Electrochemical performance of all-solid-state lithium ion battery using Li_2S-P_2S_5 glass-ceramics solid electrolyte at low temperature

Insang Yoon [a], Sungwo Noh [a], Sunho Choi [a], Sangsoo Lee [a], Jiu Ann [a] and Dongwok Shin [a*],
[a] *Division of Materials Science & Engineering, Hanyang University, 17*
222 Wangsimni-ro, Seongdong-gu, Seoul, 133-791, Korea

E-mail: dwshin@hanyang.ac.kr

Conventional lithium ion batteries (LIBs) are widely used in portable electronic devices because of their high energy density and long cycle life. Recently, as the electric vehicle(EV) and energy storage system(ESS) market grew, large-scaled lithium ion batteries have been highly attracted. However, realization of large-scaled lithium ion batteries is urgently needed to solving safety problems (leakage, explosion and flame) caused by organic liquid electrolyte. Therefore, all-solid-state lithium ion batteries(ASSLIBs) are highly researched to replace the traditional organic liquid electrolytes. ASSLIBs are believed that it can be used at low and high temperature due to high thermal stability of solid electrolyte. However, very few of researches are addressed about electrochemical performance of ASSLIBs at low temperature (under 0 ^oC).

In this research, we focused on electrochemical performance of all-solid-state cells using sulfide solid electrolyte at low temperature. charge-discharge and rate performances of all-solid-state cells were measured with a cell tester (TOSCAT-3100, Toyo system) under 0.025C and cut off voltages of 1.88 and 3.68 V vs. Li-In. AC impedance spectroscopy of all-solid-state cells cells were measured by using an impedance analyzer (Wonatech, Zive-mp5) in the frequency range from 0.1 Hz to 1 MHz after charging to 3.68 V vs. Li-In. Every electrochemical performance of all-solid-state cells were measured at several temperature points below room temperature.

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