Effect of uniaxial single-ion anisotropy on a stability of intermediate magnetization plateaus of a spin-1 Heisenberg diamond cluster

Katarína Karl'ová[1] and Jozef Strečka[1]

[1] *Institute of Physics, Faculty of Science, P. J. Šafárik University, Park Angelinum 9, 040 010 Košice, Slovakia*

Ground-state phase diagrams and magnetization curves of a spin-1 Heisenberg diamond cluster with two different coupling constants and uniaxial single-ion anisotropy are investigated in a presence of the external magnetic field with the help of exact diagonalization methods. It is shown that the spin-1 Heisenberg diamond cluster exhibits several remarkable quantum ground states, which are manifested in zero- and low-temperature magnetization curves as intermediate plateaus at 1/4, 1/2 and 3/4 of the saturation magnetization. It is demonstrated that the width of the fractional magnetization plateaus depends basically on a relative strength of the coupling constants as well as uniaxial single-ion anisotropy, which may substantially shrink or even cause full breakdown of some intermediate magnetization plateaus. The investigated quantum spin-1 Heisenberg diamond cluster is motivated by the magnetic structure the homotetranuclear nickel compound $[Ni_4(\mu\text{-}CO_3)_2(aetpy)_8](ClO_4)_4$ (aetpy = 2-aminoethyl-pyridine) [1], which displays in low-temperature magnetization curve two intermediate magnetization plateaus detected at 1/2 and 3/4 of the saturation magnetization.

References:

[1] K. Karl'ová, J. Strečka, J. Haniš, M. Hagiwara, Magnetochemistry **6**, 59 (2020).

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