Studies on the lithium ion diffusion coefficients of electrospun Nb$_2$O$_5$ nanostructures using galvanostatic intermittent titration and electrochemical impedance spectroscopy

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**Abstract**

We have studied the Li-diffusion coefficient values of electrospun Nb$_2$O$_5$ nanofibers and nanonuggets for lithium batteries. In brief, Nb$_2$O$_5$ nanofibers were prepared by electrospinning followed by sintering at temperatures range 500–1100 °C for 1 h in air to obtain pseudo-hexagonal, orthorhombic (O), and monoclinic (M) Nb$_2$O$_5$ phases. Electrochemical properties were evaluated by galvanostatic technique at room temperature. The H-, O- and M-Nb$_2$O$_5$ polymorphs delivered discharge capacities (at second cycle) of 152, 189 and 242 (±5) mAh g$^{-1}$, respectively. The lithium diffusion coefficients ($D_{Li}$) are calculated using galvanostatic intermittent titration technique (GITT) and electrochemical impedance spectroscopy (EIS) techniques carried out at room temperature. The evaluated $D_{Li}$ values by GITT for H-, O-, and M-Nb$_2$O$_5$ phases are in the range 10$^{-17}$–10$^{-16}$, 10$^{-15}$–10$^{-14}$, and 10$^{-13}$–10$^{-12}$ cm$^2$ s$^{-1}$, respectively, in the voltage range 1.0–2.6 V vs. Li. $D_{Li}$ evaluated by EIS gave similar trend in the values but with a difference of one order higher magnitude.

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