

LETTER

In-situ infrared spectra of OH in olivine to 1100 °C

XIAO-ZHI YANG^{1,2,*} AND HANS KEPPLER¹

¹Bayerisches Geoinstitut, Universität Bayreuth, D-95440 Bayreuth, Germany

²CAS Key Laboratory of Crust-Mantle Materials and Environments, School of Earth and Space Sciences, University of Science and Technology of China, Hefei 230026, China

ABSTRACT

The infrared spectra of hydrated San Carlos olivine were measured from room temperature to 1100 °C at 1 bar using a heating stage. The spectra show that even at the highest temperatures studied, there are still two well-separated groups of OH bands centered between 3200 and 3300 cm^{-1} and between 3500 and 3600 cm^{-1} , respectively. The distinction between “group I” ($\nu > 3450 \text{ cm}^{-1}$) and “group II” bands ($\nu < 3450 \text{ cm}^{-1}$) is therefore still meaningful at upper mantle temperatures. However, a prominent band at 3612 cm^{-1} already loses intensity by 100 °C and nearly disappears by 300 °C, suggesting that it corresponds to a particular H environment that only formed during cooling of the sample and that it is not stable at high temperature. A similar band is prominent in many olivines from mantle xenoliths and previously it has sometimes been assigned to OH groups surrounding Si vacancies. We show that structural models of water dissolution in olivine derived from infrared spectra at ambient conditions may not be fully applicable for the upper mantle.

Keywords: Water, olivine, infrared spectra, hydroxyl groups, defects