Magnetic Properties of Mixed System $(Co_{1-x}Fe_x)_2(OH)_3Cl$ with Ferromagnetic Co^{2+} and Antiferromagnetic Fe^{2+} Spins on a Deformed Pyrochlore Lattice

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This work reports a systematic experimental study on the mixed system $(Co_{1-x}Fe_x)_2(OH)_3Cl$ with ferromagnetic Co^{2+} and antiferromagnetic Fe^{2+} spins on a deformed pyrochlore lattice. Recently we found a new 3*d*-electron tetrahedral frustration system $M_2(OH)_3X$ (M = Cu, Ni, Co, Fe, Mn; X = Cl, Br), which are characterized by deformed pyrochlore lattices [1-3]. Among them, the cobalt version $Co_2(OH)_3Cl$ showed a zero-field kagome-ice state below T_C = 10.5 K [2], and the iron version $Fe_2(OH)_3Cl$ showed antiferromagntic transition below T_N= 9.0 K [3]. We have found that a mixed system of $(Co_{1-x}Fe_x)_2(OH)_3Cl$ can be synthesized with a single crystal phase rhombohedral in space group *R*-3*m*. Therefore, this system provides an interesting controllable material set to study the spin glass physics in this new geometrically frustrated system. For x around 0.5, the susceptibility measurements suggested a spin-glass behavior [Fig.1]. Consistently the μSR result is similar to a typical spin-glass of CuMn [Fig. 2]. For the other compositions (e.g., x= 0.3 and x= 0.7) evidences of coexisting state of spin-glass and magnetic clusters were observed.

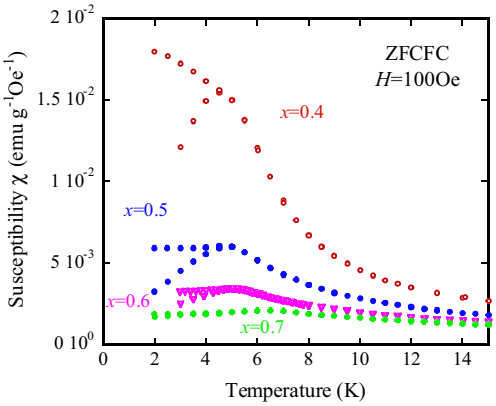

Fig.1 DC susceptibility for $(Co_{1-x}Fe_x)_2(OH)_3Cl$.

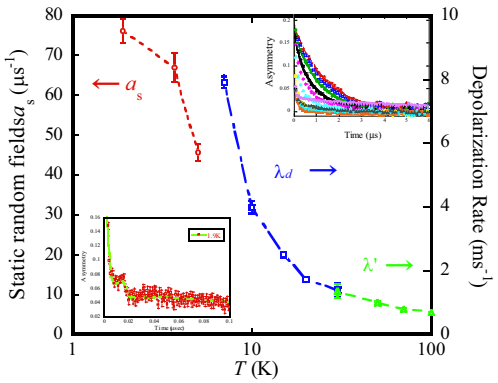

Fig2: Zero-field μSR result for the x = 0.5 sample.

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[1] X. G. Zheng et al. Phys. Rev. Lett. 95 057201 (2005).
[2] X. G. Zheng et al. Phys. Rev. Lett. 97 247204 (2006).
[3] M. Hagihala et al. J. Phys. : Cond. Matt. 19 145281 (2007).