Abstract Submitted
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Unusual features of magnetism in transition-metal-doped phthalocyanines $C_{32}H_{16}N_8TM$ (TM = Mn, Fe, Co, Ni, Cu) ZHENGJUN WANG, MOHINDAR S. SEEHRA, Department of Physics and Astronomy, West Virginia University — Transition-metal-doped phthalocyanines (TMPc), semiconductors with potential optoelectronic applications [1], are planar molecules with the TM atom at the center bound to four N atoms and forming a linear chain along the monoclinic b-axis. Because of this symmetry, the ground states of TMPc often violate the Hunds' rules; e.g. the S = 3/2 state for d^5 Mn(II) in β-MnPc, S = 1/2 state for the d^7 Co(II) in β-CoPc, and S=0 for Ni(II) in NiPc. The magnetic properties of TMPc are also affected by the stack angle δ between the orientation of the molecular plane and the b-axis, δ being 65(45) for α (β) phase [2]. For β-CoPc, our M vs. T data fits well with the Bonner-Fisher model for S = 1/2 AFM Heisenberg linear chain [3] yielding the Co^{2+}-Co^{2+} exchange constant J/k_B = - 1.5 K. For β-MnPc , a long-presumed ferromagnet with $T_C \approx 9$ K [4], our magnetic studies show it to be an Ising chain magnet with Arrhenius magnetic relaxation governed by J/k_B = 2.6 K and the zero-field splitting D/k_B = 8.3 K. In β-MnPc, the absence of λ-type peak in specific heat and no peaks in ac susceptibilities near the quoted $T_C \approx 9$ K confirms the absence of long range order (LRO). Instead we argue that LRO is absent in β-MnPc as D >J makes the spins in a chain parallel but canted with respect to spins in neighboring chains. [1]G. Mattioli et al, Phys. Rev. Lett. 101, 126805 (2008); [2]Z. Wang et al, IEEE Trans. Mag. 51, 2700104(2015); [3]J. Bonner & M. Fisher, Phys. Rev. 135, A640 (1964); [4]Y. Taguchi et al, J. Magn. Magn. Mater.301, 1229 (2007).

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