
In order to provide a comparative baseline for a variety of remote compositional analyses, reflectance spectra from the visible through the mid-infrared have been acquired for representative mature soils from Apollo 11, 12, 14, and 16. Similar spectra were acquired for size separates for Apollo 11 soil 10084. The finest fraction dominates both the visible and the midIR. Apollo 16 soils exhibit the shortest Christiansen Frequency (CF), a trend consistent with their feldspathic character. Finer soil size fractions, however, are observed to have longer CF, perhaps due to the effective strength of the Reststrahlen bands (RB). Altogether, features in the near-infrared are currently the most readily interpreted in terms of mineral composition and space weathering effects.

A brief survey of lunar mid-infrared properties was presented by Nash (1). Reflectance spectra of lunar samples presented here were acquired with the RELAB bi-directional spectrometer (0.3-2.5 μm) and bi-conical Nicolet 740 FTIR spectrometer (1 - 25 μm). The data were spliced, typically at 2.4-2.5 μm, to form a composite spectrum. Spectra of bulk samples of mature soils 10084, 12070, 14259, 62231 (2) are shown in Figures a and b and spectra of size separates and agglutinates of 10084 (3) are shown in Figures c and d.

When electromagnetic radiation interacts with solid materials it is affected by the natural frequencies of the material which often embed diagnostic features in the spectrum. Absorption features are, however, significantly modified by the physical state of the material and the number of interactions an average photon incurs. For lunar materials, and the terrestrial planets in general, three parts of the spectrum can be discussed based on the type of electromagnetic interactions that occur. The pertinent characteristics of the lunar soils and separates of Figures a - d are:

Visible to near-infrared (0.3 - 2.5 μm) Radiation from the Moon is reflected solar radiation. Light interaction with the surface involves volume scattering where radiation is transmitted through particles and is typically scattered by multiple interactions. These spectra are dominated by a red continuum (increasing reflectance toward longer wavelengths) principally the result of cumulative particles and is typically scattered by multiple interactions. These spectra are dominated by a red continuum (increasing reflectance toward longer wavelengths) principally the result of cumulative space weathering (3) and superimposed Crystal Field absorptions (4) diagnostic of pyroxene near 1 and 2 μm (high Ca pyroxenes exhibiting slightly longer wavelengths). Although the larger particles exhibit stronger absorptions, the finest fraction dominates the bulk optical properties (3).

The RB molecular absorptions between 9-12 μm are so strong that noted for Antarctic sediments (6). For such fine particles, this may be an apparent shift due to the weaker effects of the RB absorptions and their wings at shorter wavelengths. Although these RB features of soils between 9 - 12 μm appear to be regular, their assignment and the relative abundance of specific species has not been determined with confidence.

Visible to Mid-Infrared Lunar Spectra: C.M. Pieters