D_2O absorption on K-rich feldspar

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K-Feldspar ($KAlSi_3O_8$) minerals play an important role in Earth's climate and the environmental sciences owing to its high efficiency in an ice nucleation[1], therefore a fundamental understanding of water interaction with feldspar is absolutely necessary. Up tp now infrared (IR) spectroscopy was employed as a sensitive probe to investigate the ice structure and its bonding states, since both crystalline and amorphous phases have own distinctive vibrational spectrum with subtle differences.[2] Here we presented results of the IR spectroscopy study of D_2O absorption on K-rich feldspar substrate starting from monolayer coverages up to thick water/ice multilayers. Two specific K-rich feldspar samples were used in our experiments: one belongs to orthoclase with is monoclinic lattice, while the second belongs to microcline class with the triclinic lattice. Dosing of D_2O on feldspar samples and IR spectra measurements were performed at low temperatures (118 - 150 K). It was found that growth of ice clusters is limited by the mobility of water at low temperatures, resulting in a formation of amorphous solid ice. However, the discrepancy between orthoclass and microcline samples causes different ice structures. The more ordered ice structures can be formed on surfaces of the first system in comparison with D_2O growth on the second one. The structural transition of the unstable amorphous solid ice towards crystalline ice can be monitored as the sample is annealed. From annealing experiments it was established that the structures of the crystalline ice formed at high temperatures are thermodynamically stable.

References:

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