

実験報告書様式(一般利用課題・成果公開利用)

(※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
課題番号 Project No. 2012B0216 実験課題名 Title of experiment Magnetic excitation of S=1/2 antiferromagnetic trimer system 2b 3CuCl ₂ 2H ₂ O 実験責任者名 Name of principal investigator Minoru Sanda 所属 Affiliation Tokyo University	装置責任者 Name of responsible person Kenji Nakajima 装置名 Name of Instrument/(BL No.) BL14 実施日 Date of Experiment 2013/3/4-2013/3/8

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.
2b (b=C ₅ H ₁₁ NO ₂) · 3CuCl ₂ · 2H ₂ O (powder)

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>We performed neutron scattering study on the 3D interacting trimer system, 2b·3CuCl₂·2H₂O, in which the magnetic ion Cu²⁺ (3d⁹; S = 1/2) forms the 3D networking trimer. These interacting trimer system is intriguing because two different kinds of ground state are expected; one is the so-called trimer ground state, where total S = 1/2 made of three trimer spins interact with each other, whereas the other is the so-called dimer-monomer ground state, where two out of three spins in a trimer form a non-magnetic singlet with one monomer (spin s = 1/2) remaining as magnetic. The two ground states are selected by detailed balance of several inter-trimer interactions, and therefore also expected for the interacting 3D trimer system such as 2b·3CuCl₂·2H₂O. These ground states cannot be distinguished from macroscopic measurement, since they have the same remaining spin 1/2. So, aim of this experiment is to determine the proper model Hamiltonian for this trimer system.</p> <p>All experiments were performed with fully-deuterated powder sample of 2b·3CuCl₂·2H₂O. Sample was cooled down to 5, 20, and 60K. Energies of incident neutron beam were tuned into 1.94, 2.63, 5.93, and 10.53 meV. Data analysis is going on with UTSUSEMI witch is a program for 4-dimensional data analysis developed by Dr. Inamura. Below figures show a part of the analysis at T = 5K.</p>

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

Magnetic excitations can be clearly seen at $E = 1.5\text{meV}$ and $E = 2.25$. This excitations show that $2b \cdot 3\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$'s model Hamiltonian is trimer model, because two magnetic excitations are seen at . If this system is dimer-monomer model, the only magnetic excitation can be seen in zero fields.

