

Abstract Submitted  
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**Novel borate additives for lithium-ion battery cathode passivation investigated with hard x-ray photoelectron spectroscopy<sup>1</sup>**  
STEPHANIE RIVARD, BENJAMIN YOUNG, Rhode Island College, DAVID HESKETT, YINGNAN DONG, University of Rhode Island, YONGFENG HU, Canadian Light Source, BRETT LUCHT, University of Rhode Island — Cathodes presently used in industry-standard graphite-based Li-ion batteries will limit capacity improvements made on the anode side due to electrochemical limitations. The high voltage spinel cathode,  $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$ , may permit a higher 4.7 V operating potential and represents a significant step in the journey to developing higher capacity rechargeable batteries. Successful employment of the high voltage cathode will require attention paid to formation of the cathode electrolyte interphase (CEI), a passivation layer that grows on the electrode surface to prevent decomposition of the electrolyte material. Herein we present an investigation of three novel borate additives to the standard electrolyte (ethylene carbonate/ethyl methyl carbonate solvent with  $\text{LiPF}_6$  salt) using Hard X-Ray Photoelectron Spectroscopy (HAXPES). Electrochemical cycling data reveal that the standard electrolyte is significantly outperformed by batteries with these additives at elevated temperature. The HAXPES data suggest that this may be due, in part, to the thickness of the CEI layer developed on each cathode, which we have approximated for each battery. Furthermore, we see evidence of additive decomposition on the better-performing batteries, which likely leads to more effective electrode passivation.

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