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Tomographic analysis of surface reactivity and transport

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Tomographic flow field analysis using positron emission tomography (PET) has become an important method for identifying pore-scale heterogeneities. Diffusive flux [1] and advective transport [2] can be quantified using conservative tracers, and even local flow field changes due to reactions such as dissolution or precipitation can be quantitatively characterized. Reactive tracers, in comparison, can provide quantitative information on the evolution of surface reactivity. In particular, sorption and desorption reactions at material surfaces are examined with temporal and spatial resolution [3]. Here we focus on the varying surface reactivities of crystalline materials as a function of their nanoscale properties, i.e. surface nanotopography and reactive site density. We discuss the use of various PET tracers and highlight their applicability for reactive transport studies. Conclusions from these investigations provide quantitative insights into important applications, including the fate of contaminants in the subsurface, remediation reactions, and nuclear waste repositories.

References:

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[3] Schöngart, J.; Kulenkampff, J.; Fischer, C., Positron emission tomography quantifies crystal surface reactivity during sorption reactions. Chemical Geology 2024, 665, 122305.

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References

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