Chair of Materials Engineering of Additive Manufacturing
TUM School of Engineering and Design
Technical University of Munich

HIWI Position
Development of an AI-Based Phase Diagram Tool for Teaching Microstructure Evolution

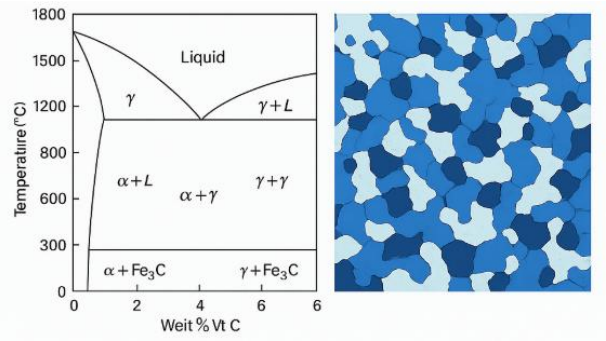
Motivation

Understanding the relationship between a material's microstructure and its mechanical properties is fundamental to materials science education. While binary phase diagrams are often used in teaching, static textbook images fail to capture the dynamic nature of phase transformations under real processing conditions. This project addresses this gap by developing an **AI-powered interactive tool** to simulate and visualize microstructure evolution in metallic binary systems. It will support students in exploring how thermal profiles and composition influence phase distribution over time, reinforcing learning in courses like *Materials Science 1 & 2* and *Additive Manufacturing.*

Objective

The aim of this semester project is to design and implement a **dynamic, web-based educational tool** that:

- Simulates phase transformations in binary metallic systems under equilibrium conditions.
- Uses AI models to predict and visualize microstructure evolution from literature or simulated data.
- Provides real-time visual feedback and interactivity for students to experiment with different compositions and thermal profiles



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Tasks

- Literature review and data collection on microstructure evolution in binary systems.
- Development of AI models to segment and predict phase evolution based on literature data.
- Implementation of a simulation and visualization module.
- Development of a user-friendly web interface.
- Validation of model results against published references.
- Integration of the tool into lecture content and teaching exercises.

Your profile

- Enrolled student at TUM with a valid work permit.
- Background in materials science, mechanical engineering, systems engineering, or related fields.
- Programming skills (Python preferred), experience with AI/ML frameworks is a plus.
- Strong interest in combining AI with materials science education.
- Ability to work independently and meet project milestones.
- Good proficiency in English (written and spoken).

What we offer you

- An exciting role at the interface of AI, materials science, and digital education.
- Practical experience in AI model development, simulation, and visualization tools.
- Close supervision and collaboration with scientific staff.
- Flexible working hours (~15 hours/week, 6 months, total 390 hours).
- Payment according to TUM guidelines (link).

Application: If you are interested, please send your application documents (**cover letter, CV, and relevant certificates**) to **application.mat@ed.tum.de**

Contact

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