



In situ observations to define the chemical evolution at the interface in a coupled dissolution –reprecipitation replacement reaction.

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The solid solution-aqueous solution system KCl-KBr-H₂O has been used as a model system (1) to determine the mechanism of the replacement process of one crystalline phase by another because:

1. its crystallography and solid solution-aqueous solution equilibria are well known (2,3),
2. the reactions occur quickly at room temperature,
3. it can be used as a simple replacement model for more complex mineral systems.

Starting with a KBr crystal in contact with a saturated KCl solution, we have used *in situ* replacement experiments to make direct observations of the coupled dissolution-reprecipitation process at the interface. The solid phases have been characterised by x-ray powder diffraction analysis and the evolution of compositional changes measured as a function of time. Real-time phase shift interferometry was used to record the changes in solution composition in contact with the surface of a KBr crystal. The measurement of diffusion fields of solutions using real-time phase shift interferometry was developed (4,5) to observe phase change phenomena such as crystal growth, by the measurement of diffusion fields around a growing crystal. Using this method, we have made direct real-time measurements of refractive index changes and therefore concentration gradients in a saturated KCl and K(Cl,Br) fluid in contact with an original KBr crystal interface and so have been able to follow the progress of the fluid phase changes during the replacement reaction.

Measurement of concentration gradients in a solution, together with a study of the solid phase changes occurring simultaneously in a replacement reaction, provides a detailed description of the replacement process. Further implications for natural pseudomorphic reactions can be made.

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