рентгеновской дифракции начинается преобразование переходных фаз Al_2O_3 в α-фазу, пик B исчезает, а интенсивность пика A уменьшается.

Исчезновение пика B при температурах отжига, больших 1200 °C, свидетельствует о том, что ловушки, ответственные за данный пик, связаны с присутствием переходных фаз оксида алюминия. Природа ловушек пика A требует дополнительных исследований. Уже сейчас можно утверждать, что по своему температурному положению пик A близок ТЛ пику, наблюдаемому в α-Al2O3 с высокой концентрацией кислородных вакансий [2].

1. Abdolvahab Amirsalari, Saber Farjami Shayesteh, Reza Taheri Ghahrizjani, Intrinsic luminescence centers in γ- and θ-alumina nanoparticles, 11(2017), 3-5
2. S.V. Nikiforov, V.S. Kortov, S.V. Zvonarev, E.V. Moiseykin, M.G. Kazantseva, Basic thermoluminescent and dosimetric properties of Al_2O_3:C irradiated by pulse intensive electron beam, Radiation Measurements. – 2014. – V. 71. – P. 74-77.

THERMODYNAMIC AND MAGNETIC PROPERTIES OF ONE-DIMENSIONAL DECORATED CHAIN IN ISING MODEL

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The Kramers-Wannier transfer matrix with translation to an arbitrary number periods of a linear chain is obtained. The exact analytical solution for largest eigenvalue of transfer matrix including magnetic field is derived.

The one-dimensional decorated Ising chain in the magnetic field is considered. The Hamiltonian of this lattice is represented in following form:

$$H(s) = -J_d \Sigma_{i=1}^{N} s_i{*}s_{i+1} - J \Sigma_{j=1,\, d+2,\, \dots}^{N} s_j{*}s_{j+d+1} - h \Sigma_{i=1}^{N} s_i \,, \qquad (1)$$

where J_d is the nearest-neighbour interaction between decorated spin and nodal spin as well as between decorated spins, J is the exchange interaction between nodal spins only, h is an external magnetic field. The index d denotes the number of the so-called decorations [1] of chain.

Figure 1 illustrates the lattice of spins corresponding to linear decorated chain described by Hamiltonian (1). Red circles are associated with decorated spins and blue circles with nodal spins. Each spin has two states s = ±1.

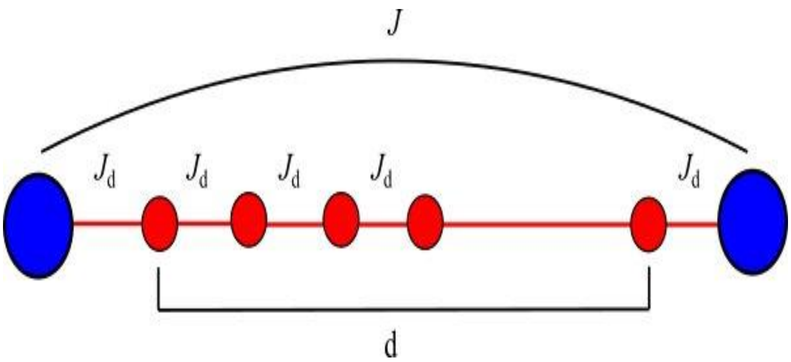

Рис. 1. The linear decorated chain with the nearest-neighbour exchange interaction J_d and the exchange interaction J

In the considered method of transfer matrix invented by Kramers and Wannier [2] all thermodynamic and magnetic quantities of the model are expressed only through its largest eigenvalue λ_{max}. Moreover, in this work unlike the usual Kramers-Wannier method, the transfer matrix is generalized [3] to an arbitrary number of translation of a linear chain.

However, taking into account that the first sum and the third sum in the Hamiltonian (1) runs through all spins of the lattice, and the second sum runs through the nodal spins only, the partition function in the thermodynamic limit ($N \rightarrow \infty$) takes the form:

$$Z = \lambda_{max}{}^{\wedge N/(d+1)} \qquad (2)$$

It is curious that if d tends to infinity, then this task reduces to the Ising's problem [4] since with an increase in the number of decoration the contribution to energy from nodal spins becomes more and more insignificant.

The research was carried out within the state assignment of Minobrnauki of Russia (theme "Quantum" No. AAAA-A18-118020190095-4), supported in part by Ural Branch of the Russian Academy of Sciences (project No. 18-2-2-11).

1. Fisher M.E., Phys. Rev. 113, 969-981 (1958).
2. Kramers H.A. and Wannier G.H., Phys. Rev. 60, 252-262 (1941).
3. Tsuvarev E.S. et al, J. Phys.: Conf. Ser. 1389, 012008 (2019).
4. Ising E., Zeitschrift fur Physik 21, 253-258 (1925).