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# Investigating K-Feldspar Dissolution Dynamics Using Quartz Crystal Microbalance and Surface Charge Measurements

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Feldspars constitute nearly 50% of the Earth's crust and are among the most abundant mineral groups in potential deep geological repository host rocks. Their alteration plays a significant role in long-term geochemical processes, including radionuclide retention and mobility in subsurface environments. Feldspar dissolution, solute transfer, and secondary mineral precipitation are critical factors that can impact the geochemistry over extended timescales. Understanding the dissolution mechanisms of feldspar under repository-relevant conditions, including variations in pH and ionic strength, is therefore relevant for predicting the behaviour of radionuclides in deep geological environments.

In this study, we employ a Quartz Crystal Microbalance (QCM) to determine the dissolution rate of K-feldspar by coating K-feldspar onto a QCM sensor and measuring frequency changes and weight loss in aqueous solutions under varying pH and ionic strength conditions (NaCl and KCl). The solution composition is analyzed using ICP spectroscopy, while surface characterization of the K-feldspar-coated sensors post-experiment is conducted using SEM-EDX, XPS, and XRD. Furthermore, Zeta potential measurements are performed using a streaming potential instrument on the used K-feldspar sensors from the QCM experiments to investigate their surface charge properties. The streaming potential experiments are conducted under solution compositions corresponding to those used in the QCM measurements, allowing direct correlation between dissolution behaviour and surface charge characteristics.

Our results offer a better understanding of the K-feldspar dissolution process under dynamic and varying geochemical conditions, contributing to a broader understanding of feldspar weathering and its implications for geochemical cycling, deep geological repositories, and reservoir quality evolution. The integration of QCM, and Zeta potential measurements provides a multi-faceted approach to evaluating feldspar dissolution kinetics and mechanisms.

**References**

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