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LETTER

Carbon oxides in cordierite channels: Determination of CO_2 isotopic species and CO by single crystal IR spectroscopy

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ABSTRACT

Polarized IR-absorption spectroscopy in the range 7000–1000 cm^{-1} has been used to examine natural cordierites of different geological origin and chemical composition. In the literature there is much information on H_2O and CO_2, as channel constituents in cordierite, though no isotopic species of these molecules have been distinguished. We newly identify $^{12}C^{16}O_2$, $^{13}C^{16}O_2$, $^{12}C^{16}O^{18}O$, as well as $^{12}C^{16}O$ from the single-crystal polarized IR spectra. The vibrational parameters, the temperature behavior, and polarization dependence of the identified carbon oxide molecules were studied in the temperature range 80–700 K. The molecular axes of the CO_2 and CO species are parallel to the *a*-axis of cordierite crystals. Repeated spectral measurements after heating confirm the low mobility along the *c*-axis channels of CO_2 and CO molecules at temperatures below 700 K. On the other hand, vibrational frequencies of CO_2 and CO species obtained in this investigation are close to those of the vapor phases, suggesting that the molecules are loosely bonded in the large cavities of the silicate framework.