Angewandte International Edition Chemie

Electrolyte additives for lithium metal anodes and rechargeable lithium metal batteries: progresses and perspectives

Heng Zhang, Gebrekidan Gebresilassie Eshetu ✉, Xabier Judez, Chunmei Li, Lide M. Rodriguez-Martínez, Michel Armand

Accepted manuscript online: 14 February 2018 Full publication history

CICenergigune, Electrochemical Energy Storage, Minano, SPAIN

Abstract

Lithium metal (Li°) - based rechargeable batteries (LMBs), such as Li° anode vs. intercalation and/or conversion type cathode batteries, lithium-sulphur (Li-S), and lithium-oxygen (O2)/air (Li-O2/air) are becoming increasingly important for electrifying the modern transportation system, enabling sustainable mobility in the near future. Though some rechargeable LMBs batteries (e.g., Li°/LiFePO4 batteries from Bolloré Bluecar®, Li-S batteries from OXIS Energy and Sion Power) are already commercially viable in niche applications, their large-scale deployment is still hampered due to the existence of a number of formidable challenges, including lithium dendrite growth, electrolyte instability towards high voltage intercalation type cathode, poor electronic and ionic conductivities of sulphur (S8) and O2, as well as their corresponding reduction products (e.g., Li2S and Li2O), dissolution and shuttling of polysulphide (PS) intermediates etc. This ultimately results in short cycle life, low coulombic/energy efficiency, poor safety, and a high self-discharge rate. Among other mitigating strategies, the use of electrolyte additives is considered as one of the most economical, and effective approach for circumventing these dilemmas. Set out to offer an in-depth insight into the rapidly growing research on the account of electrolyte additives for rechargeable LMBs, this review presents an overview of the various functional additives, that are being applied in Li-anode/intercalation cathode-based, Li-S and Li-O2 batteries. This review is believed to assess the status quo of the research and thereby arouse new thoughts and opportunities, opening new avenues for the practical realization of these appealing devices.

DOI: 10.1002/anie.201712702