

Optical Absorption Spectroscopy of Local Structure and Kinetic Processes in Minerals

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Optical spectroscopy is sensitive to the local electronic environment and the local coordination geometries of chemically selected ions. Therefore, information on local structure such as disorder, impurities, point defects and their local environments in minerals can be revealed using optical absorption spectroscopy with time and space resolution. By combination with special techniques, e.g., temperature- or oxygen partial pressure- jumps, kinetic processes involving absorbing species can be monitored under in-situ conditions.

In this presentation we demonstrate the applications of optical absorption spectroscopy into minerals at room temperature and at high temperatures. Examples presented concern apatite and olivine crystal structures, i.e., biological and geological apatites and synthetic cobalt-containing olivine single crystals. For the apatite structure, infrared vibrational spectroscopy was used to study the local environment of CO_3^{2-} and OH^- ions as well as their concentration variations upon heating. In the case of cobalt-containing olivine, the mechanism and kinetics of cation site exchange on two crystallographically distinct octahedral sites were investigated by means of UV-Vis-NIR spectroscopy combined with temperature-jump technique. Further more, cation diffusion coefficient in olivine structure has been derived from the optical kinetic parameters.

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