Karlsruher Institut für Technologie

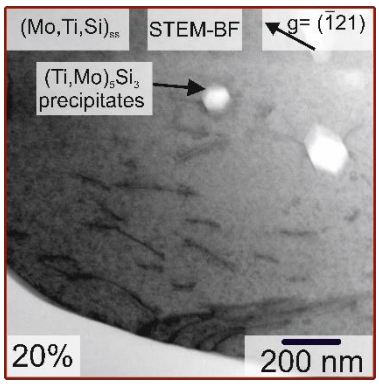
Laboratorium für Elektronenmikroskopie

# Master Thesis

## In-situ heating and tensile straining of the eutectic Mo-Si-Ti alloy in Transmission electron microscope (TEM)

### Motivation

Recently Mo-Si-Ti system has been explored as a potential alternative to the existing high temperature materials because of their high melting temperatures. Among them, the eutectic Mo-Si-Ti alloy (Mo-20Si-52.8Ti (in at.%)) displayed resistance to pesting and good creep properties. The alloy has a two phase microstructure with a molybdenum solid solution (Mo,Ti,Si)ss and hexagonal $(Ti,Mo)_5Si_3$ silicide. The presence of silicide precipitates in solid solution interfere with the gliding dislocations in the as-cast microstructure. An enhanced understanding of interfacial deformation and strain partitioning among two phases is necessary during loading. In-situ tensile tests provides better insights into the deformation mechanisms rather than ex-situ tests. Micro tensile specimens will be prepared by focused ion beam (FIB) with interfaces in different orientations (such as aligned, perpendicular and inclined) to the loading axis and tested to compare the structure of interface in terms of misfit dislocations before and after deformation. These experiments will help to understand the dislocation glide behavior and other dynamic processes such as dislocation pile up at the interfaces and precipitation hardening processes in this alloy. This information aids in designing newer alloys best suited for high temperature application.




**Left**: Scanning transmission electron microscopy STEM-bright field (BF) image of dislocations in the solid solution. **Right**: GATAN In-situ single tilt heating and straining holder model 672

### Tasks

The work is divided into the following steps:

- performing the in-situ experiments in a transmission electron microscope
- understanding of the role of dislocations and interfaces in plastic deformation
- characterization of dislocations and interfaces using high resolution transmission electron microscopy

### Timeline

- 1st month: literature review and sample preparation using focused ion beam
- 2nd – 5th month: introduction to transmission electron microscopes and performing in-situ straining tests
- 6th -7th month: analyzing results and thesis writing

### Research area:

- Microstructural characterization
- High-temperature materials

### What you will learn:

- Scanning electron microscopy
- Focused ion beam
- Transmission electron microscopy

### Focus:

- Experimental
- Structural characterization
- Literature and research

### Eligible students:

- Masters in material science

### Starting date:

- July 2024

### Notes

We offer good supervision and the opportunity to work in an interdisciplinary team on a novel topic. You must be able to work independently and be motivated to familiarize yourself with new techniques. For further information, please contact TT.-Prof. Dr.-Ing. Yolita Eggeler or Hemanth Thota.

### Contact: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