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 (Fo00, Fo20, Fo50, Fo80 and Fo100) with all these various techniques [1].

The Perkin Elmer Spektrum One workbench was used for the conventional transmission analyses, using a pressed pellet consisting 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 de-mounted 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 Fo80 analyses, using the average position of three characteristic bands (SiO₄ stretching modes 1 and 3).

<table>
<thead>
<tr>
<th>Band</th>
<th>Transmission Pellet</th>
<th>Diffuse Reflectance</th>
<th>Diamond Compression Cell</th>
<th>Transmission (Microscope)</th>
<th>Transmission (Fo74) (Thin Section)</th>
<th>Literature (Fo77) [2]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>977.1</td>
<td>973.9</td>
<td>978.3</td>
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<td>893.3</td>
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<td>836.3</td>
<td>839.4</td>
<td>835.0</td>
<td>838.6</td>
<td>840.3</td>
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</tbody>
</table>

Tab.1: Average position of three important mid-infrared bands of Fo80 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 Fo80 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]).