

Synthesis and Characterization of $\text{Li}_2\text{MnSiO}_4/\text{C}$ Composite Fibers by Electrospinning with Heat Treatments

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$\text{Li}_2\text{MnSiO}_4$ is one of attractive cathode materials for lithium-ion batteries, due to its potential of inserting/extracting two lithium ions per formula within electrolyte stability window, delivering high energy density [1]. Among different synthesis methods, electrospinning is relatively new and promising technique, and can produce composite nanofibers with unique properties [2, 3]. In this work, we have prepared $\text{Li}_2\text{MnSiO}_4/\text{C}$ composite fibers from homogeneous precursor solutions by electrospinning with heat treatment and studied its physical and electrochemical properties.

The homogeneous solutions containing stoichiometric amounts of precursor salts (LiNO_3 , $\text{Mn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ and tetraethyl orthosilicate (TEOS)) and polyvinylpyrrolidone (PVP) as electrospinning template in a mixture of ethanol and distilled water were placed into a glass syringe and electrospun at a high applied voltage. The as-spun fibers were dried to remove the solvent by a vacuum oven, and then pre-oxidized at 280°C in air flow. Finally, heat treatment at 650°C for 1 h in a $\text{N}_2+3\% \text{H}_2$ atmosphere was conducted for the pre-oxidized sample.

Figure 1 represents the XRD pattern of the final samples obtained by electrospinning followed by pre-oxidation and heat treatment. The diffraction peaks of the sample can be indexed to the orthorhombic structure with $Pmn2_1$ space group, while the small impurity peaks attributed to MnO and Li_2SiO_3 could be also detected. From the SEM image shown in the inset of Fig. 1, formation of fibrous morphology can be observed. Carbon content in the final sample, determined by CHNS elemental analysis, was 2.6 wt.%. From these results, we can conclude that $\text{Li}_2\text{MnSiO}_4/\text{C}$ composite fibers can be successfully prepared by the present method. The electrochemical properties of the $\text{Li}_2\text{MnSiO}_4/\text{C}$ composite fibers will be reported in the conference.

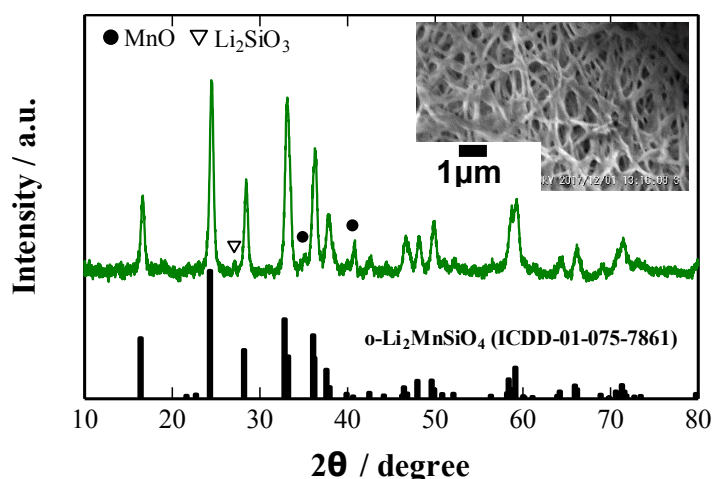


Figure 1. XRD pattern and SEM image (inset) of $\text{Li}_2\text{MnSiO}_4/\text{C}$ composite fibres synthesized by electrospinning with heat treatments.

References:

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