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Application of Time-resolved In situ X-ray Absorption Spectroscopy in Solid-State Chemistry

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Abstract

Time-resolved X-ray absorption spectroscopy (TR-XAS) possesses excellent capabilities to reveal quantitative phase composition and average valence together with the evolution of the local structure of a system under dynamic reaction conditions. The work discussed here focused on time-resolved in situ XAS investigations aiming, first, at understanding structural evolution under dynamic conditions and, second, at revealing properties of the system studied not available from investigations under stationary conditions. Hence, not only was the local structure of a material studied under reaction conditions, but also were characteristic properties of the reaction elucidated, such as reaction intermediates or the kinetics of the reaction. The solid-gas reactions presented here clearly demonstrate the potential of TR-XAS investigations to extend the suitability of XAS for in situ studies in solid-state chemistry to investigations under dynamic conditions.