

Advanced Research Lab / Master Thesis/HiWi

Unveil the role of the Cr in $\text{Sm}_3\text{Fe}_{29}$ -based compounds

Be part of pioneering magnet research! We're looking for a motivated student to join a project aimed at creating a new generation of permanent magnets with properties between ferrites and $\text{Nd}_2\text{Fe}_{14}\text{B}$, so-called *gap magnets*.

Project Highlights

Goal: $\text{Sm}_3(\text{Fe,Cr})_{29}$ -based compounds show great potential for intermediate magnetic performance as it is shown in Fig. 1. To enhance their saturation magnetization (M_s), we will explore strategies such as reducing Fe content and fine-tuning composition.

Focus Material: $\text{Sm}_3\text{Fe}_{29-x}\text{M}_x$ ($\text{M} = \text{Cr}$) compounds

Key Tasks You'll Tackle:

- Synthesize $\text{Sm}_3\text{Fe}_{24-x}\text{Cr}_x$ ($x = 5, 3, 1$) ingots using **arc or induction melting**.
- Investigate the minimum Cr concentration required to achieve a single 3:29 phase by using microstructure (SEM) and crystallographic (XRD) properties
- If needed, explore **Zr substitution** (partial $\text{Sm} \rightarrow \text{Zr}$) to stabilize the phase.
- Characterize intrinsic magnetic properties (e.g., M_s , H_a , T_c) of single-phase compounds.
- Adjust Sm content to create a Sm-rich intergranular phase.
- Apply **grain-size refinement** techniques such as melt spinning.

Why Join

- Cutting-edge experience with magnetic materials and advanced synthesis methods (**arc melting, induction melting**)
- Interest in magnetism (Magnetic characterization \rightarrow **PPMS magnetometer**) and microstructural analysis (Structural analysis \rightarrow **X-ray powder diffraction (XRD)**, Microstructure analysis \rightarrow **Scanning electron microscopy (SEM)**)
- Hands-on lab skills or a strong desire to develop them.
- Opportunity to publish results and build a strong research portfolio. Collaborate with different research group in the frame of CRC Hommage (more details: https://www.tu-darmstadt.de/sfb270/about_crc/index.en.jsp)
- Work in a dynamic, international materials science environment.

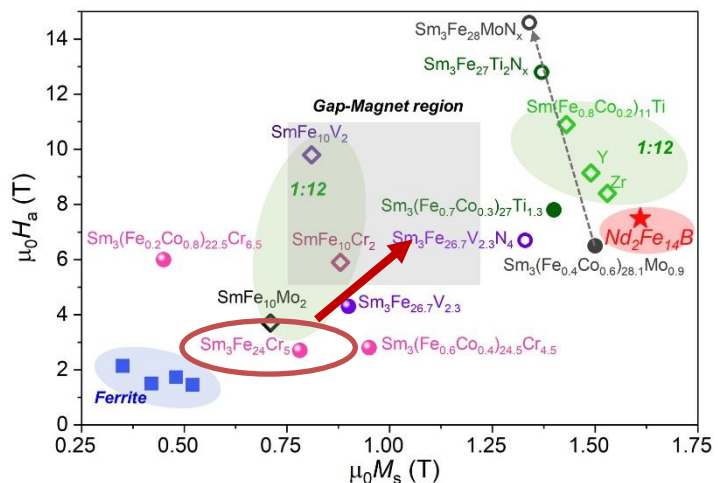


Fig. 1 . Pushing the saturation magnetization of $\text{Sm}_3\text{Fe}_{24}\text{Cr}_5$ by decreasing Cr content while obtaining the phase stability

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