（ ※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。 ）

CROSS TOKAI Experimental Report J-PARC	承認日 2014/4/30 承認者 Masayasu Takeda 提出日 2014/4/30
課題番号 Project No. 2014A0139 実験課題名 Title of experiment Neutron reflectivity measurement on the photo-induced hydrophilic reaction of rutileTiO_2(110) surface 実験責任者名 Name of principal investigator Tetsuro Shirasawa 所属 Affiliation University of Tokyo	装置責任者 Name of responsible person Masayasu Takeda 装置名 Name of Instrument/（BL No.） Polarized Neutron Reflectometer (BL-17) 実施日 Date of Experiment April 24-26th, 2014

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.

The sample was rutile type titanium dioxide (TiO_2) (110) oriented single crystal wafer with a size of 10mm^2 and a thickness of 0.5 mm.

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。）

We measured neutron reflectivity curve of the rutile-TiO_2(110) surface that is in a hydrophobic state and in a hydrophilic state. The hydrophobic state is the ground state without irradiating ultraviolet light. The hydrophobic surface was changed to the hydrophilic state by irradiating ultraviolet light for 1h (mercury lamp, λ=365 nm and 80 mW/cm^2). The sample was set in a sample cell made of Al with 0.012-mm thick Al windows for neutron beam and a 0.05-mm thick PCTFE window for the ultraviolet light. The sample cell was mounted on the sample stage of the neutron reflectometer of BL-17. Helium gas that was passed through a water (light water) bubbling cell and then it was passed through the sample cell during the measurements. Neutron reflectivity was measured with the time-of-flight mode. The neutron incident angle was 0.3°, 0.9°, and 1.8° for both of the surfaces.

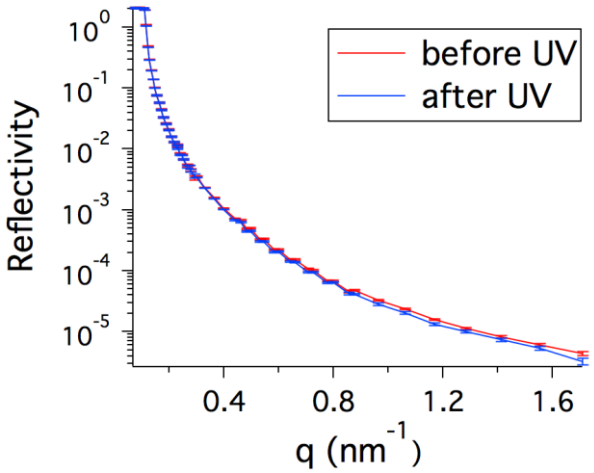

Fig. 1: Neutron reflectivity curves of the rutile-TiO2(110) surface that were measured before and after UV-light irradiation.

The measured neutron reflectivity curves for the hydrophobic and hydrophilic surfaces are shown in Fig. 1. The reflectivity of the hydrophilic surface is basically smaller than that of the hydrophobic surface. The tendency becomes clearer as q is larger ($q > 0.8$ nm^{-1}). At this state, we speculate that this change is due to

an increase of the surface roughness previously reported and/or the cancellation of the ordered single water molecule layer of the hydrophobic surface which we have suggested based on surface x-ray diffraction data. To make a clear conclusion, the reflectivity data with higher q are required. In this beamtime, due to the limited sample size (10x10 mm_2) the measurable reflectivity was limited on the order of 10^{-6}. We consider the data of 10^{-8} order are required to make a clear the conclusion. However, the tendency of the reflectivity change is consistent with the expected surface structural change. We are now planning to measure x-ray reflectivity data for the hydrophobic and hydrophilic surfaces and discuss the origin of the structural change by combining with the present neutron reflectivity data.