Magnetic investigations of a single crystal of spin chain

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The large single crystal of $[Co(NCS)_2(4\text{-}(3\text{-phenylpropyl})pyridine)_2]_n$ chain coordination polymer was synthesized. Its magnetic properties prove an almost Ising-type magnetic anisotropy with a magnetic easy axis nearly along Co-N_{ligand} bond, as predicted by single-ion *ab initio* calculations. Contrary to the powder sample [1], for the single crystal, two different magnetic relaxation processes are observed. Despite the system is ferromagnetically ordered (T_c = 3.39 K), one of the processes displays a crossover of relaxation time, indicating single-chain magnet (SCM) behavior. Dominant close to T_c, the second, faster process is assigned to spin-wave excitations. The origin of SCM relaxation was explained based on micromagnetic Monte Carlo simulations. They revealed that only chains at the borders of 3-dimensional domains for which the dipolar field cancels have their contribution to the ac magnetic susceptibility. To support the investigations of the SCM behavior, a magnetically diluted counterpart $[Co_xCd_{1-x}(NCS)_2(4\text{-}(3\text{-phenylpropyl})pyridine)_2]_n$ (x = 0.013) was used. It behaves as a single-ion magnet and its pathways of relaxation of single Co(II) spins are Raman, direct, and quantum tunneling processes. These processes were taken into account in the improved approach of the analysis of the SCM relaxation in $[Co(NCS)_2(4\text{-}(3\text{-phenylpropyl})pyridine)_2]_n$.

References:

[1] J. Werner; M. Rams; Z. Tomkowicz; C. Näther, **Dalton Trans.**, 43, 17333 (2014)