Contribution ID: **153** Type: **Talk**

In-operando neutron reflectometry reveals the solid electrolyte interface formation on surface coated silicon based anodes for lithium-ion batteries

Tuesday, December 8, 2020 4:15 PM (25 minutes)

Silicon anodes for lithium ion batteries (LIBs) exhibit a high theoretical capacity of 3590 mA h g^{-1} –one magnitude higher than commonly used graphite –but they suffer a large volume expansion of around 300 % during cycling. The formation and composition of the solid electrolyte interface (SEI) in LIBs has a huge impact on the stability and performance of the cell. Coatings of only 10 nm have a large influence on the SEI and therefor on the stability of the silicon based anode, hence also the cell.[1] Static time-of-flight neutron reflectometry (TOF NR) measurements proof the first three cycles sufficient to form the SEI using metallic lithium as counter electrode. Carbon or TiO_2 surface coatings on $Si_{85}Ti_{15}$ alloy anodes significantly influence the composition and thickness of the SEI. In-operando TOF NR measurements during cycling lead to a better fundamental understanding of the formation and growth of the SEI on these high-performance LIB anodes.

References

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Primary authors: SCHAPER, Simon J.; Dr XIE, Hezhen; WIDMANN, Tobias (TU München, Physik Department, LS Funktionelle Materialien); KREUZER, Lucas (TU München, Physik Department, E13); HAESE, Martin (Helmholtz-Zentrum Geesthacht); MANGIAPIA, Gaetano (German Engineering Materials Science Centre (GEMS) am Heinz Maier-Leibnitz Zentrum (MLZ)); Prof. BURIAK, Jillian M.; MÜLLER-BUSCHBAUM, Peter (TU München, Physik-Department, LS Funktionelle Materialien)

Presenter: SCHAPER, Simon J.

Session Classification: MLZ Users 2020 - Materials Science

Track Classification: UM: Materials Science