SUMMARY

The aim of this PhD thesis was to produce Mn–Co–Ge alloys doped with W, Pd or Zr in the solid form and then to investigate the influence of these additives on the structure and thermomagnetic properties of the obtained materials. Phase composition tests showed the presence of two crystalline phases in all the tested alloys: a high-temperature hexagonal phase of the Ni_2I–type and a low-temperature orthorhombic phase of the NiSiTi–type. Qualitative and quantitative analysis of the obtained XRD patterns supported by Rietveld analysis made it possible to notice changes in the lattice parameters, as well as the number of recognized phases depending on the additive content (W, Pd, Zr). The increase in the dopant content increases the lattice parameters of the tested alloys. To additionally confirm the results of XRD analysis and to determine the temperatures of structural and magnetic transitions, differential scanning calorimetry (DSC) measurements were performed. These studies revealed the occurrence of exothermic and endothermic peaks in all tested alloys (W, Pd, Zr) and the occurrence of lambda peaks, which correspond to the Curie temperature, thus confirming the occurrence of phase transitions.

The results of the Curie temperature (T_C) measurements, which were determined based on the temperature dependence of magnetization in an external magnetic field, showed an increase in T_C with the increase in Pd addition, while in the case of the other samples (W and Zr), a decrease in the T_C value was observed with the increase in the addition. Magnetic entropy change (ΔS_M) tests, as well as cooling capacity (RC) tests measured for an external magnetic field ($\Delta\mu_0 H$)=5T showed that the best results were obtained for the additive content y=0.05 for samples (Pd and Zr), where ΔS_M=23.99 $J\cdot(kgK)^{-1}$ and RC=646 $J\cdot kg^{-1}$ for $Mn_{0.95}Pd_{0.05}CoGe$, and for $Mn_{0.95}Zr_{0.05}CoGe$ ΔS_M=13.42 $J\cdot(kgK)^{-1}$ and RC=425 $J\cdot kg^{-1}$. In the case of the sample with W admixture, the best results were obtained for the content x=0.1, where ΔS_M=3.01 $J\cdot(kgK)^{-1}$ and RC=142 $J\cdot kg^{-1}$. The analysis of n(T) curves made it possible to confirm the results of XRD and DSC tests of the occurrence of first- and second-order phase transitions in all tested alloys. The results of testing the magnetization hysteresis curves revealed the formation of a slight hysteresis loop for alloys with the addition of: Zr (y=0.03 and 0,1), Pd (y=0.03 and 0.05), and W (y=0.03 and 0.07). For the remaining alloys, no characteristic magnetization loop was observed. The resulting curves are not typical hysteresis loop diagrams because the tested alloys are paramagnetic.

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