1. Introduction

Inter-molecular ferromagnetic exchange interaction is useful for many purposes:
- Magnetic data storage
- Single molecule and single chain magnets
- Magnetooptical devices etc.

However, ferromagnetic interaction is somewhat rare in molecule-based magnetic materials because SOMO overlaps of adjacent magnetic molecules promptly bring antiferromagnetic interactions, which is generally much stronger than ferromagnetic one. Therefore, it is significant to find a new ferromagnetically coupled systems.

Here, we report three new ferromagnetically-coupled molecule-based materials [MnCl2Saloph(NCS)](PhCN), [MnBr2Saloph(NCS)] and [MnI2Saloph(NCS)]. The complexes are obtained by the in-situ ligand transfer from [CrSalen(NCS)2]– to [MnX2Saloph]+.

2. Experimental

ca. 20 mg in solution (25 ml) standing for a week...

X = Cl  PhCN + CH2Cl2 (1:1)
X = Br  CH3CN + CH2Cl2 (1:1)
X = I

Solvent: Rigaku R-AXIS RAPID (Imaging Plate, Mo Kα)
Initial structure: SIR2004, Refine: Shelx97
Magnetic measurements: Quantum Design MPMS-XL

3. Crystal structures and magnetism

X = Cl

Mn-O: 2.534 Å  C-C: 3.777 Å  C-Cl: 3.758 Å

Inter-dimer overlaps

X = Br, I (isostructural)

Mn-O: 2.537 Å (Br)  2.532 Å (I)
C-C: 3.567 Å (Br)  3.595 Å (I)

Intra-dimer interaction \( J/k_B \): +6.3 (Cl), +6.2 (Br) and +4.7 K(I) for X = Cl, Br and I, respectively, while the inter-dimer interactions are antiferromagnetic.

Intra-dimer interaction \( 2J'/k_B \): -0.06 (Cl), -0.20 (Br) and -0.17 K(I)
D = -2.2 (Cl), -2.0 (Br) and -2.3 (I) cm\(^{-1}\) *uncertain values

No magnetic transition down to 2.0 K.

4. Conclusion

New dimeric complexes, [MnX2Saloph(NCS)] (X = Cl, Br, I) are prepared by the slow ligand transfer from [CrSalen(NCS)2]– to [MnX2Saloph]+.

Magnetic measurements reveal that the intra-dimer interactions are ferromagnetic with \( 2J/k_B \): +6.3 (Cl), +6.2 (Br) and +4.7 K(I) for X = Cl, Br and I, respectively, while the inter-dimer interactions are antiferromagnetic.

The results suggest that the slow decomposition of [CrSalen(NCS)2]– is a useful method to construct a ferromagnetically coupled dimer of [Mn(salen-type ligand)(NCS)].

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