

ENGINEERING RESEARCH INSTITUTE  
THE UNIVERSITY OF MICHIGAN  
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Quarterly Report No. 6

INFRARED STUDIES OF CRYSTALS II

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Principal Investigator

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I. PURPOSE OF THE RESEARCH

The general purpose of this research is to complete the investigations started in May of 1951 under Contract DA 36-039 sc-56736 on the infrared spectra and structure of barium titanate, brucite, mica, gypsum, and diamond.

II. ABSTRACT

During the period covered by this report no new experimental work has been done. Instead effort has been concentrated in re-examining our results and previous conclusions in the light of new information which has recently become available from several sources on the structure of brucite and of diamond. The preparation of the work on these materials and also on gypsum for publication in scientific journals is proceeding.

## III. PUBLICATIONS

No publications have been made during the period covered by this report.

## IV. FACTUAL DATA

## A. BARIUM TITANATE AND MICAS

There is nothing new to report on this subject.

## B. BRUCITE

A careful re-examination of the structure of brucite by x-ray diffraction has been made by Dr. J. E. Petch of Hamilton College, Ontario, Canada. He has located the hydrogen atoms and finds them in the positions originally proposed by Bernal and Megaw. One of our crystals was lent to Professor Dudley Williams of Ohio State University so that he might employ the technique of nuclear magnetic resonance to locate the hydrogen atoms. Professor Williams confirms that the hydrogens are in the positions deduced from x-ray data. Neutron diffraction work at Oak Ridge also places the hydrogens in the same positions but the amplitudes of their motion appear to be very large. This means that the absorption bands found near 2.7 microns must be due to a very low frequency deformation motion of the hydrogen atoms superimposed on the stretching vibration, as suggested in our last report (No. 5). A similar conclusion has been reached by Dr. Hexter of Cornell University who had found a similar phenomenon in the spectrum of crystalline iodoform. Dr. Hexter has worked out a theory for this effect and its application to brucite will be studied in detail.

## C. DIAMOND

At the Oxford Conference on diamond held in June, 1955, much new information was presented on the results of bombarding diamonds with neutrons, electrons, and gamma rays. This work is now being studied in relation to our work on diamonds. In general, our conclusions appear to be confirmed but a number of points require further study. A systematic survey of the immense literature on diamond is being made to insure that all

relevant facts are at our disposal before preparing the final manuscript on diamond for publication.

D. GYPSUM

The manuscript of the paper on gypsum is now in draft form but requires some more modifications before it can be submitted for publication.

V. CONCLUSIONS

There are no conclusions to report other than those mentioned in the preceding section of this report.

VI. FUTURE PROGRAM

Work will continue on the preparation of manuscripts for publication and on a critical review of all our preceding work. If time allows and suitable personnel are available, some experimental work may be done to check doubtful points which are brought to light as the preparation of manuscripts proceeds.

VII. PERSONNEL

The following have been engaged on the work reported here:

Professor G. B. B. M. Sutherland (part time)

Mr. A. Dockrill (part time on model construction and preparation of diagrams)

Mrs. C. Walker (part time for typing and secretarial work)

Dr. R. T. Mara (15 August to 31 August, full time)

