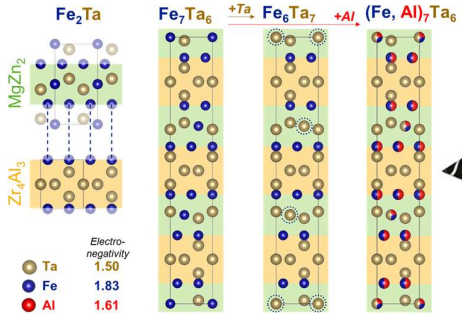
Bachelor / Master thesis

From small units to big crystals or new materials – Plastic deformation in Fe-Ta(Al)



Motivation:

The currently used high temperature superalloys are reaching their maximum operating temperatures limited simply by their melting points. New materials with high temperature strength and sufficient toughness for safe operation of jet engines and turbines in power plants are urgently needed for sustainable transport and energy conversion.

However, up to now, our ability to search for new materials amongst the >100,000 intermetallics (like Ni_3Al in the superalloys) is limited by our near complete inability to predict the mechanical properties of a complex crystal beyond its elastic constants.

This project will be the start of a large EU-funded project at IMM which explores a new, fundamental approach to understanding plastic deformation in hard crystals. Here, this will involve preparation, characterisation and mechanical testing of the Fe-Ta(Al) crystals shown above to quantify and compare the properties of the individual building blocks and their combinations in a systematic way. The obtained data will ultimately contribute to fundamental concepts in crystal plasticity and, more immediately, it will also be very useful in the design of refractory high temperature alloys.

Tasks:

- Arc-melting of the individual phases
- Metallographic preparation and phase characterisation
- Nanomechanical testing of each phase
- Identification of the dominant deformation mechanisms by SEM

What we offer:

- Obtain publishable and cutting-edge research findings
- Work with a young enthusiastic team of material engineers

The ideal candidate will:

- Have a high motivation for experimental materials science

Earliest projected starting date:

- ASAP (start WiSe 2019 also possible)

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