


(※本報告書は英語で記述してください。ただし、産業利用課題として採択されている方は日本語で記述していただいても結構です。)

 MLF Experimental Report	提出日 Date of Report 2011. 6. 16
課題番号 Project No. 2010A0062 実験課題名 Title of experiment Investigation of exotic magnetic states in geometrically frustrated materials of pyrochlore lattice Ni ₂ (OH) ₃ Cl and triangular lattice Ni ₂ (OH) ₃ Br, Ni ₂ (OH) ₃ I, Co ₂ (OH) ₃ Br and Ni ₂ (OH) ₃ I 実験責任者名 Name of principal investigator X.G. Zheng 所属 Affiliation Saga University	装置責任者 Name of responsible person Y. Miyake 装置名 Name of Instrument/(BL No.) D1 実施日 Date of Experiment 2010.6.18-20

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。(適宜、図表添付のこと)
 Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.
Ni ₂ (OH) ₃ Cl and Ni ₂ (OD) ₃ Cl

2. 実験方法及び結果 (実験がうまくいかなかった場合、その理由を記述してください。) Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.
<p>New magnetic states in geometrically frustrated systems receive intense attention. In 2004, by μSR study we found unconventional magnetic transitions in a mineral compound clinoatacamite Cu₂(OH)₃Cl [PRB71,052409(2005); PRL95,0572011-4(2005)]. It showed unconventional magnetic transitions at $T_{N1} = 18.1$ K, $T_{N2} = 6.4$ K and $T_{N3} = 6.2$ K with co-existing order and spin fluctuation. The nature of the $T_{N1} = 18.1$ K phase is still largely unknown and attracting a lot of interest. Besides, it is the first example of the $S = 1/2$ (Cu²⁺) Heisenberg quantum spin on a pyrochlore lattice and the parent compound for the substituted “perfect kagome lattice” ZnCu₃(OH)₆Cl₂ which exhibits spin liquid behavior. There is a rich material series in the formula of M₂(OH)₃X, with M = Co, Ni, Fe, Mn, and X = Cl, Br, or I. Recently we observed a unconventional dynamic order in pyrochlore-lattice Ni₂(OH)₃Cl. Even though it transits into ordered AF state at $T_N=4$K, as is evident by our neutron diffraction and specific heat measurements (Fig. 1), the μSR data, however, clearly suggested dynamic local field for this material.</p>

2. 実験方法及び結果(つづき) Experimental method and results (continued)

Furthermore, we recently found a new high-temperature phase as shown by the small anomaly at around 20 K in Fig. 1. In order to further clarify the origin for this anomaly we performed zero-field and longitudinal field μ SR measurements on samples of $\text{Ni}_2(\text{OH})_3\text{Cl}$ and $\text{Ni}_2(\text{OD})_3\text{Cl}$ at various temperatures ranging from 300 K to 5 K.

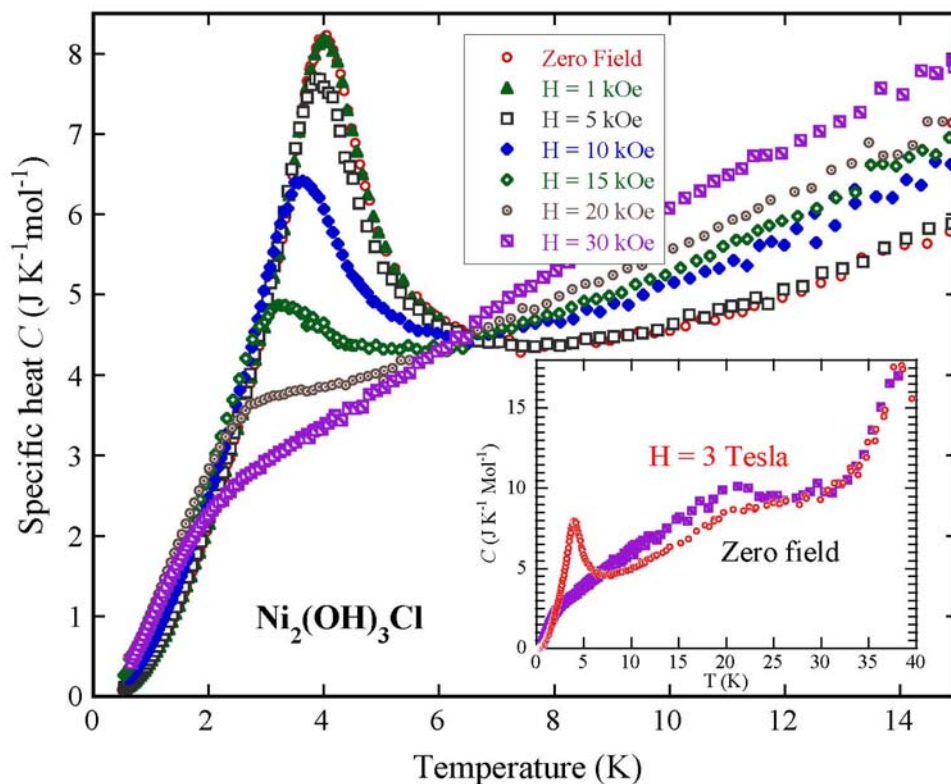


Fig. 1 specific heat for $\text{Ni}_2(\text{OH})_3\text{Cl}$ depicting transition at 4 K and a high-temperature anomaly around 20 K.

The μ SR measurements verified that there is no obvious change for the high-temperature anomaly, suggesting that it is most likely a field-induced transition.