids have been determined. Such studies are useful in attempting to learn more about the lattice dynamics of solids. The results, together with non-ambient temperature studies, are helpful in determining anharmonic interactions in solids, and testing certain models proposed for ionic solids.

(2) The measurement of the pressure dependencies of the ion-pair vibrations in non-aqueous solutions of ionic solutes. Such results have aided in studying and understanding the theory of solutions, and determining the short-range forces and dynamics of ions in solutions.

(3) The study of the pressure behavior of the low frequency modes in coordination compounds and inorganics has aided in making assignments in the FIR region. Certain vibrations are extremely pressure sensitive and may be identified by their pressure sensitivities.

(4) The study of the pressure effects of the low-frequency spectra of Ni(II) five coordinate complexes has resulted in a better understanding of certain John-Teller effects occurring in these solids. Pressure studies may be helpful in determining the stereochemistry around the central Ni(II) atom.