

SEMINAR

Thursday, 17.9.2026, 13:00 , Kolar's Lecture Hall

Novel Routes for the Synthesis of Nd-Fe-B Magnetic Materials

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Nd-Fe-B was synthesized under high-heating-rate conditions using a High-Speed Temperature Scanner (HSTS-3). This technique enables the synthesis of target materials under controlled non-isothermal conditions at predefined heating rates. The heating process can be automatically terminated at a specified temperature or time, followed by rapid quenching at rates of up to $30,000\text{ }^{\circ}\text{C}\cdot\text{min}^{-1}$, thereby effectively suppressing further reactions and phase transformations.

The synthesis was performed using an initial powder mixture of NdH_2 , Fe, and B in an argon atmosphere. The mixture was heated at a rate of $1200\text{ }^{\circ}\text{C}\cdot\text{min}^{-1}$ to $1030\text{ }^{\circ}\text{C}$. In addition, the synthesis of $\text{Nd}_2\text{Fe}_{14}\text{B}$ was investigated using Nd_2O_3 and Fe_2O_3 precursors via a calciothermic reduction route. The effects of precursor particle size, reducer content, and mechanical activation conditions on phase formation were systematically examined. Optimization of these parameters resulted in a product containing up to 60 wt.% $\text{Nd}_2\text{Fe}_{14}\text{B}$ after a holding time of only 3 min. Furthermore, partial substitution of Nd with less-critical elements was explored, resulting in an Nd-containing high-entropy system. The magnetic properties of the obtained powders were compared with those of samples prepared using conventional furnace heating. These results demonstrate the potential of high-speed heating and non-isothermal synthesis for the efficient preparation of $\text{Nd}_2\text{Fe}_{14}\text{B}$ -based magnetic materials by combustion synthesis method.

Kindly invited.