AR06

Electric Signatures of Structural and Chemical Ordering of Heusler Alloy Films

J. Dubowik[1]*, I. Gościańska[2], K. Załęski[1], Y. V. Kudryavtsev[3], and Y. P. Lee[4]
[1]Institute of Molecular Physics, Polish Academy of Sciences, Poznan, 60-179, Poland
[2]Deptment of Physics, A.Mickiewicz University, Poznan, 61-614, Poland
[3]Institute of Metal Physics, Natl. Academy of Sciences of Ukraine, Kiev-142, Ukraine
[4]q-psi and Department of Physics, Hanyang University, Seoul, 133-791 Korea
*Corresponding author: J. Dubowik, e-mail: dubowik@ifmpan.poznan.pl

Heusler alloys have recently attracted a great attention due to martensitic transformations and half-metallic properties, respectively. Their properties heavily depend on chemical and structural ordering. Thin Heusler alloy (HA) films are ideal objects to trace various stages of ordering since they can be easily prepared in a highly disordered state (e.g., amorphous) and then they can be gradually ordered at elevated temperatures [1]. The films were prepared by rf-sputtering or by flash-evaporation on substrates kept at ambient or at low temperature. Since the resistivity is affected by local disorder, the resistivity measurements were applied for indirect characterization of the order-disorder relations. We report the results on the temperature dependencies of resistivity (ρ) and magnetization for some HA films: Co_2CrAl, Co_2MnGa and off-stoichiometric $Ni_2Mn_{1+x}Sn_x$, $Ni_2Mn_{1+x}Ga_x$ that are known to exhibit half-metallic properties and martensitic transformations in bulk, respectively. From ρ vs. T characteristics we distinguish various stages of chemical/structural ordering in the films. They appear to be quite distinct in both systems investigated. The resistivity results are compared with magnetic characteristics for some films with high T_C. Structural disorder severely affects the conduction electron mean free as well as the exchange interactions resulting in the high resistivity and the lack of ferromagnetic ordering. Generally, at temperatures of ~ 500 K (Co_2MnGa, Co_2CrAl) or ~ 600 K (Ni-Mn-Ga, Ni-Mn-Sn) the films crystallize. However, our results show that chemical and structural ordering may have diverse effect on high temperature characteristics of HA films. Resistivity may decrease almost monotonically over a wide temperature range from 600 to 700 K (Ni-Mn-Ga). It may drop (Ni-Mn-Sn) or rise (Co2CrAl) in a narrow temperature range or it may show a characteristic maximum (Co2MnGa) due to appearance of mixed phases, which were confirmed with the magnetic measurements [2, 3]. In conclusion, high temperature resistivity measurement is a sensitive tool for tracing the chemical and structural ordering in HA films.

REFERENCES

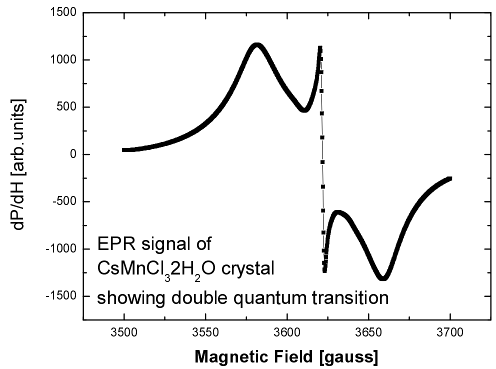
[1] J. Dubowik, I. Goscianska, A. Szlaferek, Y.V. Kudryavtsev Mater. Sci. − Poland, 25, 583 (2007).
[2] Y.V. Kudryavtsev, V.A. Oksenenko, Y.P. Lee, Y.H. Hyun, J.B. Kim, J.S. Park, S.Y. Park, J. Dubowik, Phys. Rev. B 76, 024430 (2007).
[3] Y.V. Kudryavtsev, V.N. Uvarov, V.A. Oksenenko, Y.P. Lee, J.B. Kim, Y.H. Hyun, K.W. Kim, J.Y. Rhee, J. Dubowik, Phys. Rev. B 77, 195104 (2008).

AR07

Analysis of Electron Paramagnetic Resonance and Magnetic Susceptibility of $CsMnCl_3$-$2H_2O$ and $CsMnCl_3$

Heung-Chul Kim* and Sung-Ho Na
Department of Physics, Pusan National University, Pusan, Korea, 609-735
*Corresponding author: Kim, Heung-Chul, e-mail: hchkim63@hanmail.net

For two compounds $CsMnCl_3$-$2H_20$ and $CsMnCl_3$, the electron paramagnetic resonance and magnetic susceptibility are analyzed to identify their magnetic characteristics. The exchange interaction strongly affects the electron paramagnetic resonance signal so that the EPR signal line-width is much smaller than the usual Mn^{+2} EPR signal. From the EPR signals of the two compounds, the super-exchange interaction in $CsMnCl_3$-$2H_20$ and the direct exchange interaction in $CsMnCl_3$ are identified. The exchange interaction between magnetic moments (Mn^{2+}) can also be confirmed from the temperature dependence of the magnetic susceptibility of the samples. For the first time the double quantum transition is observed in the EPR of $CsMnCl_3$-$2H_20$ crystal.



REFERENCES

[1] P. P. Sorokin et al, Phys. Rev., 112, 1513 (1958).
[2] R. E Dietz et al., Phys. Rev. Lett., 26, 1186 (1971).
[3] M. Katayama, Phys. Rev., 126, 1440 (1962).
[4] S. Na et al, J. of Magnetics, 13, 23 (2008).