Contribution ID: **102** Contribution code: **O-17** Type: **Oral**

Negative muon spin rotation and relaxation for energy materials

Tuesday, 30 August 2022 12:10 (20 minutes)

A positive muon spin rotation and relaxation (μ^+SR) has been widely used for assorted materials to study a microscopic internal magnetic field. However, the counterpart technique, μ^-SR, is less common mainly due to a small asymmetry of the μ^-SR signal, typically 1/6 to that of μ^+SR, caused by the loss of the spin polarization during a capture process of μ^- by nuclei. This means that 36 times higher statistics are needed for μ^-SR measurements to achieve a reliability comparable with the one of μ^+SR. Fortunately, recent developments of the intense pulsed muon beam together with a multi-detectors counting system enable the measurement of the μ^-SR spectrum within a reasonable amount of beamtime. As a result, we have developed a new tool to detect internal magnetic fields from a fixed view point, since the muonic atom (the bound state between μ^- and an element of the target material) should be stable up to the decomposition temperature of target materials. This is particularly important for research on energy materials, in which various atoms and/or ions are diffusing and such species could affect the local stability of the implanted μ^+ at the interstitial site. Here, we summarize our μ^-SR results on hydrogen storage material MgH_2 [1], cathode materials of ion batteries $LiMnPO_4$ [2] and $Li[Ni_{1/2}Mn_{3/2}]O_4$ [3], and an anode material $Li_4Ti_5O_{12}$ [4].

[1] J. Sugiyama et al., Phys. Rev. Lett. **121**, 087202 (2018).
[2] J. Sugiyama et al., Phys. Rev. Research **2**, 033161 (2020).
[3] J. Sugiyama et al., Z. Phys. Chem. **236**, 799 (2022).
[4] I. Umegaki et al., J. Phys. Chem. C **126**, 10506 (2022).

Primary author: Dr SUGIYAMA, Jun (CROSS Neutron Science and Technology Center)

Co-authors: Dr UMEGAKI, Izumi (Toyota Central R&D Labs., Inc.); Dr OHISHI, Kazuki (CROSS Neutron Science and Technology Center); Dr TAKESHITA, Soshi (KEK); Ms NOCERINO, Elisabetta (KTH); Mr FORSLUND, Ola K. (KTH); Dr MATSUBARA, Nami (KTH); Prof. NAKANO, Takehito (Ibaraki University); Dr HILLIER, Adrian (STFC / UKRI); Prof. SASSA, Yasmine (Chalmers University of Technology); Prof. MANSSON, Martin (KTH); NINOMIYA, Kazuhiko (Osaka University); Prof. SHIMOMURA, Koichiro (KEK); Dr ISHIDA, Katsuhiko (Riken); Prof. KUBO, M. Kenya (International Christian University)

Presenter: Dr SUGIYAMA, Jun (CROSS Neutron Science and Technology Center)

Session Classification: Oral contributions

Track Classification: Energy materials