**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI**
**SHORT ABSTRACT OF THESIS**

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Thesis Title: STRUCTURAL, MAGNETO-STATIC AND MAGNETODYNAMIC PROPERTIES OF Ni-Mn-Z AND Ni-Mn-X-Z (X = Cu, Fe, Co; Z = Sn, In) THIN FILMS

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| Name of Thesis Supervisor(s) | : | Prof. A. Srinivasan |
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**SHORT ABSTRACT**

Ni-Mn-based Heusler alloys are well investigated in the bulk form and are known to display martensite phase to austenite (M $\leftrightarrow$ A) phase structural transition in specific alloy compositions. Due to this unique feature, these alloys show several interesting property like large magneto-caloric effect (MCE), considerable exchange bias, large magneto-resistance which could be exploited for application. But, these alloys have not been well explored in their thin film form. So, the question as to how these novel properties will change in reduced dimension remains unanswered. So, the main objective of my PhD thesis was to explore various physical and functional properties of Ni-Mn-based thin films deposited on cost effective Si (100) substrates. Structural and other functionally important parameters of Ni-Mn-Z (Z = Sn, In) alloy films of specific compositions and the effect of fourth element (such as nonmagnetic Cu and magnetic Fe and Co) substitution on these parameters have been investigated. My thesis work was primarily focused on exploring the properties of these alloy films from two different application viewpoints, magnetic refrigerants which use MCE properties in terms of magnetic entropy change ($\Delta S_M$) and refrigeration capacity (RC) and spintronic application based on magneto-dynamic properties in terms of intrinsic damping (Gilbert constant α) and extrinsic damping parameters at microwave frequency. In the current thesis room temperature ferromagnetism with high $L2_1$ ordering has been achieved for the first time in $Ni_{48.14}Mn_{38.14}Sn_{13.72}$ films on Si (100) substrate. The lowest $\alpha$ (= 0.007) along with high perpendicular anisotropy is observed in these thin films. Enhancement in soft magnetic property has been observed with Fe/Co substitution in these Ni-Mn-Sn films. Low value of α (= 0.007) was also found in $Ni_{55.7}Mn_{33.0}Co_{3.8}Sn_{7.4}$ film together with perpendicular anisotropy and easy axis along film plane. These significant results have been reported for first time explored in these films showcasing there potential for spintronic applications. Also a maximum $-\Delta S_M$ of $1.28\times10^5$ erg/cc.K (1.58 J/kg.K) for magnetic field change ΔH = 18 kOe was observed in $Ni_{49.1}Mn_{36.9}Fe_{2.9}In_{11.1}$ in the vicinity of Curie temperature ($T_C$) around room temperature. This is the highest $-\Delta S_M$ value achieved in Ni-Mn-In based thin films across $T_C$ and is comparable to values obtained in bulk Ni-Mn-In alloys. These indicate that these films can be utilized in micro cooling devices.