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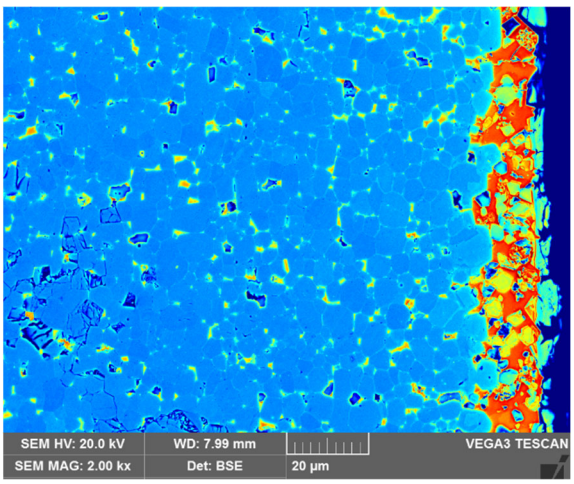
Advanced Research Lab / Master's Student

Enhancing Coercivity and Thermal Stability in NdFeB Magnets via Grain Boundary Diffusion Process

The Grain Boundary Diffusion Process (GBDP) presents a promising method for enhancing the properties of NdFeB permanent magnets, particularly their coercivity and thermal stability. By focusing on the mechanisms of grain boundary diffusion, we aim to develop magnets that decrease reliance on heavy rare earth elements while maintaining high performance. These advancements are crucial for e-motor applications in electric and hybrid vehicles, where high-performance magnets play a significant role in optimizing efficiency and power. Our objective is to systematically investigate how magnets with specific grain sizes respond during the GBD process, focusing on the changes in their magnetic properties—such as coercivity, residual induction, maximum energy product, and thermal stability.

The primary goal of this project is to improve coercivity and thermal stability while minimizing the use of heavy rare earth elements, including Terbium (Tb) and Dysprosium (Dy). Upon completion of this project, students will gain the ability to synthesize materials from scratch and acquire hands-on experience with essential characterization techniques used in materials science. They will engage in practical activities related to sample preparation for Scanning Electron Microscopy (SEM) and X-ray Diffraction (XRD).



Experience to be gained:

- Experience on industrially relevant preparation routes → induction/arc melting /Melt spinning/jet milling
- powder x-ray diffraction (XRD)→ structural properties, phase identification
- Scanning Electron Microscopy (SEM) and energy dispersive x-ray (EDX) analysis→ Microstructure analysis and chemical composition determination.
- Differential Thermal Analysis (DTA) → Identification of heat changes and phase transitions
- Vibrating Sample Magnetometer (VSM)→ Magnetic property determination
- HyMPulse magnetic properties tester-Metis → Characterizing magnetic materials.

[1] T. Helbig et.al *Alloys and Compounds, 992*, 174490.
[2] Loewe, K., et al. Acta Materialia 124 (2017): 421-429.

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Documents required for application:
1. Current CV,
2. Up-to-date transcripts of Bachelor and Master semesters,
3. Motivation letter.