MLF Experimental Report	提出日 Date of Report
課題番号 Project No. 2016A0099 実験課題名 Title of experiment Observation for antiferromagnetic Bragg edges under high pressure 実験責任者名 Name of principal investigator Hiroaki MAMIYA 所属 Affiliation National Institute for Materials Science	装置責任者 Name of responsible person Kenichi Oikawa 装置名 Name of Instrument/（BL No.） NOBORU/BL10 実施日 Date of Experiment 20th June –21st June 28th June– 30th June

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.

Nickel oxide NiO powder
Nickel oxide NiO single crystal

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.

Experimental method

Samples were commercially supplied nickel oxide powder and single crystal; the former was obtained from Kojundo Chemical Laboratory Co., while the latter was a cuboid of 10 mm in height, 10 mm in width and 4 mm in thickness, made by SurfaceNet GmbH. The powder was contained in a 10 mm diameter vanadium cell. On the other hand, the single crystal was fixed on the sample holder so that its (111) surface was, in case I, roughly perpendicular to the incident beam, and in case II, inclined to the beam by almost 80 degrees. Their transmission spectra of the powder and single crystal samples were measured as a function of time of flight at beam line 10 (BL10) NOBORU in J-PARC. We counted neutrons transmitted through the perpendicularly fixed crystal by a gas electron multiplier (GEM) detector 14.5 m away from the neutron source, and neutrons transmitted through the obliquely fixed crystal and powders by a Li glass scintillator 14.0 m away from the source.

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

Results

Figure shows intensity of transmitted neutron beam through the nickel oxide powder as a function of time of flight. It can be seen that several stepwise increases as the time of flight increases.

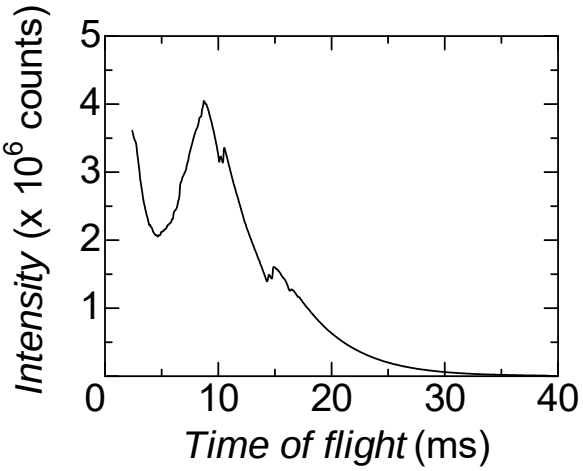

Figure 1 Intensity of transmitted neutron beam vs. time of flight for NiO powder.

For further analyses, total cross section estimated by the comparison with the incident intensity is shown as a function on neutron wavelength calculated from time of flight for the path from the source to the detector. Several saw tooth shapes can be clearly found in the spectrum. The positions of the drop-off indicated by the downward arrows coincide with the values of $2d_{hkl}$ for {hkl} atomic planes. Hence, these can be considered as Bragg edges due to nuclear scatterings. On the other hand, there are an extra step at λ = 0.96 nm. This length corresponds to twice of the period for collinear antiferromagnetic superstructure of {1/2 1/2 1/2} ferromagnetic sheet. For this reason, we can consider the observed step as a Bragg edge due to magnetic scattering. Further discussion will be given in research papers.

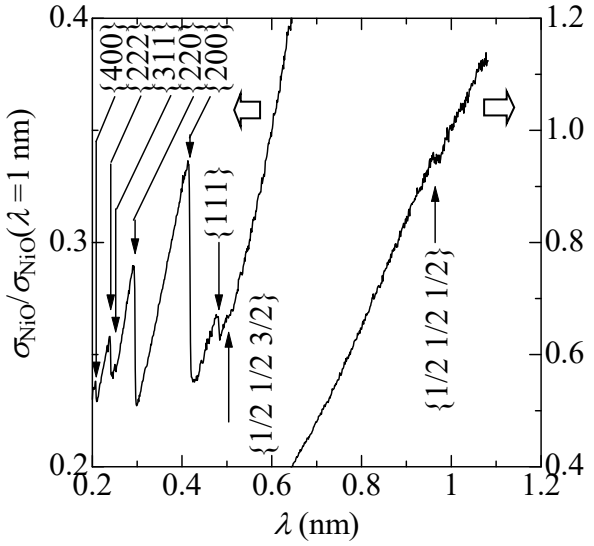

Figure 2 Wavelength dependent neutron cross section normalized by the magnitude at 1 nm for NiO powder.