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## Opening PhD position at the Institute for Applied Materials

### Development of Fast Electron Microscope Imaging using Deep Learning

The Institute for Applied Materials – Mechanics of Materials and Interfaces (IAM-MMI) at the Karlsruhe Institute of Technology (KIT) strives for a fundamental understanding, prediction and optimization of mechanisms responsible for the degradation of advanced functional material systems. Our material portfolio comprises, among others, materials crucial for the energy transition, including those for energy conversion and storage, and advanced structural materials.

We are currently seeking a highly motivated PhD candidate (f/m/d) with a solid foundation in materials science or physics to join our dynamic team. As a PhD candidate, you will be part of an international research group focusing on fundamental research on multi-dimensional, correlative microstructure characterization during *in situ* scanning electron microscope (SEM) testing to deepen our understanding of mechanical degradation mechanism of structural/functional materials.

You firstly will be challenged to image crystalline defects, i.e. dislocations, through the use of 4D-STEM-in-SEM. This cutting-edge technique has been successfully established in our group recently. As a next step, you will expand the real-time imaging capabilities of this technique by combining it with *in situ* SEM deformation experiments to capture dynamics of moving dislocations. In collaboration with the research group led by Prof. Stefan Sandfeld at Forschungszentrum Jülich, we will develop deep-learning (DL) adaptive scanning algorithms. This development will significantly enhance the time-resolution of *in situ* tests by autonomously detecting regions of interest, such as moving dislocations, and limiting the observation area. Ultimately, the successful development will unlock new perspectives on comprehending the mechanical degradation mechanisms of materials under various stimuli, bridging real-space and reciprocal space information. We are pleased to highlight that this project will be supported by Helmholtz Imaging and be carried out in collaboration with Carl Zeiss Microscopy GmbH.

As successful candidate, you will take on the following responsibilities:

- Prepare thin lamella samples using a focused ion microscope (FIB).
- Investigate dislocation structures *in situ* and *ex situ* using 4D-STEM-in-SEM.
- Perform data analysis using LiberTEM open-source Python package, followed by interpretation.
- Implement a DL-based feedback loop algorithm to *in situ* 4D-STEM-in-SEM.
- Publish results in peer reviewed journals and presentation at international conferences.

You should hold a Master's degree in materials science, mechanical engineering or physics at the time of your start at IAM-MMI.

Besides a state-of-the-art laboratory at the IAM and an inclusive, caring, and supportive atmosphere, we can offer a three-year PhD contract (75% TVL-E13). We strongly encourage applications from women and candidates from underrepresented backgrounds in STEM research to apply for this position, as a diverse workplace is vital to our success and life at the institute.

The call for applications is open until filled. Intended starting date is 1<sup>st</sup> of February, 2024.

For more information, do not hesitate to contact either one of us.

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