


(※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
課題番号 Project No. 2014A0204 実験課題名 Title of experiment Investigation of muon cascading process after muon capture by measuring pressure dependence on muonic X-ray structure for hydrogen mixture system. 実験責任者名 Name of principal investigator Kazuhiko Ninomiya 所属 Affiliation Osaka University	装置責任者 Name of responsible person Y. Miyake 装置名 Name of Instrument/(BL No.) Muon D1 実施日 Date of Experiment 2014/5/10-2014/5/14

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. H ₂ gas CO + H ₂ gas CO ₂ + H ₂ gas

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 this study, we focused on muonic atom formation process through muon transfer. The muonic hydrogen is free from Coulomb interaction with other atoms and can diffuse in substance like neutron because of the small atomic radius of the muon. When the muon hydrogen closes to the nucleus of other atom, the muon move to the atomic orbital of the nucleus. This process is called muon transfer.

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

To investigate molecular effect in muon transfer process, we performed muon irradiation for CO+H₂ and CO₂+H₂ gases below 100kPa condition and measured muonic X-rays emitted after muon capture in C and O atoms. Because the muon firstly captured in hydrogen atom in the muon transfer process, the muonic X-rays emitted after muon transfer process are delayed from muon beam pulse. We extracted muonic X-ray spectra by direct muon capture and muon transfer capture processes separately using TDC spectra of muonic X-rays. Figure 1 shows the prompt (direct muon capture) and delayed (muon transfer process) muonic X-ray intensity patterns for muon irradiation for CO+H₂ and CO₂+H₂ sample. The muonic X-ray intensity patterns are completely different each other. We are now discussing on the difference in initial state of captured muon by two processes and on the influences in muon capture phenomena by molecular structure (CO and CO₂).

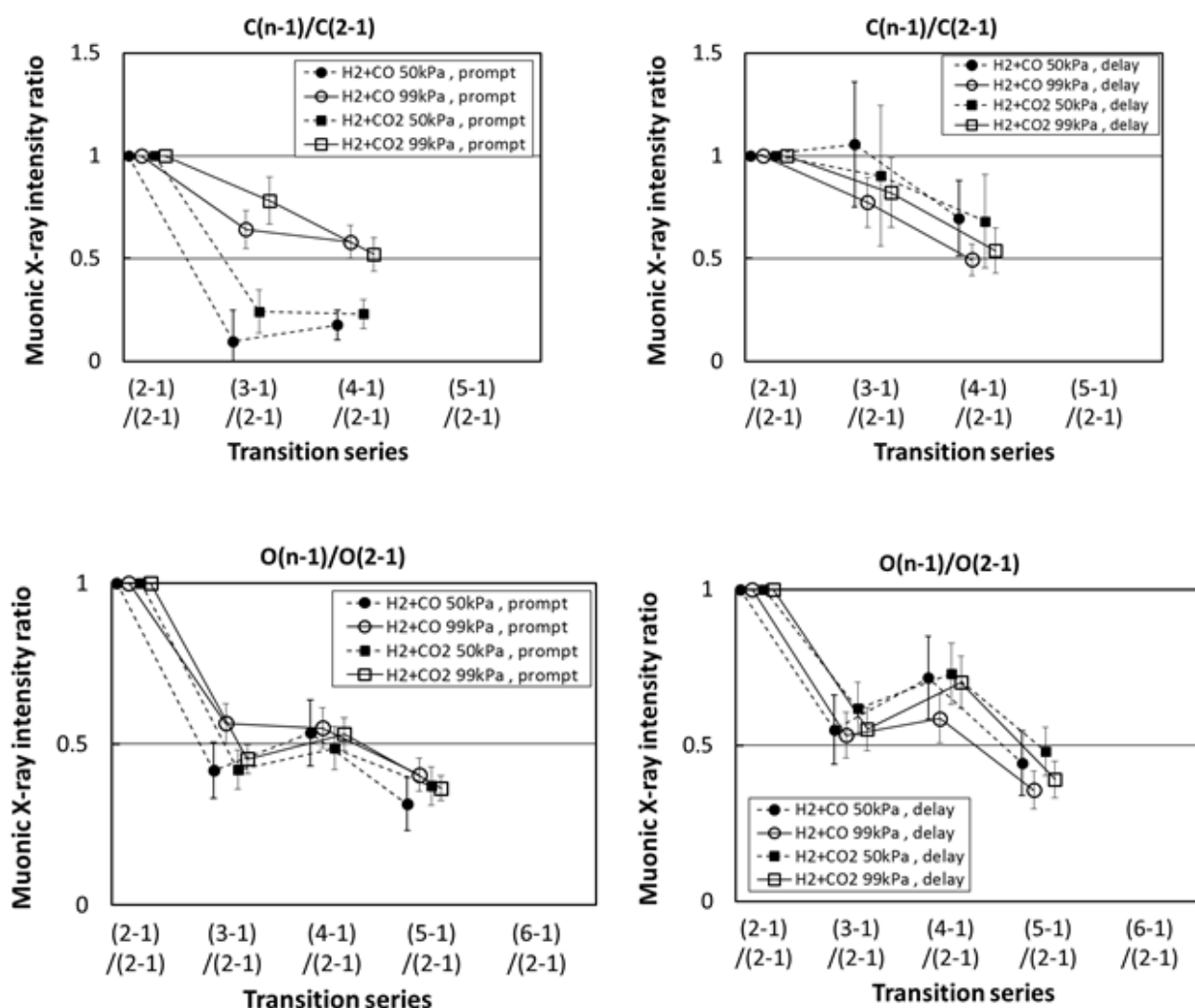


Figure 1 : Prompt (direct muon capture) and delayed (transfer muon capture) muonic X-ray intensity patterns for muon irradiation for CO+H₂ and CO₂+H₂ sample.