Министерство образования и науки Российской Федерации
Федеральное государственной бюджетное образовательное учреждение
высшего образования
«Иркутский государственный университет»

МАГНИТНЫЕ МАТЕРИАЛЫ. НОВЫЕ ТЕХНОЛОГИИ

Тезисы докладов
VII Байкальской Международной конференции

Пос. Листвянка, Иркутская область, Российская Федерация
22–26 августа 2016 г.

MAGNETIC MATERIALS. NEW TECNOLOGIES

Abstracts of 7th Baikal International Conference

Lystvyanka village, Irkutsk region, Russia
August 22nd – 26th 2016

FERROMAGNETISM OF POLYCRYSTALLINE $Si_{1-x}Mn_x$ (x~0.5) FILMS WITH A SELF-ORGANIZING STRUCTURE

Nikolaev S.N.[1], Semisalova A.S.[2,3], Rylkov V.V.[1,4*], Chernoglazov K.Yu.[1], Tugushev V.V.[1], Zenkevich A.V.[5,6], Vasiliev A.L.[1], Pashaev E.M.[1], Chesnokov Yu.M.[1], Likhachev I.A.[1], Perov N.S.[3], Matveyev Yu.A.[5,6], Novodvorskii O.A.[7], Vedeneev A.S.[4], Granovsky A.B.[3], Bugaev A.S.[4,5], Wang Y.[2], Zhou S.[2]

[1]*National Research Centre "Kurchatov Institute", 123182 Moscow, Russia*

[2]*Helmholtz-Zentrum Dresden-Rossendorf, Institute of Ion Beam Physics and Materials Research, Bautzner Landstrasse 400, 01328 Dresden, Germany*

[3]*Faculty of Physics, Lomonosov Moscow State University, 119991 Moscow, Russia*

[4]*Kotel'nikov Institute of Radio Engineering and Electronics RAS, 141190 Fryazino, Russia*

[5]*Moscow Institute of Physics and Technology, 141700 Dolgoprudny, Moscow Region, Russia*

[6]*National Research Nuclear University "MEPhI", 115409 Moscow, Russia*

[7]*Institute on Laser and Information Technologies RAS, 140700 Shatura, Moscow Region, Russia*

**e-mail: vvrylkov@mail.ru*

The results of a comprehensive study of magnetic, magneto-transport and structural properties of nonstoichiometric Mn_xSi_{1-x} (x≈0.51-0.52) films grown by the Pulsed Laser Deposition (PLD) technique onto Al_2O_3(0001) single crystal substrates at T = 340°C are presented. A highlight of used PLD method is the non-conventional ("shadow") geometry with Kr as a scattering gas during the sample growth [1]. It is found that the films exhibit high-temperature (HT) ferromagnetism (FM) with the Curie temperature T_C ≈ 370 K accompanied by positive sign anomalous Hall effect (AHE); they also reveal the polycrystalline structure with unusual distribution of grains in size and shape. It is established that HT FM order is originated from the bottom interfacial self-organizing nanocrystalline layer which consists of small (~ 5 nm) rounded grains. The upper layer adopted columnar structure with the lateral grain size ≥50 nm, possesses low temperature (LT) type of FM order with T_C ≈ 46 K and contributes essentially to the magnetization at T ≤ 50 K. Under these conditions, AHE changes its sign from positive to negative at value of T = 30-50K depending on film thickness (Fig.1). We attribute observed properties to the synergy of distribution of Mn_xSi_{1-x} crystallites in size and shape as well as peculiarities of defect-induced FM order in shadow geometry grown polycrystalline Mn_xSi_{1-x} (x≈0.51-0.52) films.

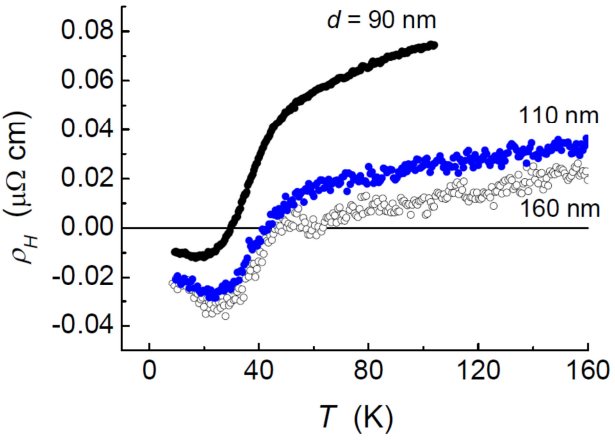

Fig.1. The temperature dependences of Hall resistivity $\rho_H(T)$ measured in the field B = 1.2 T for samples with various Mn_xSi_{1-x} film thickness (d ≈ 90, 110 and 160 nm).

The work was supported by the RSF (grant No 16-19-10233).

[1] V.V. Rylkov, A.S. Bugaev, O.A. Novodvorskii et al., J. Magn. Magn. Mater., V.383, 39-43 (2015).