

Abstract

The Heusler alloys Ni-Mn-Sn belong to a class of ferromagnetic shape memory alloys (FSMA), in which a martensitic transformation takes place in a ferromagnetic state. This magnetostructural transformation leads to magnetocaloric effect, modification of exchange coupling, large magnetoresistance etc. While these properties have been extensively investigated in bulk FSMA, only little is known how the above effects occur in thin films of FSMA. In this PhD thesis the comprehensive investigation of the magnetic, transport and structural properties of Ni-Mn-Sn thin films was undertaken.

It is found that the magnetic properties of epitaxial Ni_2MnSn thin films deposited on MgO substrates and polycrystalline Ni_2MnSn thin films deposited on Si substrates were different. Furthermore, the impact of alloy composition on the magnetic moment and exchange-bias effect in off-stoichiometric, epitaxial austenite films was analyzed. The martensitic transformation in epitaxial $\text{Ni}_{50}\text{Mn}_{35}\text{Sn}_{15}$ films were studied. We studied such properties like: magnetic anisotropy, magnetocaloric effect, electric transport and exchange-bias effect. A simple phenomenological model, which originates from spin disorder scattering was proposed to explain magnetotransport in a ferromagnet with the martensitic transformation.

A phase decomposition in polycrystalline films with a low concentration of Sn was showed. The presence of ferromagnetic Ni_2MnSn phase and antiferromagnetic NiMn phase was confirmed by structural, magnetic and transport properties investigations. In particular, we use an effective medium approximation EMA to describe the electric transport of such a heterogeneous polycrystalline system.

In this thesis, the results of *ab initio* calculations were presented. It was shown that the atomic configuration of the austenite affects its magnetic properties. The estimated values of the martensitic transformation temperature and the Curie (Néel) temperature were collected in the form of phase diagram. The magnetic properties of austenite and transformations temperatures were consistent with the experiment results.