



Watching materials fail – Experimental insights provided by modern in-situ techniques

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■ Catastrophic failure is the most critical even for any load bearing structure or component, as it bears the risk to cause human harm. As such, we aim to develop possibly damage resistant materials to design the respective parts. Nonetheless, the local nature of microstructure-related deformation and fracture processes poses a challenge to their analysis, in particular for high-strength nanostructured materials and composites.

■ Over the last years, we developed a suite of experimental methods and analysis tools to examine purely brittle as well as elastic-plastic fracture processes in a fully quantitative manner utilizing in-situ experiments on miniaturized specimens inside scanning or transmission electron microscopes. This approach provides a direct link between the mechanical data, such as load and displacement, on the one hand, as well as the crack path and microstructure interaction on the other hand.

■ In this presentation, we will focus on the challenges and possibilities enabled by these novel experimental capabilities, highlight some recent insights and discuss possible future research directions.

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