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BATTERIES & SUPERCAPS
Editorial

Special Collection

SEI and Interphases at Electrodes

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Progress and setbacks of alkali-metal (primary and rechargeable) and alkali-ion batteries have been and are still be very much influenced by the reactivity of anode and cathode with the electrolyte. Metals, alkylated carbons, and alternative anodes (nitrides, phosphides, oxides, alkali storage metals and alloys, etc.) that work at decently negative electrode potentials, and thus are used as anodes for high-voltage cells, are thermodynamically unstable against the electrolyte and thus the anode surfaces exposed to the electrolyte need to be protected by a "protective" film, the so-called solid–electrolyte interphase (SEI). First applied for the films formed on metallic lithium, the SEI concept has been basically adapted for carbonaceous anodes and is now used for alternative (cf. above) anodes and even cathodes, where the term cathode-electrolyte interphase has been established.[1]

In this special collection, Cabo-Fernandez et al. provide a contribution demonstrating the use of in situ shell-isolated nanoparticles for enhanced Raman spectroscopy (SHINERS) to investigate the structural evolution at electrode materials and SEI formation (10.1002/batt.201800063), while Leanza et al. unveil how the oxygen released from layered cathodes contributes to the degradation of the electrode surface and oxidation of the electrolyte in Li-ion batteries by using surface sensitive soft X-ray photoemission electron microscopy (10.1002/batt.201800126). Horowitz et al. study the SEI formation on a silicon nanowire anode in a liquid disiloxane electrolyte and demonstrate that low concentrations of fluoroethylene carbonate is essential for the SEI (10.1002/batt.201800123), and Moretti et al. compare three SEI formation methods on the anode surface of graphite//$LiFePO_4$ cells and share their findings on which of them provides optimal results (10.1002/batt.201800109). Santhosha et al. contribute with a research article studying an indium–lithium alloy anode for solid-state batteries, in which they provide insights into the interphase formation and stability (10.1002/batt.201800149). On the other side of the battery, Hata et al. report on the formation of a cathode–electrolyte interphase (CEI) between a $LiCoO_2$ cathode and a ZrO_{2-x} surface layer (10.1002/batt.201800122). With a more theoretical approach, Röder et al. contribute to this special collection with a multiscale analysis of SEI film formation in Li-ion batteries based on an extension of a pseudo two-dimensional model (P2D) (10.1002/batt.201800107). Shukla and Franco bring us a comprehensive review on interphases in electroactive suspension systems, particularly applied to the semi-solid redox flow batteries and explain that to study such complex systems, a combination of advanced simultaneous techniques and a unified theoretical framework is necessary (10.1002/batt.201800152), while Kranz and et al. give a detailed account of the influence of the formation current density on the transport properties of ions and molecules across the SEI (10.1002/batt.201900110).

We do sincerely hope that this collection of focused contributions on the SEI and other interphases in batteries will help the interested readers to get a better understanding of the peculiar films formed at high-voltage battery anodes and cathodes. Nevertheless, as has been already published elsewhere,[2] the SEI remains a super-interesting topic of further investigations also in the future.

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