Bi-layer polymer electrolyte for highly stable lithium metal batteries

공용준[1], 김연상[1,2,†], 유가영[1,3], 조진일[1,3], 유지영[4,5], 표선미[1,3]
[1]서울대학교; [2]융합기술과학대학원; [3]융합과학기술대학원; [4]경북대학교; [5]에너지공학부
(younskim@snu.ac.kr†)

Li metal is the attractive next-generation anode material for lithium ion batteries(LIBs) due to its high theoretical specific capacity and low redox potential. However, there are several critical issues associated with an interface of Li metal. The repeated formation/collapse of an unstable solid electrolyte interphase(SEI) layer on the surface of the Li metal anode results in accumulated dendritic growth and isolated Li, which eventually lead to a short lifetime and safety issues. To solve these interfacial problems, we introduce a bi-layer consisting of a stacked structure of a polymer layer containing Ni microparticles and an additional identical polymer layer. After adopting this bi-layer structure, a symmetrical cell system showed a tolerable voltage range within ±15mV even at a high current density of 20 mA cm^{-2} up to 500 cycles. In addition, for Li metal batteries with the common cathode material LiFePO4, the specific capacity is maintained at 85.16% after 500 cycles at 5 C-rate when the bi-layer structure is used. Li metal batteries with the proposed bi-layer electrolyte show much better cycling characteristics than conventional polyolefin separators.