FT-IR microanalysis of mineral separates from primitive meteorites: techniques, problems and solutions

Conference or Workshop Item

FT-IR MICROANALYSIS OF MINERAL SEPARATES FROM PRIMITIVE METEORITES: TECHNIQUES, PROBLEMS AND SOLUTIONS

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Introduction: We compared several methods of infrared micro spectroscopy using an FT-IR microscope and workbench. This is part of a project to assemble a database of infrared and optical spectra from mineral separates from meteorites, for comparison with astronomical data. Since we usually have to work with small amounts of material (original grain sizes often <50 m), special sample preparation and analytical procedures have to be applied.

Techniques: For comparison, we mostly measured powdered synthetic standard olivine with varying forsterite contents (Fo_{00}, Fo_{20}, Fo_{50}, Fo_{80} and Fo_{100}) with all these various techniques [1].

The Perkin Elmer Spektrum One workbench was used for the conventional transmission analyses, using a pressed pellet consiting of KBr and small amount of sample. The workbench was also used for diffuse reflectance measurements, where sample material was analysed on a metal coated abrasive disc. For actual microanalyses, we used the Perkin Elmer AutoImage FT-IR Microscope. Here infrared spectra have been taken from powdered material as well as *in situ* of polished thin sections.

We compared powders placed either on KBr-discs or in a diamond compression cell. Also spectra of forsterites in demounted thin sections have been measured *in situ* using the transmission mode. The spectral resolution used was $4cm^{-1}$.

Results: Tab.1 shows the preliminary results of Fo_{80} analyses, using the average position of three characteristic bands (SiO_4 stretching modes $_1$ and $_3$).

In wave numbers (cm^{-1})	Band1	Band2	Band3
Transmission Pellet	977.1	884.8	835.7
Diffuse Reflectance	973.9	883.5	836.3
Diamond Compression Cell	978.3	889.7	839.4
Transmission (Microscope)	974.7	886.6	835.0
Transmission (Fo_{74}) (Thin Section)	968.5	893.3	838.6
Literature (Fo_{77}) [2]	984.3	885.7	840.3

Tab.1: Average position of three important mid-infrared bands of Fo_{80} olivine, obtained with several different techniques (in wavenumbers cm^{-1}). Note that the olivines from the *in situ* transmission and literature analyses have slightly different forsterite compositions.

Generally, the band positions of the Fo_{80} powder measurements in this study show only small differences. The range is between $6.2cm^{-1}$ and $4.4cm^{-1}$. This is close to the spectral resolution of $4cm^{-1}$. The *in situ* transmission measurements show a more significant divergence from the powders for band1 and band3.

The results from earlier studies [2] are similar, but in two cases slightly higher than the results of this study.

Reasons for these variances are probably effects of sample thickness or incomplete coverage of the aperture (see [3])

References: [1] Morlok A. et al 2004 in prep. [2] Koike et al. 2003. *Astronomy&Astrophysics* 399. [3] Hofmeister et al 2000. Proceedings of the Conference"ISO beyond the Peaks" ESA SP-456)