Improving High rate Electrochemical Performance of Patterned Lithium Metal Anode for Lithium Secondary Batteries by using Dual Salt Electrolyte System.

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Recently, demand for lithium (Li) secondary batteries has been increasing as the market for mid- to large-size batteries such as electric vehicles (EV) and energy storage systems (ESSs) is expanding. Especially in order to popularize EVs, it is essential to improve the energy density in order to secure mileage. However, using commercialized graphite as an anode material is difficult to increase energy density due to their limited capacity. Li metal is an ideal anode material due to its extremely high theoretical specific capacity (3860 mAh g^{-1}), low density (0.59 g cm^{-3}) and the lowest negative electrochemical potential (–3.040 V vs. the standard hydrogen electrode). For instance, Li/air and Li/S batteries enable to increase dramatically energy density. However, Li metal has been proposed as a problem of deterioration of cell performance due to dendrite caused by charging / discharging process and battery short circuit. More importantly, Li dendrite-growth lead to safety issue, i.e., thermal runaway, causing a catastrophic satety failure accompanied by fire and smoke.

To overcome this problem, many efforts have been devoted to suppress lithium dendrite-growth. Recently, we demonstrated the possibility of using mechanically surface-patterned Li-metal for Li secondary batteries. In our previous work (J. N. Park et. Al), patterned Li-metal anode showed good cycle life at low current density cycling. Still, high current density cycling showed limited cycle life because of bulky Li dendrite formation in the micro-patterned Li-metal holes. These consume more amount of electrolytes during charging/discharging processes.

In this work, we applied dual salt system electrolyte on the micro-patterned Li metal to suppress mechanically bulky Li deposition in the micro-patterned Li-metal holes during charging/discharging processes. And then, their electrochemical properties are investigated in detail.

References:

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