MLF Experimental Report	提出日 Date of Report 2012/07/27
課題番号 Project No. 2012A0128 実験課題名 Title of experiment Development of high pressure cell for muon spin rotation and relaxation experiments at JPARC/MUSE and its application to organic systems 実験責任者名 Name of principal investigator Kazuhiko Satoh 所属 Affiliation Graduate School of Science and Engineering, Saitama University	装置責任者 Name of responsible person Yasuhiro Miyake 装置名 Name of Instrument/（BL No.） D1 実施日 Date of Experiment 2012/05/11～2012/05/13

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.

NiCrAl

Daphne oil 7474

Teflon

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.

Ground states of strongly correlated electron systems are very sensitive to external conditions. Especially, application of high pressure is an important technique because some of strongly correlated electron systems are located near the quantum critical point and exotic phenomena, e. g. non-Fermi liquid behavior and/or pressure-induced superconductivity, are frequently seen around the quantum critical point.

Muon spin rotation and relaxation method is an important technique to investigate microscopic magnetic properties for strongly correlated electron systems and we have continued to develop the high-pressure μSR technique at KEK and TRIUMF until now. Maximum muon momentum is about 100 MeV/c for KEK and TRIUMF, whereas it is about 70MeV/c for J-PARC MUSE D1 area. Thickness of a high pressure cell for J-PARC should be smaller and maximum pressure will be limited as compared to previous cells. Nevertheless, ground state of strongly correlated systems is sensitive to external pressure and various interesting phenomena are expected even below 1GPa. Therefore development of high pressure cell for J-PARC MUSE is valuable.

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

We have prepared a new high pressure cell using non-magnetic NiCrAl alloy for J-PARC/MUSE D1 by changing the design. Maximum pressure is estimated to be 1 GPa at room temperature. Using new pressure cells, we carried out following experiments.

1. μSR study of NiCrAl alloy at ambient pressure

We first check the zero-field μSR signal of high pressure cell itself, namely NiCrAl alloy, between 8 and 70 K at ambient pressure. μSR spectra of NiCrAl alloy are described by Kubo-Toyabe-type relaxation function and relaxation rate of NiCrAl is found to be smaller than that of previously used material, MP35N. NiCrAl is suitable for high-pressure cell for μSR.

2. New pressure medium Daphne 7474

Recently Murata *et al*. reported that a new pressure medium named Daphne 7474 shows high-quality hydrostaticity. We carried out zero-field μSR experiment for Daphne 7474 and found that μSR spectra of Daphne 7474 show relaxation signals which are similar to those of previously used Daphne 7373. Although Daphne 7474 is expensive, it is suitable for pressure medium for μSR,

3. Determination of optimum muon momentum for our pressure cell

In high pressure μSR experiment, some of muons will stop at a pressure cell and it is important to determine optimum muon momentum for individual pressure cells. We tried to determine optimum momentum by measuring asymmetry of Teflon as a function of muon momentum. We chose 75 and 80 MeV/c as muon momentum. We could not distinguish the μSR signal of Teflon, however, presumably due to the improper tuning condition. We would like to continue high pressure μSR experiments by improving the tuning condition.