Supporting Information for

Facile Insertion of Lithium into nanocrystalline $AlNbO_4$ at Room Temperature

Experimental:

To demonstrate the crystallite size effects, we prepared micrometer and nanometer-sized $AlNbO_4$. Micrometer-sized samples of $AlNbO_4$ are prepared by the conventional solid state reaction (SSR) starting from the stoichiometric amounts of Al_2O_3 and Nb_2O_5 (Alfa, 99.9 %). The reactants are ground well and are calcined at 900 ºC for 24h in air. The resulting powder is reground and finally calcined at 1200 ºC for 24h and the sample is allowed to cool to RT. Nanometer-sized samples are prepared by polymerizable complex (PC) method. The starting precursors used for this method are $Al(NO_3)_3.9H_2O$ (Fulka, 98 %) and $Nb_2O_5.xH_2O$. The $Nb_2O_5.xH_2O$ precursor is prepared according to the procedure reported elsewhere.[20] The value of x is estimated to be 4.25 from thermo gravimetric analysis. Requisite amount of citric acid (CA) (Spectrochem, 99.7 %) is dissolved in distilled water and the resulting solution is kept at 60 ºC. $Nb_2O_5.xH_2O$ is dissolved in the above solution. After complete dissolution of $Nb_2O_5.xH_2O$ precursor, $Al(NO_3)_3.9H_2O$ is added and the solution is maintained at 60 ºC for a few hours to ensure metal-complex formation. Ethylene glycol (EG) is now added and the temperature is raised to 90 ºC to facilitate the polyesterfication step. The metal: CA: EG mole ratio is maintained as 1:4:16. The obtained gel is dried at 120 ºC and is decomposed by heating at 300 ºC for 4h. The resulting powder is calcined at 800 ºC for 4h to obtain nanocrystalline $AlNbO_4$.

The phase purity of the synthesized samples was checked using Rigaku mini flex XRD (Japan) using Cu Kα radiation. Lattice parameters were obtained using Autoexe program. A scanning electron microscope (SEM) Philips Field Effect Gun (FEG) XL-30 and transmission electron microscopy (TEM) JEOL 3010 was used to study the sample morphology. Electrodes were fabricated by mixing active material, acetylene black (Denka Singapore Pvt. Ltd.) and poly vinylidene fluoride (PVDF) in the weight ratios 70:20:10. Slurry containing the above mixture was prepared by using N-methyl-2-pyrrolidinone and was spread on a stainless steel foil and dried in an oven at 100 °C for 12h. Swagelok cells were used for electrochemical studies. The cells were fabricated in an argon filled glove box (mBraun, Germany) with Li foil as anode, Teklon (Anatek, USA) as separator and 1 M $LiPF_6$ in 1:1 ethylene carbonate plus dimethyl carbonate as the electrolyte (Chiel Industries Ltd., Korea). Charge discharge cycling of the cells was carried out in galvanostatic mode at RT by using Arbin battery cycling unit (BT2000, USA).

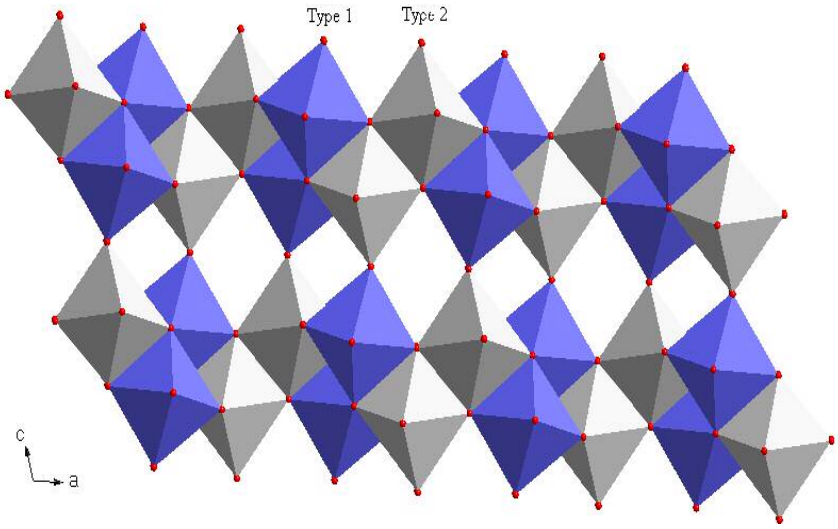

Figure S1. Crystal structure view of $AlNbO_4$ in *ac* plane

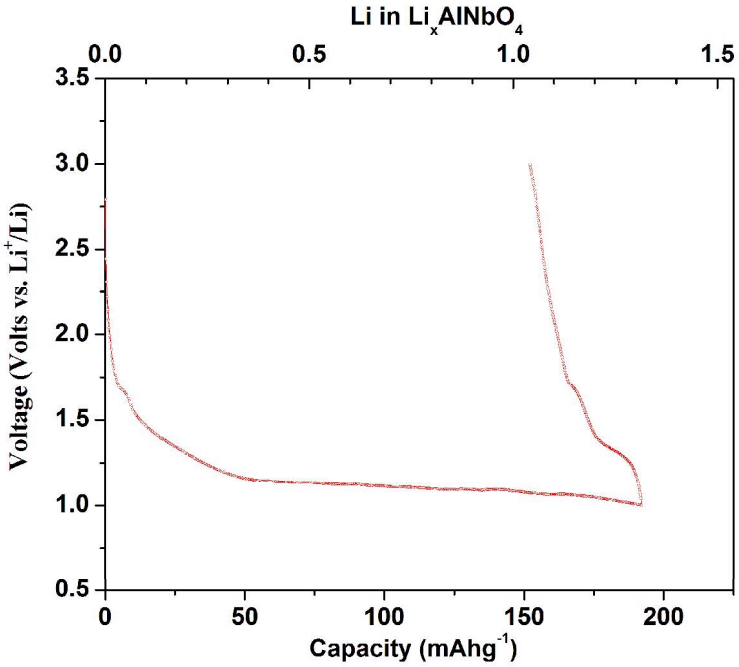

Figure S2 Voltage-composition profile of micrometer-sized $AlNbO_4$ obtained at C/100 rate (~1.4 mA g^{-1})