Preparation of $LiMn_2O_4$ Cathode material via Plasma-enhanced Chemical Vapor Deposition method

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Spinel $LiMn_2O_4$ cathode material has been largely investigated for commercial Lithium-ion batteries applications. Conventional solid-state method requires long reaction time (>10h) and high temperature (>700℃), which caused large cyrstalline of material. Plasma-based method has been used to prepare or modify electrode materials with shorten reaction time and lower temperature[1]. In this paper, spinel $LiMn_2O_4$ cathode material were prepared by mixing Lithium carbonate and manganese dioxide in a moral ratio of Li_2CO_3:MnO_2=1:4 and ball milled for 30min, then the mixture was dried and introduced into the PECVD rotary tube furnace (OTF-1200X-S-II-4CV-PE, kejing) to obtain LMO-PLA, the RF power is 300W, the flow rate of O_2 is 5sccm, the temperature is 550℃, the pressure in the tube is maintained at 200mTorr, the rotary speed is 2rpm and the reaction time is about 45min. We also synthesized $LiMn_2O_4$ cathode material via conventional solid-state method, the temperature is 750℃ and the reaction time is 10h(LMO-SS).

The X-ray patterns of obtained samples are shown in Fig.1. The peaks of two samples are all indexed to spinel$LiMn_2O_4$. It can be found that the full width at half-maximum (FWHM) of LMO-PLA is larger than that of LMO-SS, which demonstrate smaller cyrstalline size. Therefore, the PECVD method is an energy saving way to prepare well crystalline spinel $LiMn_2O_4$.

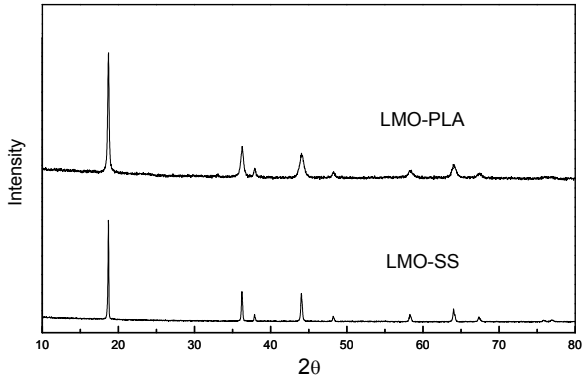

Fig.1 XRD patterns of obtained LMO samples

References:

[1] J Nava-Avendaño, J Veilleux. J. Phys. D: Appl. Phys. 50 (2017) 163001 (23pp)