Kamyob yer metallari oilasiga kiruvchi Gd-In birikmalarining Xoll koeffisiyenti (R_H) ni tempetaruga bog‘liqligi

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Annotatsiya: Ushbu ishda kamyob yer matallaridan (KYM) Gd va In ning turli xildagi konsentratsiyalaridagi birikmalarining Xoll koeffisiyentining temperaturaga bog‘liqligi keltirilgan bo‘lib, 3 xil birikmaning Gd_3In, Gd_3In_5 va $GdIn_5$ lar olingan bo‘lib, temperatura esa T ~ (77-1000) K oralig‘ida hisoblangan.

Kalit so‘zlar: Xoll koeffisiyenti, effektiv spin-orbital o‘zaro ta’sir parametri

The temperature dependence of the Hall coefficient (R_H) of Gd-In intermetallic compounds, which belong to the rare earth metals family

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Abstract: This work presents the temperature dependence of the Holle coefficient of accumulations of Gd and In of various concentrations in rare earth intermetallic compounds (REM) from low-lying materials. Three types of accumulations, Gd_3In, Gd_3In_5, and $GdIn_5$, wereobtained, and the temperature was calculated in the range of T ~ (77-1000) K.

Keywords: Hall coefficient, effective spin-orbital interaction parameter

Spin - orbital o‘zaro ta’sirni nazariy hisoblash mumkin. Bunda KYM uchun Gamiltanian quyidagicha hisoblanadi:

$$H = H_b + H_{SO} + H_{kriss.\ may} + H_{YM} \quad (1)$$

Bu yerdagi H_{SO} - spin orbital Gamiltaniani [1]. Elektr, magnit va galvanomagnit xususiyatlarining integratsion o‘rganishlari Gd-In birikmasi uchun effektiv spin-orbital parametrlarini o‘lchash uchun ishlatilishi mumkin bo‘lgan metallararo birikmalarning

experimental o‘rganishini ifodalaydi. Bir guruh rus tadqiqotchilari bu sohada Zr-Fe birikmasinining spin-orbital o‘zaro ta’sir optik spektrlar yordamida o‘rgangan [2-4]. Bizga ma’lumki KYM ning anomal Xoll effekti R_H quyidagicha aniqlanadi [4-5]:

$$R_{\mathrm{H}} = \frac{\rho_{\mathrm{H}}}{B} = R_0 + \frac{2e^2}{\mu_0 \mu_{\mathrm{B}} \hbar g} \rho^2 \lambda_{\mathrm{SO}} \chi = R_0 + R_S \chi \quad (2)$$

$$R_S = \frac{2e^2}{\mu_0 \mu_{\mathrm{B}} \hbar g} \rho^2 \lambda_{\mathrm{SO}} \quad (3)$$

$$\lambda_{\mathrm{SO}} = \frac{R_S \mu_0 \mu_{\mathrm{B}} \hbar g}{2e^2 \rho^2} \quad (4)$$

Bu yerda μ_B=0.927*10^{-23} J/T Bor magnetoni, μ_0=4 π*10^{-7} G/m magnit dimiysi, h =

1.054 × 10-34 J·s Plank diomiysi, e = 1.6 × 10^{-19} Cl elektrinning zaryadi, g - Landé faktori, ρ solishtirma qarshiligi, va λ_{SO} spin-orbital o‘zaro ta’sirning parametri. R_H-Xoll qarshligi, B-magnit maydon induksiyasi, R_0-normal Xoll koeffisiyenti, R_S - anomal Xoll koeffisiyenti, χ - magnit qabul qiluvchanlik.

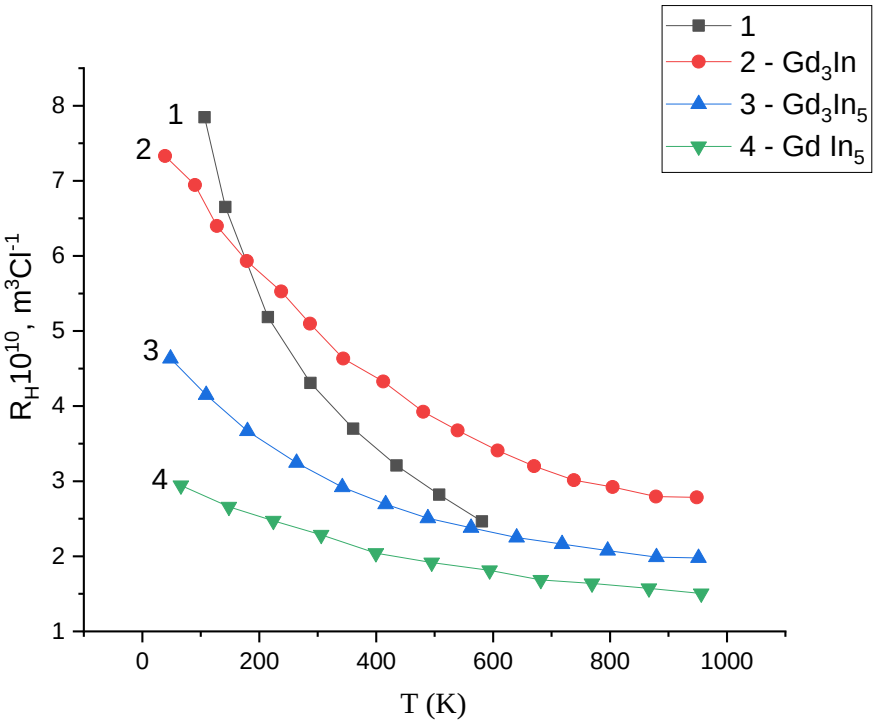
1-Jadval.

Gd_3In, Gd_3In_5, $GdIn_5$ birikmalari uchun Xoll qarshiligini R_H ning temperatura T ga bog‘liqligi. (R_H - 10^{10}, m^3*Cl^{-1}; T,K)

Gd_3In		Gd_3In_5		$GdIn_5$	
T	R_H	T	R_H	T	R_H
39,08	7,331	48,4	4,634	66,14	2,943
90,1	6,944	109,3	4,15	148,1	2,659
127,7	6,398	179,8	3,667	224,1	2,472
178,9	5,932	263,9	3,245	306	2,286
237,7	5,526	342,1	2,921	399,6	2,042
286,8	5,099	416,2	2,694	495	1,917
343,8	4,634	488,4	2,507	594,2	1,812
412,2	4,328	562,4	2,379	681,8	1,686
480,7	3,924	640,3	2,251	769,3	1,638
539,3	3,676	718,1	2,163	866,5	1,573
607,7	3,409	795,9	2,075	956	1,506

Ushbu ishda KYM ning Gd-In birikmasida R_H anomal Xoll qarshiligi keng harorat oralig'ida eksperimental ravishda tekshirildi. 77-1000 K da ular an'anaviy to'rt probli usul yordamida, 800-2000 K da esa aylanadigan magnit maydonning kontaktsiz usuli bilan o‘lchandi.

Bu tekshirilayotgan birikmalarning magnit xossalarini hosil qilishda Gd pastki panjara joylarida lokalizatsiya qilingan 4f-elektronlarning asosiy rol o‘ynashini ko‘rsatadi. Experiment ma’lumotlarini tahlil qilishda, 1- rasmda ko‘rsatilgan quyidagi birikmalar Gd_3In, Gd_3In_5 va $GdIn_3$ uchun Xoll koefitsienti R_H va magnit sezuvchanlik χ orasida bir qarshilik ko‘rsatadi. Rasmga ko‘rinishi bo'yicha, namunalar uchun R_H ning χ ga bog‘liqligi qatorcha bo'yicha bo'ladi. R_H ni nolga (OY o‘qi) ekstrapolyatsiya qilib, Xoll koefitsientlari normal R_0, va anomal R_S, komponentlari aniqlanishi mumkin. Anomal Xoll qarshiligining R_H temperaturaga T bog‘liqligi 1- jadvalda keltirilgan.



1-rasm. Gd-In birikmalari uchun R_H ning T ga bog‘liqligi.

Xulosa. Olingan tajribalarga tayangan holda umumiy olib qaraganda Gd - In birikmasi uchun temperaturani oshirib borish mobaynida uning Xoll qarshiligi gepirbolik kamayib borar ekan. Birikmaning tarkibida Gd ning miqdori In miqdoriga qaraganda qanchalik ko‘p bo‘lsa, shunga mos ravishda Xoll qarshiligining kamayish monotonligi va uning son qiymadi shunchalik kichik bo‘lar ekan. Xoll qarshiligining temperaturaga bog‘liqligining son qiymatlari 1-jadvalda, uning grafiklari esa 1-rasmda tasvirlangan. Olingan natijalar shuni ko‘rsatadiki D. Ruzmetov va b. [5] olib borgan tadqiqotlar bilan solishtirildi va 1- rasmda tasvirlangan 1-chiziq [5] ilmiy ishga tegishli va 2,3,4 - chiziqlar ushbu ishda olingan natijalar bo‘lib, ular bir-birlari bilan mos tushgan.

Foydalanilgan adabiyotlar

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