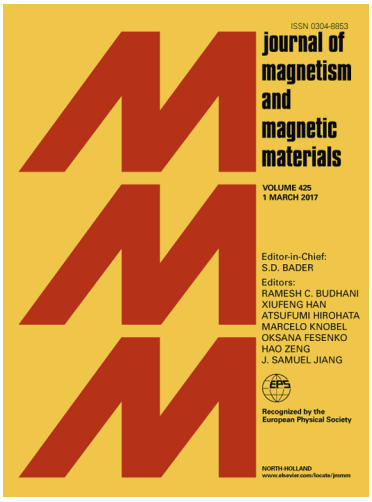

Complex transport properties of the $Ni_{1.92}Mn_{1.56}Sn_{0.52}$ Heusler alloy and its magnetic behavior

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Complex transport properties of the $Ni_{1.92}Mn_{1.56}Sn_{0.52}$ Heusler alloy and its magnetic behavior

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Abstract

The electric and thermal transport properties (electric resistivity ρ, magneto-resistance *MR*, Hall coefficient R_H and anomalous Hall effect, thermal conductivity *K* and Seebeck coefficient *S*) of the off-stoichiometric $Ni_{1.92}Mn_{1.56}Sn_{0.52}$ Heusler alloy were measured in a wide temperature and magnetic field range. The simultaneous measurement of several transport and magnetic properties offers a possibility to combine information arising from the received experimental results. The phonon and the charge carriers parts of complex temperature dependence of thermal conductivity *K(T)* were consistently separated using the Lorentz factor and temperature dependence of resistivity ρ*(T)*. The positive values of the Hall coefficient R_H has been determined in martensite phase of the alloy at low temperatures. R_H reaches zero value at temperature range where the so-called "paramagnetic gap" was observed and the negative value of R_H was detected in austenite phase. Temperature dependence of the Hall coefficient $R_H(T)$ was used to derive both, the density and the mobility of charge carriers. The standard relations were used to describe the measured temperature dependence of the Seebeck coefficient. All the received result point to an important role of changes in electronic structure of the alloy in all the studied transport effects. A scenario of the complex behavior of the transport properties of the Heusler alloy based on a possible existence of an energy gap in electronic structure is discussed.

Keywords: electric resistivity, magneto-resistance, Hall effect, thermal conductivity, Seebeck coefficient, Heusler alloy

1. Introduction

The studied $Ni_{1.92}Mn_{1.56}Sn_{0.52}$ (also mentioned as $Ni_{48}Mn_{39}Sn_{13}$) alloy belongs to a family of the long-time studied Mn-rich Ni_2MnSn Heusler alloys that exhibit diffusionless martensitic transformation [1-9]. The structural transition from high-temperature austenite (A) (cubic $L2_1$ structure) to low-temperature martensite (M) (orthorhombic Pmma structure) is accompanied by the pronounced changes of magnetic, magneto-striction and magneto-caloric properties