Perspectives in Multi-Functional Single-Molecule Magnets and Single-Chain Magnets

M. Yamashita  
Graduate School of Science, Tohoku University & CREST(JST), Aramaki-Aza-Aoba, Aoba-ku, Sendai 980-8578, Japan  
(yamasita@agnus.chem.tohoku.ac.jp)

Recently, the quantum molecular nano-magnets have been attracting much attention based on the basic sciences as well as the applied sciences such as memory storages, quantum computers, etc. So far 20 type of single-chain quantum magnets have been reported. Among them, we have synthesized 10 types of single-chain quantum magnets so far. More recently, we have synthesized the novel single-chain quantum magnet formed by a twisted arrangement of easy XY-plane magnetic anisotropy (D>0) for the first time. The compound consists of an alternating high-spin Fe(II) and low-spin Fe(III) mixed-valence chain complex, catena-[Fe^{II}(ClO_4)_2{Fe^{III}(bpca)_2}]ClO_4.3MeNO_2. The compound shows the photo-induced switching between a single-chain quantum magnet and a paramagnetic state reversibly for the first time by irradiation of the mixed-valence charge transfer band from Fe(II) to (Fe(III). This shows the reversible absorption and desorption of 3MeNO_2 crystalline solvents, which is accompanied by the change of the magnetic behaviours and is the first sponge quantum single-chain magnet. Moreover, this shows the semi-conducting behaviour. More recently, we have succeeded to synthesize conducting single-molecule quantum magnets such as [Mn_4(hmp)_6(MeCN)_2][Pt(mnt)_2]_6 and [Mn_2(5-MeOsalmen)(MeCN)_2]_2[Ni(dmit)]_2. 4(MeCN). These show the semi-conducting behaviors. We have accessed to one single-molecule magnet of Pc_2Tb by STM. We have observed “Kondo peak” in it by STS. We have a plane to input one memory into one single-molecule magnet and output from one single-molecule magnet.