Journal of Power Sources
Volume 423, 31 May 2019, Pages 218-226

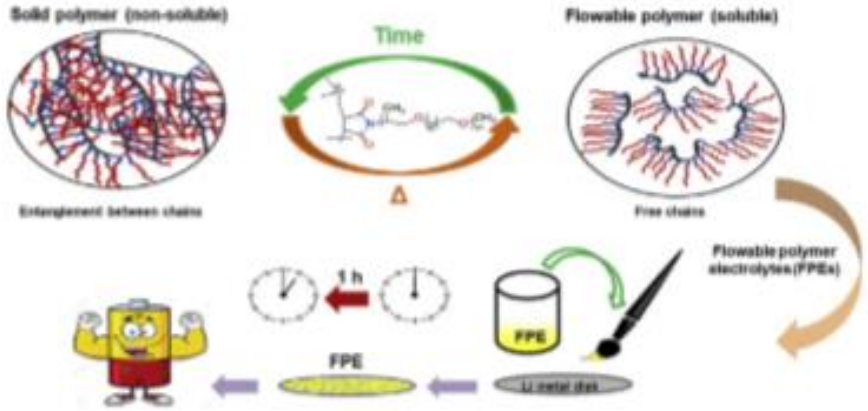
Flowable polymer electrolytes for lithium metal batteries

Itziar Aldalur[a,*], Maria Martinez-Ibañez[a], Anna Krztoń-Maziopa[b], Michal Piszcz[b], Michel Armand[a], Heng Zhang[a,**]

[a] CIC Energigune, Parque Tecnológico de Álava, Albert Einstein 48, 01510, Miñano, Álava, Spain
[b] Faculty of Chemistry, Warsaw University of Technology, Noakowskiego 3, 00-664, Warsaw, Poland

https://doi.org/10.1016/j.jpowsour.2019.03.057

GRAPHICAL ABSTRACT



ABSTRACT

Solid polymer electrolytes (SPEs) are currently attracting extensive interest as Li-ion conducting materials for building safe and high energy density rechargeable lithium metal batteries due to their low flammability and ease in process. The structural design of polymer matrices could effectively regulate the physicochemical and electrochemical properties of SPEs, thereby enhancing the performance of rechargeable all solid-state lithium metal batteries (ASSLMBs). Herein, we report a new type of flowable polymer electrolyte (FPE), containing a liquid-like polymer with highly conductive polyether side chains and sulfonimide lithium salts [i.e., lithium bis (trifluoromethanesulfonyl)imide (LiTFSI) and lithium bis(fluorosulfonyl)imide (LiFSI)]. The high amorphicity and segmental mobility of the liquid-like polymer matrices facilitate fast ionic transport, thus leading to the highest ionic conductivity reported (6.6×10^{-4} S cm^{-1} at 70 °C and 1.4×10^{-4} S cm^{-1} at 30 °C). The introduction of FPE as a buffer layer between Li metal (Li^0) electrode and poly(ethylene oxide)-based SPE decreases the interfacial resistivity of Li^0/electrolyte and improves remarkably cyclability and coulombic efficiency of the Li^0 || $LiFePO_4$ cell. These results suggest that the FPEs are promising candidates for lithium metal protection in ASSLMBs.