Effect of electrode porosity and thickness on electrochemical performance of rechargeable all-solid polymer batteries

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Although solid polymer electrolytes (SPEs) show low ionic conductivity and poor interfacial stability towards electrodes comparing to liquid electrolytes, they have been constantly considered for inherent non-explosive rechargeable batteries.[1] However, most of researches on SPEs have been focused for electrolytes themselves without broad cell performance data such as cycle life and rate capability. Therefore, as a practical point of view, SPEs should be evaluated along with promising cathodes and anodes like liquid electrolyte systems. High porous cathode and lithium metal anode are thought to be good candidates for all-solid polymer batteries.

So, in this work, we propose an all-solid polymer battery system consisting of $LiFePO_4$/SPE/Li metal. Especially, since $LiFePO_4$ is composed of nano-sized particles, it is chosen for an appropriate cathode active material from various other candidates. In addition, SPEs, at the same time, have to function as a binder material for the porous cathode material. So we manufacture SPEs for electrolyte and cathode binder by in-situ polymerization after cathode/high porous separator/Li cell assembly. In this process, we try to find the effects of the porosity and thickness of cathode on electrochemical performances of all-solid polymer batteries. Especially, the cycle performances at room and high temperatures, rate capability, and electrochemical impedance have been extensively studied.

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References

[1] Y. Aihara et al, Journal of Power Sources 65(1997) 143-147