"Electrolytes for High Energy Li-ion and Li Metal Batteries"

Wednesday
October 6, 2021
3:30 pm
Wu and Chen Auditorium
Levine Hall

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Abstract

Electrolytes are critical enabling components for Li-ion batteries to safely operate within a wide temperature range, under extreme fast charging, and under intense abuse conditions without sacrificing energy density and cycle life. Current electrolytes cannot satisfy these requirements. We developed advanced all-fluorinated electrolytes, water-in-sale (WIS) electrolytes and solid-state electrolytes aiming to simultaneously enhance cell energy density and safety. Guided by the electrolyte design principle for high-capacity electrodes with large volume changes, we developed serval organic liquid electrolytes suitable for micro-sized Si and Li metal anodes and NMC cathodes. We also reduced the salt concentration of water-in-salt electrolytes from 21m to 4.5m, and extended the electrochemical stability window from 3.0V of WIS to 3.4V. These improved electrolytes enable $LiMn_2O_4/Li_4Ti_5O_{12}$ pouch cells with an areal capacity of 2.5 mAh/cm^2 and a P/N capacity ratio of 1.14 to achieve a long cycle life of 500. For solid state electrolyte Li metal batteries, we suppressed the Li dendrite growth and reduced the interface resistance by constructing a lithionphobic-lithiophoilic interlayer between solid electrolyte and Li metal anodes. The critical role of solid electrolyte interphase in accommodating electrode volume changes was also investigated.

Bio

Chunsheng Wang is the Robert Franklin and Frances Riggs Wright Distinguished Chair at the University of Maryland, College Park. He is a co-founder and UMD Director of the UMD-ARL Center for Research in Extreme Battery, and associate editor of ACS Applied Energy Materials. His current research focuses on Li-ion battery electrolytes and developed a water-in-salt electrolyte and a transition metal free LiBr-LiCl-Graphite cathode for Li-ion batteries. He has published more than 300 papers and has been ranked as a Highly Cited Researcher by Clarivate. He is the recipient of University of Maryland's 2016 and 2021 Invention of the Year Award. His battery technologies have been licensed by the Aqualith Advanced Materials. He also received the ECS Battery Division Research Award in 2021.

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