**D$_2$O adsorption on K-rich feldspar**

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**Introduction**

K-rich feldspar (KAlSi$_2$O$_8$) minerals play an important role in Earth’s climate and the environmental sciences owing to its high efficiency in ice nucleation, therefore a fundamental understanding of water interaction with feldspar is absolutely necessary. Up to now infrared (IR) spectroscopy was employed as a sensitive probe to investigate the ice structure and its bonding states, since each of crystalline as well as amorphous phases has its own distinctive vibrational spectrum with subtle differences. Here a novel UHV-FTIRS apparatus was employed to study D$_2$O adsorption on two specific K-rich feldspar samples (orthoclase and microcline) starting from monolayer coverages up to thick water/ice multilayers. It was found that the discrepancy between orthoclase and microcline samples causes different structures and thermal behavior of the absorbed D$_2$O.

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**Experimental details**

1. The K-rich feldspar samples are (Na, K)AlSi$_2$O$_8$ with prevailing K concentration.
2. The K-rich feldspar investigated in our experiments are microcline/orthoclase (010), (001).
3. Microcline and orthoclase are referred as MC and OC in the following context.
4. IRRAS measurements were performed in the UHV-apparatus “Theo” with a base pressure of $10^{-10}$ mbar.

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**D$_2$O on K-rich feldspar (001) surfaces at 118 K**

- 2728 cm$^{-1}$: dangling O-D band;
- 2200 - 2700 cm$^{-1}$: hydrogen-bonded O-D stretching vibration mode;
- The distinct line shapes of two spectra suggest D$_2$O adopts different structures on MC(001) and OC(001) surfaces.

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**Conclusions**

- Growth of ice clusters at low temperatures (118 K) results in amorphous solid ice and some perturbed state of the polycrystalline reference state;
- The structural transition of amorphous ice towards crystalline ice can be monitored as the sample is annealed;
- Crystalline ice can be formed for increasing D$_2$O coverages on K-rich feldspar at high temperatures (150 K);
- Annealing experiments show that the structures of the crystalline ice are thermodynamically stable.

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**References**


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