μ-FTIR mapping of fayalitic olivine fabrics in carbonaceous chondrites

V. E. HAMILTON[1]

[1]Southwest Research Institute, 1050 Walnut St., #300, Boulder, CO 80302 USA; hamilton@boulder.swri.edu

Mapping μ-FTIR spectroscopy (4000 – 400 cm^{-1}, 2.5 – 25 μm) is an underutilized technique for the *in situ* measurement of mineralogy in solar system materials. It permits direct comparison with chemical mapping methods, as well as the ability to study crystallographic orientation and directly measure hydration. In addition, infrared (IR) spectroscopy is a remote sensing technique that bridges the worlds of meteoritics and planetary exploration.

A question to which the application of mapping μ-FTIR spectroscopy may be particularly well suited is the origin of *c*-axis elongated, fayalitic olivine in CV, CK, and CO carbonaceous chondrites (CC). These olivines have been hypothesized to form in either the solar nebula or by alteration on the parent body. Using electron backscattered diffraction (EBSD), [1] examined crystallographic orientation (fabrics) in lath-shaped, fayalitic matrix olivines in Allende (CV3). The fabrics observed in matrix and adjacent to dark- and refractory inclusions (DI and CAI) imply a common deformational origin on the parent body. [1] interpret their data as suggesting that the fayalite was already present at the time of deformation and unlikely to have formed by hydration/dehydration processes. Because μ-FTIR spectroscopy is also sensitive to crystallographic orientation of minerals we are investigating the applicability of its use for characterizing the orientation of fayalitic olivine in CC.

We have previously identified the potential for IR spectra of matrix olivines in Allende to exhibit features indicative of preferential orientation [2] based on notable differences from spectra of randomly-oriented, coarse granular olivine of comparable solid solution composition. In this work, we are using the observations of [1] as a guide to a more focused spectral analysis of fayalitic olivines in the matrix as well as adjacent to chondrules and CAI in our sections of Allende. We will perform comparable analyses on maps of other petrologic type 3 CC exhibiting similar matrix olivine features (e.g., ALH 83108 (CO3.5), Isna (CO3.8), Vigarano ($CV3_{red}$) Grosnaja ($CV3_{oxB}$), and Mokoia ($CV3_{oxB}$)[3]) to determine how similar these are to the observed fabrics in Allende, which may help place additional constraints on the formation of fayalitic olivine.

[1] Watt, L. E. et al. (2006) *MaPS 41*, 989-1001. [2] Hamilton, V. E. and H. C. Connolly Jr. (2012) *LPSC 43*, #2495. [3] Hamilton, V. E. et al. (2018) *LPSC 49*, #1753.