Effect of Cathode Structure on Electrochemical Properties of Solid-State Li-Air Batteries

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Much attention has been focused on the energy storage systems beyond Li-ion batteries. Li-air battery is one of the most promising candidates because it has a theoretical energy density over 3000 Wh kg^{-1} which is about 10 times greater than that of Li-ion battery [1-3]. Li-air battery uses oxygen from the air as active material, and thus may be charged and discharged by oxidation and reduction of oxygen in the cathode.

Organic liquid electrolytes have been pursued extensively for Li-air batteries. However, organic liquid electrolytes feature fluidity, flammability and volatility, causing the safety problems during the electrochemical cycling of Li-air batteries. Compared with organic liquid electrolytes, solid electrolytes such as polymer and inorganic ionic conductors have non-volatility and non-flammability, preventing the electrolyte from ignition, evaporation and depletion. Recently, a few studies have been devoted to the development of solid-state Li-air batteries [4]. However, the effect of cathode structure on the electrochemical properties of solid-state Li-air batteries has not been clarified yet in the literature.

Fig. 1 shows the schematic sketch of solid-state Li-air cell that we have developed. PEO (polyethylene oxide)-based electrolyte containing LiTFSI (lithium bis(trifluoromethanesulfonyl) imide) was used as a solid electrolyte. Carbon was directly coated on the GDL (gas diffusion layer) with solid electrolyte as a slurry and then used as a cathode. Solid-state Li-air cell was fabricated by the lamination of lithium, solid electrolyte and cathode, as shown in Fig. 1.Specific capacity of 1200 mAh g^{-1} based on the weight of carbon in the cathode was delivered during the first discharge of a solid-state Li-air cell, as shown in Fig. 2.

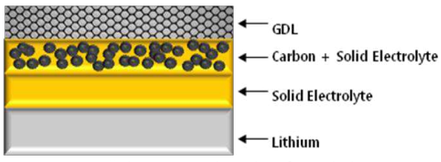

Figure 1. Schematic sketch of a solid-state Li-air cell.

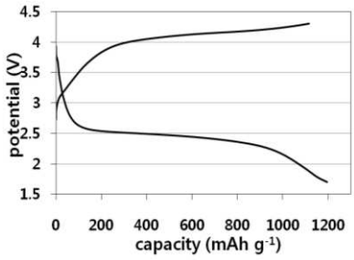

Figure 2. Charge/discharge profiles of a solid-state Li-air cell

We will discuss on the effect of cathode structure on the electrochemical properties of solid-state Li-air batteries at the meeting.

References

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