


(※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 2012 August 3
課題番号 Project No. 2011B0019 実験課題名 Title of experiment Study of Diffuse Reflection for the Characterization of Candidate Materials of Ultracold Neutron Storage Cell 実験責任者名 Name of principal investigator Tamaki Yoshioka 所属 Affiliation Kyushu University	装置責任者 Name of responsible person Norifumi Yamada 装置名 Name of Instrument/(BL No.) BL16 実施日 Date of Experiment 2012 March 14

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.
Diamond-Like Carbon (C, D)

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 measure the fraction of the diffuse reflection by observing the neutrons detected out of the specular region on the detector plane. One-dimensional distribution on the detector plane will be observed as a function of the neutron time-of-flight. We will convert the projected one-dimensional distribution into the neutron rest frame so that we obtain the angular distribution of the vertically incident UCNs. We are interested in the UCN reflection in the velocity range of 0-3 m/s, with the velocity step of 1 m/s or smaller, which corresponds to the angular resolution of 1 mrad or smaller for the incident velocity of 1000 m/s. We are going to adjust the beam divergence 1 mrad or smaller so that we clearly identify the specularly reflected neutrons.</p>
<p>We took data for 21 samples of diamond-like carbon thin film coated on the silicon wafer. We made the diamond-like carbon samples using our coating machine by changing various parameters such as bias voltage. In order to understand our diamond-like carbon, we firstly evaluated the</p>

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

Fermi potential which is also very important parameter of a neutron mirror. Figure 1 shows the typical reflectivity data of our diamond-like carbon. We obtained the diamond-like carbon whose Fermi potential is $\sim 230\text{eV}$ which is close to that of the nickel. We have checked the reproducibility of the Fermi potential for the diamond-like carbon with the same coating parameters. Figure 2 shows the results and we found the reproducibility is good. We also compared the measured Fermi potential with the calculated values. Figure 3 shows the results and we found that the about 30eV discrepancy between the measured and calculated Fermi potential. The reason is not clear and we need to take more data to understand this discrepancy.

For the diffuse reflection study, we have to develop the de-convolution method in order to discriminate specular reflection to non-specular reflection. We are now developing such method and study is now under way.

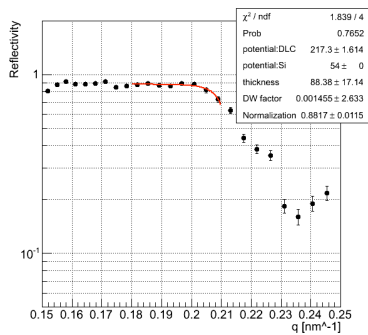


Figure 1: Typical reflectivity data of our diamond-like carbon. Fermi potential is calculated from this data.

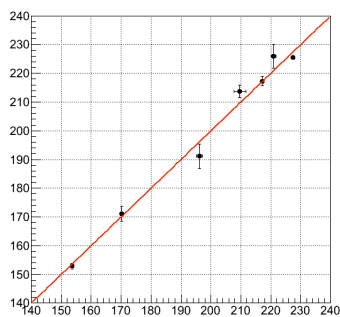


Figure 2: Correlation between Fermi potential of diamond-like carbon with same coating parameter. The reproducibility is found to be good.

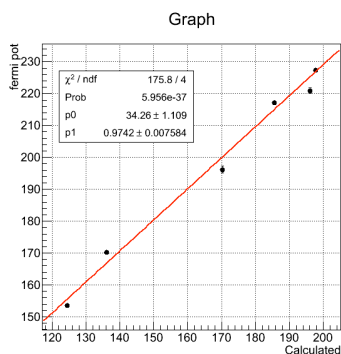


Figure 3: Comparison between measured (y-axis) and calculated (x-axis) Fermi potential. There is about 30eV discrepancy. The reason is now under investigation