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Effect of Electron Itineracy on Magnetism of S=1/2 Ferromagnetic Ising Model

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Abstract: The effect of electron itineracy on the magnetism of S=1/2 ferromagnetic Ising model is investigated by introducing a hopping term. The electron Green's function method is used to deal with this Hamiltonian. Here emphasis is made on that the magnetization is caused by the difference between the filling of spin-up and spin-down electrons. This concept is in accordance with that of band structure theory. In the zero band width limit, our results are the same as obtained by spin Green's function method. However, our method achieves more detailed physical information. The spontaneous magnetization, Curie temperature, total energy, and specific heat are calculated and investigated in detail by the densities of states. Hopping term depresses the Curie temperature but remains the order-disorder transformation still to be second order transition. Above the transition point, the energy band is the same as that of tight binding system because exchange interaction has no effect anymore. While under the transition point, the energy band splits into two subbands due to exchange interaction.

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Key words: ferromagnetic Ising model, electron itineracy, energy band, order-disorder transition

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