Laboratory far-IR Spectroscopy of Phyllosilicates

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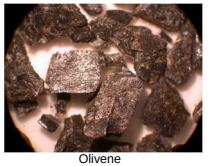
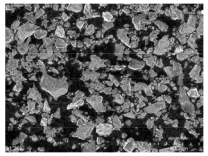
Introduction

Spectra of terrestrial phyllosilicate minerals have been measured and analyzed in the wavelength range 15 - 250 μm to support interpretation of returned data from far-IR space-missions such as the Herschel Space Observatory. Seventeen phyllosilicates were sampled from the American Museum of Natural History for diversity and astrophysical relevancy, based on their identification in Stardust, in stratospheric IDP samples, or in meteorites. These minerals include Serpentines, Smectites, Chlorites, Micas, and Kaolinites. Spectra of micron-sized powder suspensions in polyethylene pellets reveal prominent and characteristic far-IR features in the spectral range of 40 - 650 cm^{-1} (250 - 15.4 μm wavelength). A spectral resolution of 4 cm^{-1} adequately resolved all far-IR mineral features. Our laboratory far-IR spectral analyses of these phyllosilicate minerals is going to support the data returned by space missions such as Herschel Space Observatory because our spectral range and analyses cover the observation range of spectrometers such as PACS (spectroscopy range: 60 - 210 μm), an instrument of Herschel. All data files will be made available on-line via the planetary data system (PDS).

Experiment

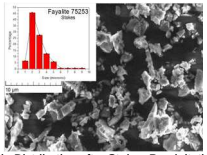

Olivene


Micronizing Mill


Coarse Grain Fayalite

Pelletier used for 2% mass mineral studies

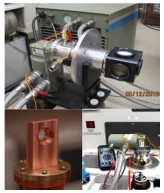

Mineral in Polyethylene Pellet



Grain Distribution after Stokes Precipitation


4.2K Bolometer (on right)


FTIR Spectrometer


Cryostat and Low T Sample Holder

Discussion

Phyllosilicates are formed by the interaction of anhydrous rock and water. A variety of phyllosilicates, such as smectite, serpentine, and micas, have been identified on astrophysical bodies such as Mars, interplanetary dust particles, asteroids, meteorites and disks of stars. The fundamentally important question of presence, distribution, and history of water makes it important to detect and identify phyllosilicates in dust populations and on the surfaces of planets, asteroids, and in comets. Phyllosilicates play important roles, for instance, as a possible source of water on Earth. Such studies can benefit from remote spectral sensing in many wavelength ranges, including the far-IR.

Acknowledgements

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References

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Results