Synthesis of LiAl$_{0.05}$Ni$_{0.05}$Mn$_{1.9}$O$_4$ Cathode Material via Electrostatic Spinning Method
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Introduction
Spinel lithium manganese oxide (LiMn$_2$O$_4$) has been widely studied as one of the most promising cathode materials for lithium ion batteries due to its low cost and environmental friendliness [1, 2]. In this work, we use Ni and Al doping, synthesis LiAl$_{0.05}$Ni$_{0.05}$Mn$_{1.9}$O$_4$ (LANMO) cathode material via electrostatic spinning method with good cycle stability

Experimental
Lithium acetate, manganese acetate, aluminum nitrate, nickel nitrate in the required molar ratio for the formation of LiAl$_{0.05}$Ni$_{0.05}$Mn$_{1.9}$O$_4$ were dissolved in deionized water, then the solution was dropped slowly into ethanol PVP solution with thorough stirring. Then precursor fibers were prepared by electrostatic spinning method. The thus formed precursor fibers were calcined to formed LANMO nanofiber.

Composite cathode electrodes were prepared by using a mixture of LANMO, carbon black and PVDF with the weight ratio of 75:15:10% in NMP solution then dried at 80°C under vacuum for 12 h. Metallic lithium was used as anode. The electrolyte solution used was 1M LiPF$_6$/EC+DEC. Charge-discharge characteristics were evaluated by constant current charge/discharge tests with a coin-type cell at 0.5C, 30°C.

Results and Discussion
The SEM photograph of LANMO nanofiber was shown in Fig. 1. It could been seen that nanofibers with diameter of 150-250nm composed of LANMO nanoparticles were formed. The discharge capacities and cyclic stability at 0.5C of LANMO was shown in Fig. 2. The discharge capacity of cycle number 1 and 60 are 110 and 104mAh/g, retain 94.5% initial capacity at 60th cycle.

Reference