Contribution ID: **116** Type: **not specified**

Reversible magnetoelectric switching by electrochemical lithium intercalation

Tuesday 29 October 2019 14:00 (5 minutes)

Manganese based perovskites ("maganites") of the composition A1-xBxMnO3 appear in various electronic and magnetic phases, with features like colossal magnetoresistance. Those phases are composition and temperature dependent as shown in complex phase diagrams. The complexity of this system originates from competition between order mechanisms, magnetic interactions and structural aspects. The macroscopic phase diagram is believed to be an overlap of small phases where the disorder that is induced by the distribution of A3+ and B2+ and the ratio of Mn3+/Mn4+ results in local variation of the mechanisms mentioned earlier. During this project, we want to cross magnetic phase boundaries reversibly by chemical doping and monitor the process in-situ. To achieve this, we want to use electrochemical lithium intercalation and de-intercalation. The material of choice is La1-xSrx MnO3 (LSMO) where Lithium would replace part of lanthanum or strontium. At a composition of 50% strontium and at room temperature LSMO shows a phase transition between ferro- and paramagnetism. It is believed that one could switch between those magnetic states by lithium inter- and de-intercalation. Furthermore, the in-situ measurements are carried out using polarized neutron reflectometry (PNR) and resonant X-ray techniques as well as elechtrochemical characterization. With PNR, we investigate the distribution of the Lithium and the magnetic induction profile. Another goal is to relate these phenomena to the Mn3+/Mn4+ ratio. Because the process should be reversible we want to investigate the same sample in various states along the phase transition border using various methods and connect the different appearing phenomena as mentioned above to each other.

Position

Phd

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Session Classification: Flash talks

Track Classification: Flash talks