Review of: "The importance of electrode interfaces and interphases for rechargeable metal batteries"

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This is a concise and comprehensive Comment. The author discusses progress and future perspectives of the practical importance of electrode interfaces and interphases for rechargeable metal batteries. The author’s understanding is instructive for researchers working in the field of rechargeable metal batteries.
It is widely understood by researchers that the stability of electrolytes against metal electrodes has a significant impact on interfacial property, together with electrochemical performance of metal electrodes. However, relevant discussion was missing. Additionally, based on recently reported cryogenic electron microscopy results (Science 358.6362 (2017): 506-510; Joule 2.10 (2018): 2167-2177.), the thickness of SEI ranges from just a few nanometres to tens of nanometres, and not the hundreds of nanometres claimed in the Comment. The structure of SEI is actually rather complicated, and includes the mosaic structures that is covered in the communication, however it includes also multilayer structures that are not canvassed.
The section on present important questions surrounding SEI is however excellent. A drawback nevertheless is a lack of necessary emphasis on functions of the organic components of SEI, to include important questions, for example, what is the actual structure? are these ionically conductive? and, what is the bond with inorganic components?
An improved understanding of ‘activation’ of artificial SEIs, that is, reaction with metal electrodes and electrolytes during battery cycling, is crucial to function and failure mechanism(s). Metal anode dissolution with or without artificial SEI during stripping also needs to be better understood than at present.
It is likely advanced *in-operando* characterizations would result in new information if applied to investigation of interfacial properties of electrodes working under practical conditions. In addition to those techniques assessed, ambient pressure X-ray photoelectron spectroscopy, and liquid-phase transmission electron microscopy with *in-situ* electrochemical cells, appear practically promising as tools to confirm the solid-liquid (electrode-electrolyte) interfacial chemistry during electrochemical reactions.
The flammable and reactive nature of alkali and alkaline earth metals in air significantly increases cost of rechargeable metal batteries. This will therefore require future development of air-stable metal electrodes.