(※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 2012/8/10
課題番号 Project No. 2011B0014 実験課題名 Title of experiment Investigation of molecular effect on muonic atom formation by measuring muonic X-rays for low pressure oxide gases (2) 実験責任者名 Name of principal investigator Kazuhiko NINOMIYA 所属 Affiliation Japan Atomic Energy Agency	装置責任者 Name of responsible person Y. Miyake 装置名 Name of Instrument/(BL No.) D1 実施日 Date of Experiment 2012/2/2-2012/2/5

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.

NO_2 gas (0.1, 0.2 and 0.5 atm)

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.

When a negative muon approaches to an atom, the muon is captured on the Coulomb field of the nucleus and a muonic atom is formed. Characteristic muonic X-rays and Auger electrons are emitted after formation of the muonic atom following to muon deexcitation. It is known that muon capture process is strongly influenced by molecular structure of the muon capturing atom (molecular effect). In fact, muon capture probability of each atom (corresponds to total intensities of muonic X-rays of each atom) and structure of muonic X-rays (muon deexcitation path) are changed by molecules. In addition to molecular effect, structure of muonic X-rays is influenced by the density of sample because muon-electron Auger process competes with the electron refilling process of muonic atom during muonic cascade.

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

To investigate the detail of molecular effect, we have been studying on the formation process of muonic atom for low pressure nitrogen oxide gases by measuring muonic X-rays.

In this study, we performed muon irradiation experiment for nitrogen dioxide (NO2) gases at D1-port, MUSE. The experimental setup is shown in Figure 1. In this work, muonic X-ray spectra were measured for 3 pressure conditions; 0.1, 0.2 and 0.5 atm. We found obvious difference on muonic X-ray structure between 0.2 and 0.5 atm conditions; muonic K-beta X-ray intensity in 0.5 atm condition is twice higher than that in 0.2 atm condition. On the other hand, there are no difference between 0.1 and 0.2 conditions. This fact shows that electron refilling processes are never influenced by the muon cascading process below 0.2 atm for NO2, that is, muonic atom can be regarded as an isolated system in this sample pressure condition.

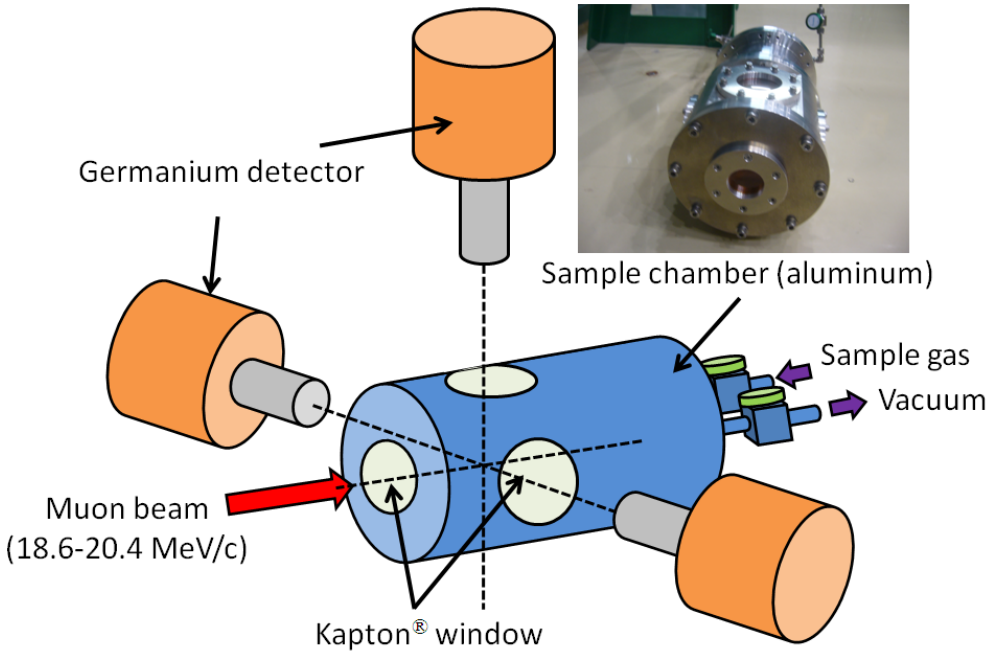

Figure 1. schematic view of the experimental setup