Influence of a spatial anisotropy on presence of the intermediate one-half magnetization plateau of spin-1/2 Ising-Heisenberg branched chain

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The spin-1/2 Ising-Heisenberg branched chain constituted by regularly alternating Ising spins and Heisenberg dimers involving an additional side branching is rigorously solved in a magnetic field by the transfer-matrix method. The spin-1/2 Ising-Heisenberg branched chain involves two different types of the Ising couplings and one type of the Heisenberg coupling. The ground-state phase diagram and magnetization curves of the spin-1/2 Ising-Heisenberg branched chain are examined depending on a relative strength of the coupling constants. Three different ground states were found depending on a mutual interplay between the magnetic field and three different coupling constants: the modulated quantum antiferromagnetic phase, the quantum ferrimagnetic phase, and the classical ferromagnetic phase. It is shown that the spatial anisotropy connected to two different Ising coupling constants substantially influences a breakdown of the intermediate one-half magnetization plateau of the spin-1/2 Ising-Heisenberg branched chain reported in our previous work for the special case involving just one type of the Ising coupling constant [1]. The magnetic structure of the investigated spin-1/2 Ising-Heisenberg branched chain is inspired by the heterobimetallic coordination polymer $[(Tp)_2Fe_2(CN)_6(OCH_3)(bap)Cu_2(CH_3OH) \cdot 2CH_3OH \cdot H_2O]$ (Tp = tris(pyrazolyl)hydroborate, bapH = 1,3-bis(amino)-2-propanol) [2].

References:

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