Magnetic properties of a molecule-based Fe[TCNE]2 magnet

KONSTANTIN POKHODNYA, Ohio State University/University of Utah, ARTHUR J. EPSTEIN, Ohio State University, MICHAEL BONNER, JOEL S. MILLER, University of Utah — The temperature dependence of magnetization \( M(T) \) of Fe[TCNE]2 • xCH2Cl2, (x~0.3-1; TCNE = tetracyanoethylene) molecule-based magnet\(^1\) demonstrates two phase transitions (at \( T_1 \sim 95-100 \) K and at \( T_2 \sim 10-25 \) K) whose temperatures depend upon the degree of disorder. The position of the ac susceptibility peak related to the high-temperature transition is almost frequency independent, while the low-temperature peak demonstrates a shift per frequency decade \( (\phi = dT/T_1)/d(\log \omega) \) of 0.03 characteristic for spin-glasses. A coercive field \( H_{cr} \) (400 Oe at 2 K) decreases exponentially on warming and vanishes when approaching \( T_1 \). This behavior may be qualitatively described in terms of the Heisenberg mean-field model developed for the systems with competing ferrimagnetic (FM) and spin-glass ordering. At \( T_1 \) the system passes from PM to FM state (the \( M \) component parallel to \( H \) orders while the perpendicular \( M_{tr} \) freely rotates). On further cooling, the system begins to acquire a static \( M_{tr} \) component (non-vanishing \( H_{cr} \)). At \( T_2 \), a crossover between weak and strong irreversibility occurs and a spin- or a cluster-glass state is achieved. [1] K. Pokhodnya, N. Petersen, and J. S. Miller. Inorg. Chem. 41, 1996 (2002)

\(^1\)Supported in part by the DE FG 03-93ER45504, DE-FG02-86ER45271, DE-FG02-01ER45931 grants.