NASA TECH BRIEF

Study Made of Far Infrared Spectra of Silicate Minerals

"Far Infrared Spectra of Silicate Materials for Use in Remote Sensing of Lunar and Planetary Surfaces," by James R. Aronson, Alfred G. Emslie, Ronald V. Allen, and Hugh G. McLinden, Final Report, Arthur D. Little, Inc., Cambridge, Mass., April 1966.

This report details the results and conclusions of a study of mineral spectroscopy in the far infrared region of the spectrum. The studies have been concentrated in the 15-200μ (667–50 cm^{-1}) region. The objectives of this work were to examine the problems and ascertain the feasibility of remote sensing of the composition of the Moon (or tenuous atmosphere planets, such as Mars) and evaluate the importance of the far infrared spectral region to this end.

The subject matter devolved into a series of smaller problem areas that were pursued concurrently to some degree. They are:

1. The degree of useful mineral spectroscopic information present in the far infrared and its characteristic similarities and differences from that obtainable in the near and middle infrared regions.
2. The effects of departures from optically smooth surfaces (principally to fine particulate surfaces) on the information content of spectra in general.
3. The nature of the ways in which the spectra of composite samples may be derived from the spectra of individual minerals and the resulting implications for disentangling composite spectra in practical cases.

For many years the field of mineral infrared spectroscopy has received considerable attention. Most investigators have concentrated their efforts in the near and middle infrared regions for which commercial instruments have long been available. The far infrared region (i.e., beyond $\approx 25\mu$), in this as in other areas of spectroscopic research, has been almost totally neglected. The reason for the neglect is simply the difficulties involved in working in this inherently low signal region of the spectrum. Most of these difficulties relate to the lack of good sources for the region. Despite this problem, general instrumental improvements in recent years have greatly increased the amount of far infrared research taking place. In addition, lasers have now been developed for a number of discrete wavelengths in the region. It is believed that the large amount of useful spectral information in this region makes it very important to include it in plans for remote sensing of lunar and planetary surfaces.

While the far infrared spectra to be obtained in remote sensing applications from lunar or planetary surfaces will be self-emission spectra, most of the work described here utilized reflection techniques. The reason for this is the comparative simplicity of the reflection method with available laboratory instruments due to the low power available in emission from cool samples.

Note:

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