MLF Experimental Report	提出日 Date of Report June 2, 2015
課題番号 Project No. 2014B0112 実験課題名 Title of experiment Powder neutron diffraction of valence ordering compound YbPd 実験責任者名 Name of principal investigator Akihiro Mitsuda 所属 Affiliation Department of Physics, Kyushu University	装置責任者 Name of responsible person Toru Ishigaki 装置名 Name of Instrument/(BL No.) iMATERIA(BL20) 実施日 Date of Experiment March 29~March 31, 2015

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.

YbPd, powder

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

We carried out time-of-flight powder neutron diffraction of YbPd at T=0.59K and 3.0K at BL20 (iMATERIA) to examine magnetic structure below T_N=1.9K. The powder sample of 4.4g was sealed in a vanadium cylinder with an inner diameter of 5.8mm together with helium gas. The sample, of which length was 47mm, was set to a 1K cryostat. It took about 12 hours to cool the sample from room temperature to 0.7K. The temperature of 0.59K was the lowest temperature that the 1K cryostat could reach. To obtain enough strong magnetic reflection, the 4-hour measurement at T=0.59K were carried out 4 times. To obtain nuclear reflection, 5-hour measurements at T=3.0K were done 3 times.

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

・Experimental results

YbPd crystallizes in the cubic CsCl-type structure with a lattice parameter *a* of ~3.44A at room temperature. This compound exhibits two structural phase transitions at T_1=125K (from cubic to tetragonal symmetry) and at T_2=105K (to double c-axis structure). Below T_2, it has a tetragonal *P*4/*mmm* structure with lattice parameters of a~3.435A and c~6.92A [1,2].

Figure 1 shows neutron diffraction patterns measured by LA25 bank at *T*=0.59K and 3.0K. Most of peaks can be indexed as those of the *P*4/*mmm* structure. Unfortunately, our sample contains small amount of impurities of Yb_2O_3. Comparing 0.59K and 3.0K patterns, the pattern at *T*=0.59K contains some extra peaks. It is found that some of them are associated with the magnetic order of YbPd at T_N=1.9K, and that the others are due to magnetic order of Yb_2O_3 at T_N=2.3K [3]. The magnetic peaks of YbPd are clearly observed at *d*=19.34A and 9.87A. The peak at *d*=19.34A is almost consistent with our previous results in JRR-3, which suggests a long-period incommensurate magnetic structure. The peak at *d*=9.87A is newly observed in the present experiment. This is probably because the present powder sample has less distortions than the previous one does and a neutron beam is stronger than that of JRR-3. Analysis of magnetic structure of YbPd is now in progress.

[1] A. Mitsuda et al.: J. Phys. Soc. Jpn. 82 (2013) 084712.

[2] R. Takahashi et al.: Phys. Rev. B 88 (2013) 054109.

[3] R. M. Moon et al.: Phys. Rev. 176 (1968) 176.

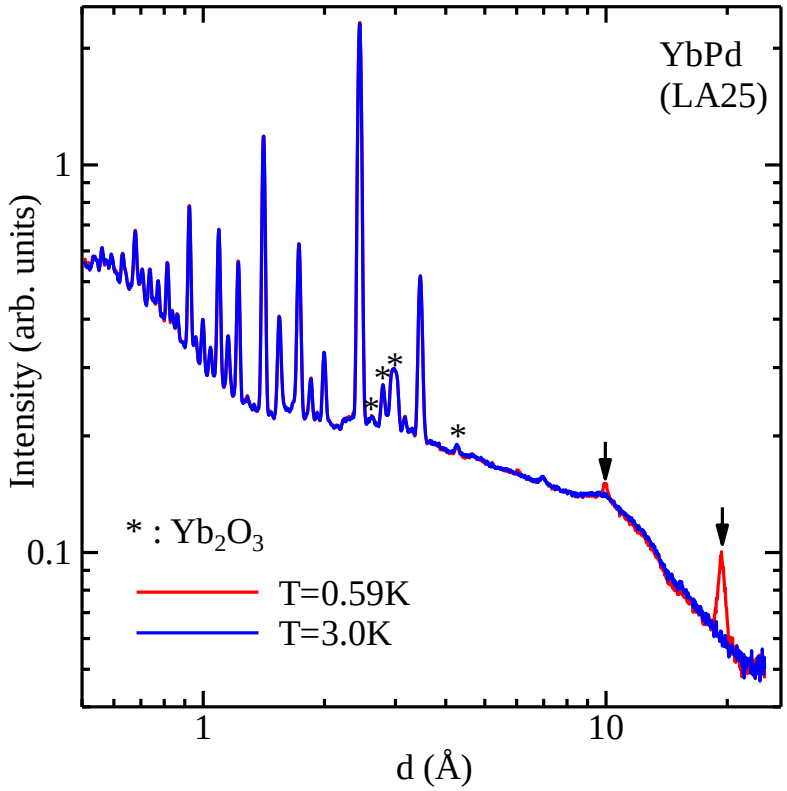

Figure 1: Time-of-flight neutron diffraction patterns measured by LA25 bank at *T*=0.59K and 3.0K. Solid arrows depict magnetic peak of YbPd. The asterisk symbols stand for nuclear peaks of Yb_2O_3.