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Crystallographic and Magnetic Properties Studies on a Novel Cyanide-Bridged Molecule-Based Chiral Magnet

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The association of chiral ligands with achiral connectors is a rational synthetic approach towards the elaboration of chiral magnets which are expected to show fascinating physico-chemical properties, for example, asymmetric magnetic anisotropy and magnetochiral dichroism.[1,2]

Here, we present the study on novel chiral magnets $\{Mn^{II}[D(L)\text{-}NH_2ala]\}[Mn^{III}(CN)_6]_{1/3}\cdot H_2O$ (abbreviated as D(L)-**1**). The single crystal of **1** were obtained by the reaction of $MnCl_2$, $K_3[Mn(CN)_6]$, either D- or L-aminoalanine hydrochloride (D/L-NH_3ala·HCl) and KOH in a mixture of ethanol and H_2O. X-ray diffraction analysis indicates both the enantiomers crystallize in chiral space group $P6_3$. The NH_2ala^- anion offers 4 ligating atoms and chelated two adjacent Mn^{II} ions to form a triple-helical-stand structure. Then one $[Mn^{III}(CN)_6]^{3-}$ coordinates to three Mn^{II} ions through CN group to complete Mn^{II}'s octahedral coordination and gives rise to magnetic superexchange interaction between cyanide bridged Mn^{II} and Mn^{III}.

The magnetic properties study was carried on of both powder sample and a single crystal. It is interesting that this compound shows antiferromagnetic like behavior while the spin values of antiferromagnetic coupling Mn^{II}-Mn^{III} are non-equivalent. We infer that crystal **1** has a chiral magnetic structure with the screw axis along *c* direction which results in the antiferromagnetic like magnetic behaviors. Details of the discussion will be given in the presentation.

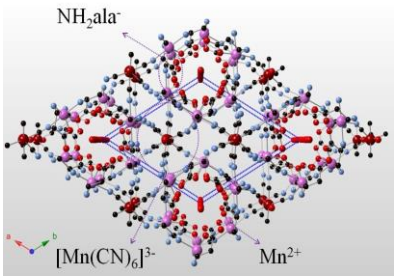

Fig. 1. Projection of the structure of **1** along *c* axis.

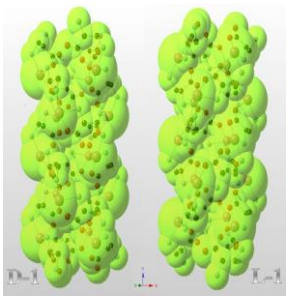

Fig. 2. Triple-helical-strand structure of **1** (D- and L-).

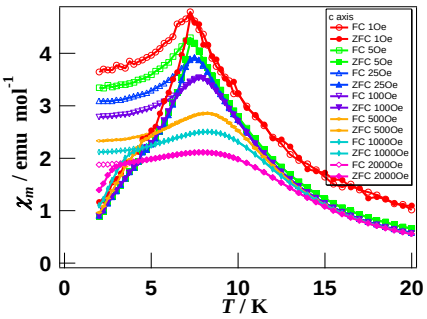

Fig. 3. FC-ZFC magnetization along *c* axis of the single crystal.

[1] C. Train, M. Verdaguer *et al.*, *Chem. Soc. Rev.*, **2011**, *40*, 3297-3312.

[2] H. Imai, K. Inoue, K.Kikuchi, Y.Yoshida, M.Ito, T.Sunahara, S.Onaka, *Angew Chem. Int. Ed.*,**2004**, *43*, 5618-5621.