Spin-1/2 asymmetrical diamond Ising-Heisenberg chain

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The ground state and thermodynamics of the spin-1/2 asymmetrical diamond Ising-Heisenberg chain are considered. For the XYZ anisotropic Heisenberg interaction exact results for free energy, entropy, specific heat, magnetization and magnetic susceptibility are obtained by using the method of decoration-iteration transformation.

In the case of antiferromagnetic Ising and XXZ Heisenberg interactions the ground state, field and temperature dependencies of magnetization, magnetic susceptibility, and specific heat are investigated. The influence of geometric frustration and quantum fluctuations on these characteristics is studied. It is shown that in the ground state the strong enough quantum fluctuations remove the effect of geometric frustration on the Heisenberg bond. An increase of the quantum fluctuations shifts the high-temperature magnetization curve of the Heisenberg (Ising) subsystem to the region of higher (lower) magnetization. Consequently, the total high-temperature curve shifts to the higher magnetization. The zero-field specific heat of the system may have two additional low-temperature peaks.