Poster | Material, processing, and characterization

Tue. Jul 29, 2025 4:35 PM - 6:00 PM JST | Tue. Jul 29, 2025 7:35 AM - 9:00 AM UTC Blue zone, Conference rooms 101 and 102(1F)

[P2] Sm-based Magnets & Nitrides

Session Chair: Mr. Johann Fischbacher (University for Continuing Education Krems, Austria), Dr. Yusuke Hirayama (AIST, Japan)

[P2-37] Enhancing ferromagnetism in the $Sm(Co, Mn)_5$ system: Impact on phase stability and magnetic properties

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This work demonstrates that Mn can be a beneficial candidate for the performance modulation of permanent magnetic materials like $SmCo_5$. Theoretical calculations reveal that Mn has a large positive contribution to the magnetization of $SmCo_5$, owing to the strong ferromagnetic exchange interaction between Co and Mn atoms. It is also found that Mn could occupy both 2c and 3g crystal sites because of the minute energy difference between them can be easily overcome through thermal activation. Co atoms on the same site with Mn have increasing moments with the increase in Mn content, whereas those on the other sites show decreasing moments. The experimental substitution of Mn for Co leads to a contraction of the $SmCo_5$ single-phase region, and thus pure $Sm(Co, Mn)_5$ phase could only be obtained through subtle control of Sm content by annealing. Significantly, a 13 % increase in saturation magnetization of $SmCo_5$ is achieved through Mn substitution. A slight rise in the Curie temperature is also obtained, suggesting that Mn substitution does not strongly disturb the exchange interactions of the Co sublattice. This study offers a new option for enhancing magnetic properties in Sm–Co systems and introduces novel physical phenomena resulting from Mn substitution, which is worthy of further investigation.

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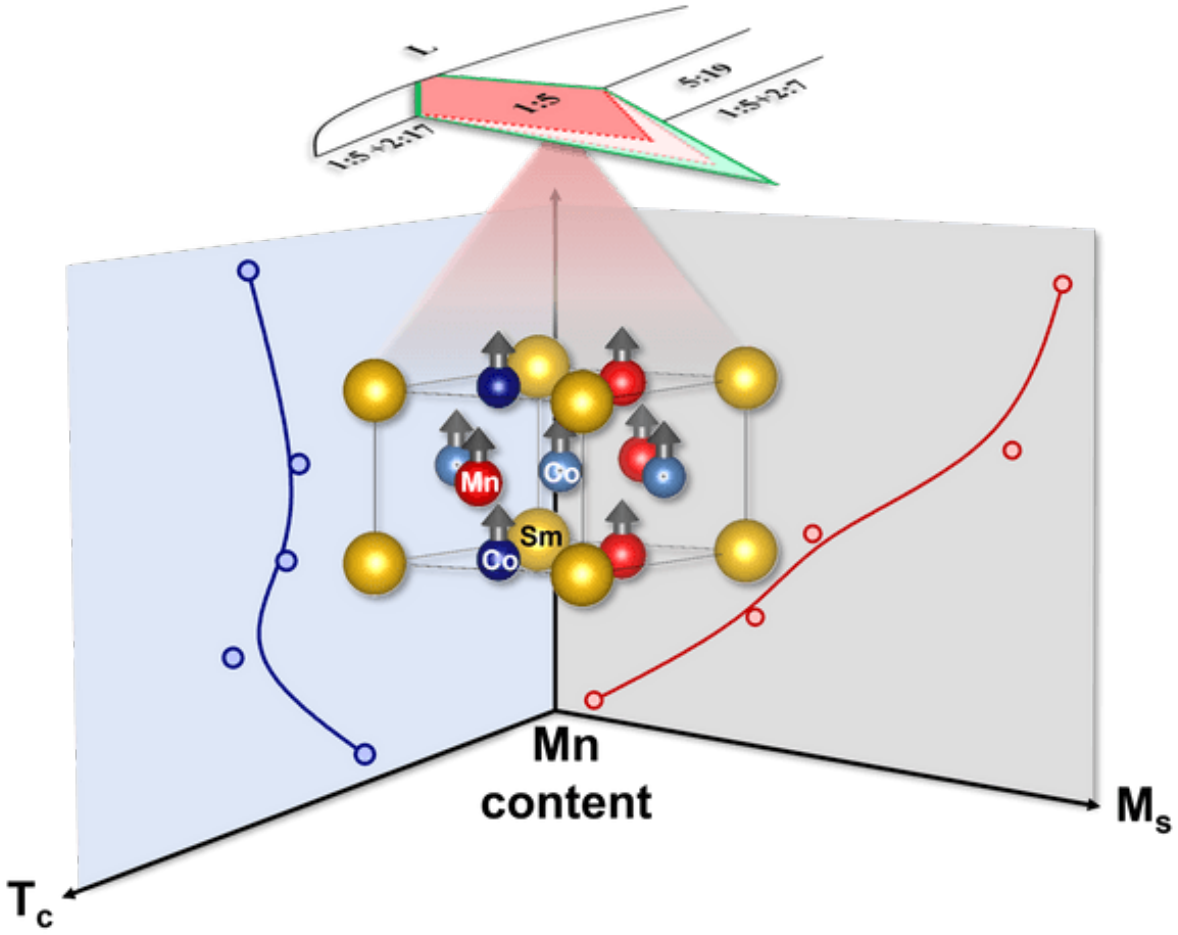

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