16-100μm Spectra of Crystalline Silicates at 2K and 295K

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Far-infrared laboratory spectra are normally taken at room temperature. However, the grains responsible for the silicate emission bands observed in ISO SWS and LWS spectra are at temperatures below $\sim$ 150K. Therefore we have conducted a comparative study of the absorption spectra of crystalline olivines, pyroxenes and hydrous silicates at 1.5K and at room temperature (295K). In order to resolve fine structure at 1.5K the resolution must be increased to 0.25cm^{-1} whilst 2cm^{-1} resolution is adequate at 295K.

Preliminary analysis suggests that:

bands are shifted to shorter wavelengths at 1.5K. In forsterite the magnitude of the shift increases with wavelength e.g. 49.7μm (295K) $\rightarrow$ 49.3μm (1.5K); 69.6 (295K)$\rightarrow$ 68.8μm (1.5K). However in pyroxenes and hydrous silicates the behaviour of the shift is more complicated since neighbouring bands are shifted by different amounts.

many bands become deeper and narrower at 1.5K. In forsterite the 68.8μm (1.5K) band is 2-3 times as deep as its 69.6 (295K)μm counterpart. There is also evidence that some bands split at at cryogenic temperatures. Once again this behaviour appears to vary between mineral groups.