

Structural, Magnetic, and Thermal properties of Full-Heusler Ni₂FeAl alloy for Spintronic device applications

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Abstract. Heusler alloys were discovered by Fritz Heusler more than century ago and are still a field of active research. Due to their unique electronic structure it exhibits half-metallicity at room temperature and utilising these properties novel materials for many technological applications are developed in the field of Spintronics. The Ni₂FeAl Full Heusler alloy nanoparticles were synthesized by solid state reaction method. The synthesized Ni₂FeAl alloy was characterized by using XRD to determine the structure, VSM measurement confirms the exhibiting magnetic properties, and thermal studies confirm the thermal stability of the prepared alloy. First the as-prepared Ni₂FeAl Heusler alloy particles were characterized by using thermal analysis techniques to identify the annealing temperature. Thermogravimetric analysis (TGA) result shows that no significant changes (i.e: weight loss) in the sample up to 800°C. Differential Thermal analysis (DTA) measurements result confirms that exothermic and endothermic peaks were obtained at 613 °C and 739 °C respectively. Then the synthesized sample was annealed at 800°C for 72 h in the vacuum atmosphere to achieve the desired phase. XRD pattern confirms that the annealed sample shows cubic structure with an average crystallite size of 18 nm. From magnetic studies, (M versus H) hysteresis curve shows that the alloy exhibits soft ferromagnetic behaviour. This kind of magnetic alloys can be used for Spintronics based devices like GMR, TMR, MTJ and MRAM applications.

References:

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