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Magnetic properties and magneto-structural transformations in Cu and Pd doped ferromagnetic Ni-Mn-Sn shape memory alloys

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The Heusler ferromagnetic shape memory alloys are becoming an important topic of research due to their large magnetic-field-induced strain and shape memory effects [1]. The present study reports on the influence of the Cu and Pd doping on magnetic properties and martensitic transformation. Ni_{50-x} Mn_{36} Sn_{14} Cu_x, Pd_x (x=0, 1, 2) and Ni_{50} Mn_{36} Sn_{14-y} Cu_y, Pd_y (y=1) ribbons were produced by rapid solidification using melt spinning technique (master alloy was previously prepared by arc melting).

The magnetic measurements were performed by a vibrating-sample magnetometer (VSM) in the temperature range 10–400 K. It is worth to note that, besides, the first order martensitic structural transition (induced by change of temperature and/or magnetic field), the Heusler ferromagnetic alloys analyzed in this study exhibit also magnetic transitions including superparamagnetism and exchange bias [2]. Furthermore, experimental results indicate that the martensitic transformation (MT) temperature and Curie temperature (Tc) undergoes a slight shift towards high temperature with substituting Cu and Pd for Ni whereas, they disclose an important shift to high temperature through the substitution of Pd and Cu for Sn. The substitution of a fraction of Ni by a fourth element leads to changes in the nanoscale magnetic structure [2]. The nanocrystalline structures were determined by X-ray diffraction technique (XRD). It was found that the substitution of Cu and Pd for Sn stabilized the martensite modulated structure. In addition, the thermal analysis was performed by differential scanning calorimetry (DSC).

Keywords: Martensitic transformation, magnetic properties, phase transitions, Cu addition, Pd addition, Heusler alloys.

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