Integral molar absorptivities of OH in muscovite at room temperature to 500C by in situ high-temperature IR microspectroscopy

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Dehydration of hydrous minerals and melts is one of the important elementary steps in the dynamic process of the earth's interior. For better understanding of dehydration processes, behavior of water in hydrous minerals under in-situ conditions should be investigated. Muscovite was selected here as a representative hydrous mineral and behavior of OH in this mineral was studied by in situ high-temperature IR microspectroscopy. We report developments of quantitative measuring methods for OH in muscovite, and changes with temperature of the OH band and its integral molar absorptivity.

First, molar absorptivities of OH in muscovite were determined at room temperature by IR spectroscopy. Muscovite (Ishikawa, Fukushima) flakes were cut with a punch into about 3mm in diameter. The sample thicknesses were measured with a Laser Scanning Confocal Microscope to be about 2 to 10 micrometers. Peak heights (absorbance) and areas (integral absorbance) were determined after a baseline correction on transmission spectra by FT-IR microspectroscopy at room temperature. Both the peak height and area showed linear relations with the sample thickness. The slopes of the fitted lines can be used to calculate linear and integral molar absorptivities of OH in muscovite by using a molar concentration of OH in Lambert-Beer's law.

Next, changes in the OH absorption band on heating and cooling were examined from room temperature to 500C by using a heating stage set in the IR microscope. The peak position of OH in muscovite shifted to lower wavenumber from 3627cm^{-1} at room temperature to 3618 cm^{-1} at 500C. The peak height and area decreased linearly on heating, and recovered on cooling. These data will provide the basis for a quantitative treatment of dehydration kinetics of muscovite by in situ high-temperature IR microspectroscopy.