

# THE EFFECT OF Ge SUBSTITUTION IN $\text{Ni}_2\text{MnGa}_{1-x}\text{Ge}_x$ HEUSLER ALLOYS AND FILMS

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Structural instabilities typical of Ni-Mn-Ga Heusler alloys with ferromagnetic shape-memory effect have recently been predicted to exist in  $\text{Ni}_2\text{MnGe}$  <sup>1</sup>. We present the results on the effect of adding Ge on the magnetic properties of  $\text{Ni}_2\text{MnGa}_{1-x}\text{Ge}_x$  ( $0 < x < 0.4$ ) alloys and thin films. It is found that the alloys are single phase with  $L2_1$  ordering (cubic lattice constant  $a \simeq 0.581$  nm). The Ge addition causes a drastic decrease in the martensitic transformation temperature from  $T_M = 200$  K ( $x = 0$ ) to  $T_M = 50$  K ( $x = 0.4$ ) with almost no effect on the Curie temperature  $T_C \simeq 390$  K and magnetization  $M_S(0) \simeq 450-500$  G. The magnetic properties of thin films strongly depend on ordering. The ordered films deposited by flash-evaporation from the powdered alloys have similar  $L2_1$  (or B2) ordering and exhibit the magnetic properties similar to the properties of corresponding bulk alloys. First principle calculations of site-projected density of states for Ga and Ge were carried out to trace differences in the spin-down electronic states close to the Fermi level.

<sup>1</sup>A. T. Zayak and P. Entel, J. Magn. Magn. Mater. (preprint)

13.4 cm

## Subject category :

3. Transition Metals, Alloys and Compounds

## Presentation mode :

poster

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9.7 cm