Magnetocaloric effect in alternating-spin Cu(II)/Mn(II)-based complexes

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Magneto-thermal properties of alternating-spin (1/2-5/2) coordination complexes with a general formula $Cu(L)_iMnCl_4$, where $i = 2$ for L = men, bmen, and dmen, and $i = 1$ for L = dac, dpc (men = N–methyl–1,2–diaminoethane, bmen = N,N'–dimethylethylenediamine, dmen = N,N-dimethylethylenediamine, dac = 1,8-diallyl-1,4,8,11-tetraazacyclotetradecane, dpc - 1,8-dipropyl-1,4,8,11-tetraazacyclotetradecane). The structure of the compounds consists of covalent chains with alternating Cu(II) and Mn(II) ions for L = men and bmen, while covalent Cu(II)-Mn(II) dimers for L = dmen, dac, and dpc are formed. Measurements of magnetic susceptibility revealed the presence of a long-range order (LRO) in the complexes with L = bmen and dmen at ≈45 K. For complexes with L = men and dpc the LRO appears at 1.6 K and 3 K, respectively. A magnetocaloric effect was studied by the measurement of isothermal magnetization curves and the maximum change of the magnetic entropy during isothermal magnetization of the system was obtained close to 1.8 K for all complexes despite the magnetic ordering observed at much higher temperature in some of the studied complexes. Very high value $-\Delta S_M = 37$ JK^{-1}kg^{-1} at ΔB = 5 T was estimated for complex with L = bmen, which is even higher than for some spin clusters with high-spin Mn(II) ions only [1]. The analysis of the n exponent of $-\Delta S_M \sim B^n$ dependence close to the LRO temperature gives an insight into the critical behavior of the spin system [2,3].

References:

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