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

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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 therefore 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 $\text{Si}_{85}\text{Ti}_{15}$ 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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