
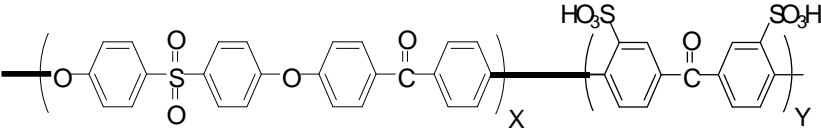


(※本報告書は英語で記述してください。ただし、産業利用課題として採択されている方は日本語で記述していただいても結構です。)

 MLF Experimental Report	提出日 Date of Report January 5, 2017
課題番号 Project No. 2016A0246 実験課題名 Title of experiment Neutron reflectance measurements on fuel-cell electrolyte membranes under dry and wet conditions 実験責任者名 Name of principal investigator Junji Inukai 所属 Affiliation Fuel Cell Nanomaterials Center, University of Yamanashi	装置責任者 Name of responsible person Norifumi Yamada 装置名 Name of Instrument/(BL No.) BL-16 実施日 Date of Experiment 11/22/2016-9/24/2016

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.
1. Nafion (100-nm thick) / Si(111) (2-inch ϕ) 2. SPK-bl-1 (100-nm thick) / Si(111) (2-inch ϕ)  <p>Fig. 1 Chemical Structure of SPK-bl-1</p>

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>Instrumental</p> <p>Figure 2 schematically shows the experimental set-up for the neutron reflectivity measurements on electrolyte membranes for fuel cells attached on substrates (Si(111) this time). With this system, neutron reflectivity measurements was carried out at controlled temperatures (30-90 degree C) and relative humidities (0-100% RH) suitable for the actual fuel-cell operations. The chamber was made of aluminum. The water vapor was collected in the form of liquid water by cooling the humidified N₂ gas. This system was planned to be used in Proposal 2016B0036, but since the system was ready, it was used in Proposal 2016A0246.</p> <p>One of the purposes of the experiments, therefore, was to confirm the performance of this system.</p>

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

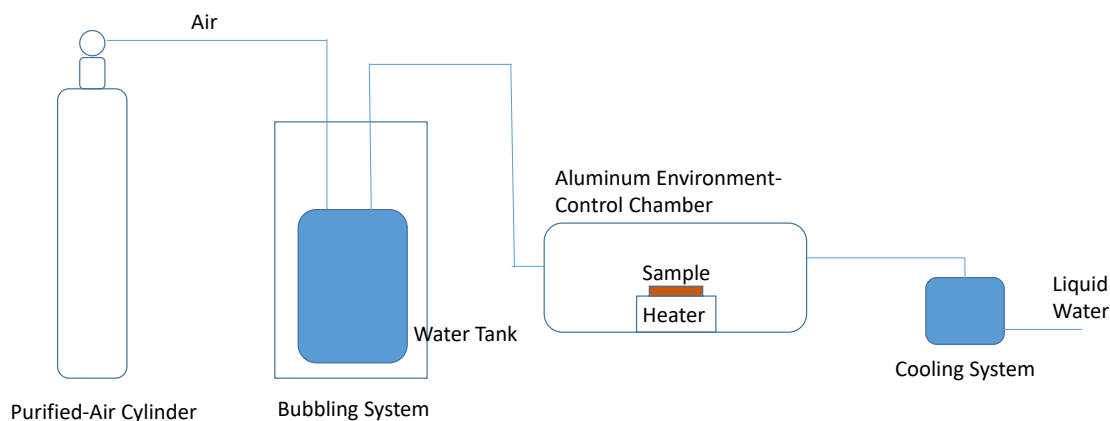


Fig. 2 Illustrative Experimental Set-up

Experimental

Temperature was 80 degree C. Relative humidity was 30% and 80%. Samples were Nafion/Si(111) and SPK-bl-1/Si(111). The area for the neutron irradiation was ca. 40 mm x 30 mm. Incident angle was 0.3-2.4 degree.

Results

Fig. 3 shows the reflectivity on Nafion and SPK at 80 degree C with different relative humidities.

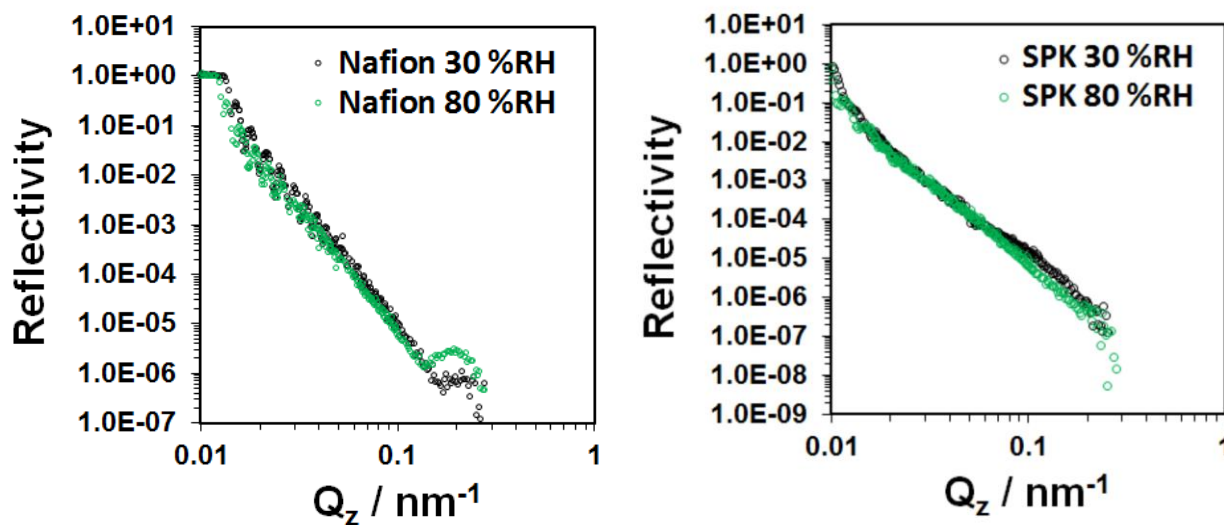


Fig. 3 Reflectivity on Nafion (left) and SPK-bl-1(right). Temperature = 80 degree C.

For Nafion, reflectivity was properly measured with distinct oscillations. For SPK-bl-1, the oscillations were hardly observed because of the similar densities of SPK-bl-1 and Si. It was confirmed that the system worked well for the reflectivity measurements at controlled conditions adequate for fuel-cell operations.

For/In Proposal 2016B0036:

- 1) Modify the system (dimensions, hose length, chamber height, etc.).
- 2) Use H_2O and D_2O for understanding the backbone structures and accumulated water structure.
- 3) Use Si, Pt-coated Si, C-coated Si, and quartz for substrates.