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In situ Measurements of the Solid Electrolyte Interphase in Li-Ion Batteries Using Neutron Reflectometry JOSEPH DURA, NIST - Center for Neutron Research, JEANETTE OWEJAN, Electrochemical Energy Research Laboratory, General Motors, STEVEN DECALUWE, Dept. of Mechanical Engineering, Colorado School of Mines, JON OWEJAN, Electrochemical Energy Research Laboratory, General Motors — The huge advantages of Li-ion batteries, i.e. high energy density and specific power are due not only to the low mass of Li, but also a direct result of the high operating voltage provided by the large electrochemical potential of Li. However, these advantages come at a cost, as all known electrolytes are unstable at these potentials. Li-ion batteries are only made possible by the solid electrolyte interphase, SEI, a passivation layer that forms from the decomposition products of certain electrolytes. Ideally the SEI offers sufficient electronic resistance when it has grown thick enough to stop additional electrolyte decomposition. However, slow continued SEI growth leads to capacity fade and increased cell resistance. Despite the SEI's critical significance, currently structural characterization is incomplete because of the reactive and delicate nature of the SEI and the electrolyte system in which it forms. Here we present the first in situ neutron reflectometry measurements of the SEI layer as function of potential in a working lithium half-cell. The SEI layer after 10 and 20 CV cycles is 4.0 and 4.5 nm, respectively, growing to 8.9 nm after a series of potentiostatic holds that approximates a charge/discharge cycle. Specified data sets show uniform mixing of SEI components.

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