



Physical Chemistry
Marc G. Willinger

Electron Microscopy with research emphasis on Energy Materials

Our aim is to understand the structure-properties correlation of materials on the basis of direct atomic scale observation. Using methods of in-situ and operando electron microscopy, we are able to move beyond the analysis of thermodynamically isolated systems in vacuum and thus, to observe how materials behave under the influence of a defined physical or chemical stimuli. We relate structural and chemical dynamics with the emergence of catalytic function, and study processes that are relevant for energy storage and conversion. Since atomistic processes can lead to complex dynamics at larger scale, we combine local observation by in-situ transmission electron microscopy with in-situ scanning electron microscopy. This multi-scale approach enables context embedded studies of collective behaviour, such as the formation of dissipative structures (top right figure), or oscillatory red-ox dynamics (bottom right) that can only be observed under reaction conditions.

