SPECTRAL REFLECTANCE PROPERTIES OF CI1 CARBONACEOUS CHONDRITES

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Introduction: CI carbonaceous chondrites exhibit a range of spectral properties, and identification of CI parent bodies remains unresolved. To better address this issue, we have measured reflectance spectra (0.35-2.5 μm) of some CIs under a range of conditions as well as re-examined existing CI spectra.

New reflectance measurements of <125 μm powdered samples of Alais and Orgueil were conducted at the University of Winnipeg PSF [1]. Measurements were conducted at standard viewing geometry (i=30°, e=0°), over a range of phase angles (where either i or e were varied), with a bifurcated probe (where i=e), and for regularly packed, densely packed, and fluffed samples. These data were supplemented by spectral measurements of CI constituent phases, as well as various relevant mineral mixtures (e.g., carbon black + serpentinite). The new measurements extend existing results to encompass more diverse viewing geometries and packing conditions, providing new insights into the causes of spectral variations.

Results: Previous spectral studies of CIs [e.g., 2-5] have shown that their spectra vary from red- to blue-sloped with variable evidence of resolvable absorption bands. The new measurements confirm the variability of CI spectral slopes: Alais is strongly red-sloped while Orgueil is blue-sloped. Both CI spectra exhibit a shoulder near 0.5 μm attributable to Fe^{3+} (spin-forbidden) crystal field transitions, and a broad absorption in the 1.90-1.97 μm region attributable to H_2O in the phyllosilicates. Orgueil also exhibits a broad, weak region of absorption between ~0.9 and 1.2 μm that can be assigned to Fe^{2+} spin-allowed crystal field transitions in the phyllosilicates ± magnetite.

Phase angle effects. The effects of phase angle variations are somewhat variable. Increasing emission angle (i=0°) results in an increase in overall reflectance and a more red-sloped spectrum. Increasing incidence angle (e=0°) shows more variable and less systematic behavior. Phase angle measurements where i = e indicate that increasing phase angle results in an increase in overall reflectance but no significant change in overall slope.

Packing effects. For measurements conducted at i=30° and e=0° indicate that the highest overall reflectance is associated with "regularly" packed samples (gently tamped in a sample cup with a flat surface) as compared to the same sample after: (1) the surface has been fluffed with a needle, or (2) compressed into the sample cup and a flattened sample surface. are more variable.

Summary: These data confirm that the spectral properties of CIs, particularly overall reflectance, can be affected by many factors, including viewing geometry and the physical state of the sample. These effects must be accounted for in comparing laboratory and telescopic spectra in the search for CI parent bodies.

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