

**MOLECULES OF CARBON OXIDES IN CORDIERITE CHANNELS:
A SPECTROSCOPIC STUDY**

Khomenko, V.¹ & Langer, K.²

¹ Institute of Geochemistry, Mineralogy and Ore Formation, Ukrainian Academy of Science,
pr. Palladina 34, 03142 Kyiv, Ukraine

² Institut für Angewandte Geowissenschaften, Technische Universität Berlin,
Ernst-Reuter-Platz 1, D-10623 Berlin, Germany
e-mail: vladkhom@hotmail.com

The spectroscopic micro-FTIR technique has been used to examine a series of natural cordierite samples of different geological environments and chemical composition. Polarized single-crystal spectra were measured in the range 3000-2000 cm⁻¹ on oriented polished platelets (100), (010) and (001). The behaviour of CO₂ and CO molecules, as well as other minor volatile components trapped in the structural channels of the cordierites, was studied in the temperature range 80-700 K. An experiment on degassing was performed by heating a cordierite sample at a temperature of 1250 K during 10 hours. Location and orientation of ¹²CO₂, ¹³CO₂ and CO molecules in structural channels, as well as the character of CO₂ libration were determined. Polarization-dependent complex sets of valence vibrations were identified for CO₂ molecules. Most intense bands were measured in *a*-polarization at 2348 and 2283 cm⁻¹, the latter was assigned to ¹³CO₂. δ¹³C values were calculated for different samples from the *A*₂₂₈₃/*A*₂₃₄₈ band intensities ratio and compared with published data. A weak CO band at 2135 cm⁻¹ is detected in samples of CO₂-enriched cordierites from granulites. The main *a*-polarized ¹²CO₂ band at 2348 cm⁻¹ becomes narrower and exhibits fine structure at LN₂ temperature: an additional band at 2330 cm⁻¹ and a shoulder at 2352 cm⁻¹ appear in the spectra. The molecular axes of the CO₂ and CO molecules are parallel to the *a*-axis of cordierite crystals. Only trace amounts of CO₂ oriented parallel to the *c*-axis were found in some samples. This confirms recent results of KOLESOV & GEIGER (2000). The complex spectral shape of CO₂ band envelopes in *a*- and *b*-polarizations is very likely due to a rotational motion of the carbon oxides molecules. Repeating spectral measurements after heating confirm the weak mobility of CO₂ and CO molecules in the channel sites at temperatures below 700 K and the full degassing of cordierite after heating at 1250 K. Differences in the carbon oxides spectra observed in cordierites from genetically different environments, including variations in CO/CO₂ ratio and in the δ¹³C of captured carbon dioxide molecules, are discussed.

References

KOLESOV, B.A. & GEIGER, C.A. (2000): *Am. Mineral.*, **85**: 1265-1274.