



(※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。)

 <b>Experimental Report</b> 	承認日 Date of Approval 6/13/2013 承認者 Approver Kaoru Shibata 提出日 Date of Report 3/29/2013
課題番号 Project No. 2012A0037 実験課題名 Title of experiment Dynamics of surface condensed water in nano-porous silicate 実験責任者名 Name of principal investigator Takeshi Yamada 所属 Affiliation CROSS-Tokai	装置責任者 Name of Instrument scientist Kaoru Shibata 装置名 Name of Instrument/(BL No.) BL02 実施日 Date of Experiment 2012/06/09 09:00– 2012/06/11 09:00 2012/11/08 09:00– 2012/11/12 09:00 Total 6 days

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.
SiO <sub>2</sub> -nH <sub>2</sub> O

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.  Dynamics and/or phase transition of materials confined in nano-meter space are different from those in bulk state due to the increase of the surface/volume ratio and/or interaction between materials and pore walls. The interaction depends on the distance from the pore wall, therefore, the dynamics in the confined space shows hierarchical structure. In order to understand effects of the confined space, it is needed to investigate the hierarchical dynamics in wide time and/or space region.  The meso-porous silicate having ordered structure is good for the confined space. Many studies for the water dynamics in the meso-porous silicate have been reported along the way. However the effects of the interface are little discussed comparing with the amount of reports. Therefore, the dynamics of water in the confined space in wide time range was investigated by using BL02 spectrometer in this proposal. The fully hydrated meso-porous silicate which was 12 nm diameter and which pores were connected three dimensionally was used in this experiment. The QENS experiments with different temperature were performed with two kinds of energy resolution, 3 μeV and 13 μeV to cover the wide time range.

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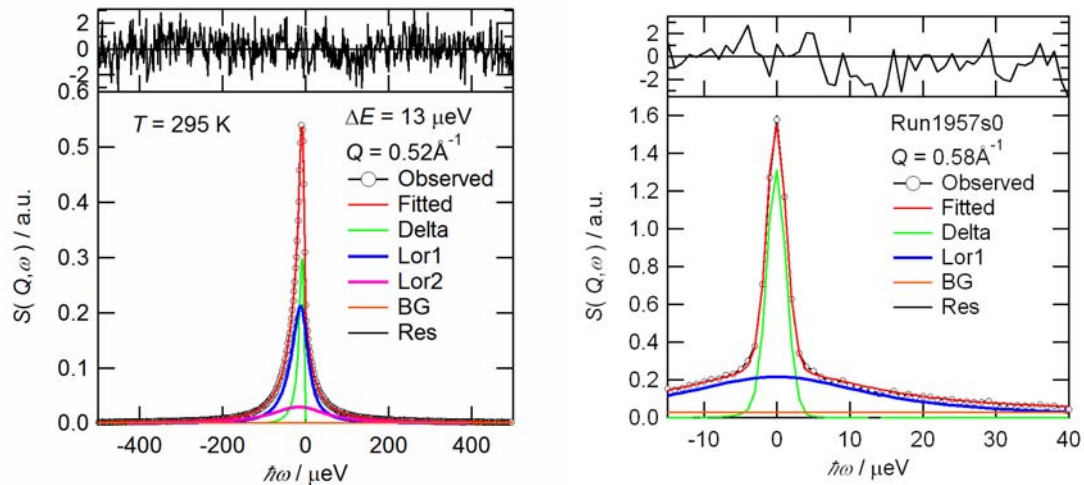


Figure 1. QENS profiles of fully hydrated meso-porous silicate at 295 K with different energy resolution 13  $\mu\text{eV}$  (left) and 3  $\mu\text{eV}$  (right).

Figure 1 shows QENS profiles at 295K with different energy resolution. The quasi-elastic broadenings were observed in both energy resolutions. The QENS profiles of 13  $\mu\text{eV}$  energy resolution were well fitted by sum of an elastic, two Lorentz and a constant background components. On the other hand, the QENS profiles of 3  $\mu\text{eV}$  energy resolution were well fitted by sum of an elastic, a Lorentz and a constant background components. The obtained half-width at half maximum of the Lorentz components (HWHM) is shown in Figure 2.

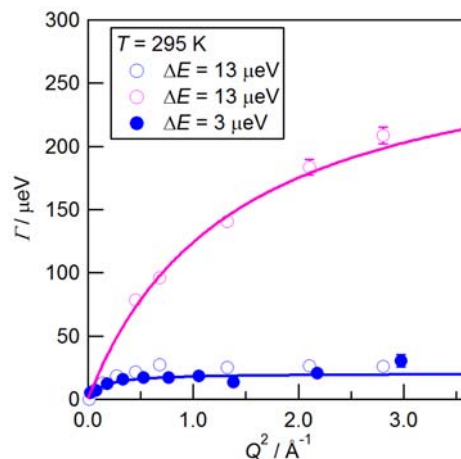


Figure 2. The half-width at half maximum of the Lorentz components of fully hydrated meso-porous silicate at 295 K with different energy resolution.

The HWHM of narrow component obtained by 13  $\mu\text{eV}$  energy resolution was matched with the HWHM of 3  $\mu\text{eV}$  energy resolution. This result indicated that there were two kinds of water dynamics due to the free and confined water in the fully hydrated meso-porous silicate. Further analysis is in progress.