

## **Supplementary information**

# **Carbon supported, Al doped-Li<sub>3</sub>V<sub>2</sub>(PO<sub>4</sub>)<sub>3</sub> as high rate cathode material for lithium-ion batteries**

A.R.Cho<sup>a</sup>, J.N. Son<sup>a</sup>, V. Aravindan<sup>a, b</sup>, K.S.Kang<sup>c</sup>, W.S.Yoon<sup>d</sup>, W.S.Kim<sup>e</sup> and Y.S. Lee<sup>a</sup>

<sup>a</sup> Faculty of Applied Chemical Engineering, Chonnam National University,

Gwang-ju 500-757, Korea

<sup>b</sup> Energy Research Institute (ERI@N), Nanyang Technological University, Research Techno  
Plaza, 50 Nanyang Drive, Singapore 637553

<sup>c</sup> Department of Materials Science and Engineering, Seoul National University,  
Seoul 151-742, Korea

<sup>d</sup> Department of Energy Science (DOES), Sungkyunkwan University,  
Suwon 440-746, Korea

<sup>e</sup> Daejung EM co. Ltd, Incheon 405-820, Korea

**Fractional coordinates of C-Li<sub>3</sub>V<sub>1.98</sub>Al<sub>0.02</sub>(PO<sub>4</sub>)<sub>3</sub>**

Atom	x	y	z	Biso	occupancy
Li1	0.220(10)	0.789(9)	0.166(6)	2.1(11)	1
Li2	0.920(9)	0.301(9)	0.228(6)	2.1(11)	1
Li3	0.548(10)	0.425(9)	0.194(6)	2.1(11)	1
V1	0.2475(10)	0.4620(8)	0.1095(6)	0.62(9)	0.974
Al1	0.2475(10)	0.4620(8)	0.1095(6)	0.62(9)	0.0197
V2	0.7520(10)	0.4710(8)	0.3898(6)	0.62(9)	1
P1	0.1037(14)	0.1024(14)	0.1481(10)	0.58(11)	1
P2	0.6039(13)	0.1155(14)	0.3521(9)	0.58(11)	1
P3	0.0353(13)	0.2479(16)	0.4928(10)	0.58(11)	1
O1	0.922(3)	0.117(3)	0.1470(19)	0.66(14)	1
O2	0.151(3)	0.983(3)	0.2372(18)	0.66(14)	1
O3	0.169(3)	0.051(3)	0.0418(19)	0.66(14)	1
O4	0.159(3)	0.270(3)	0.1898(19)	0.66(14)	1
O5	0.429(3)	0.099(3)	0.3301(17)	0.66(14)	1
O6	0.701(2)	-0.005(3)	0.2810(19)	0.66(14)	1
O7	0.653(3)	0.084(3)	0.4702(18)	0.66(14)	1
O8	0.642(3)	0.285(3)	0.3130(19)	0.66(14)	1
O9	0.950(3)	0.137(3)	0.5664(17)	0.66(14)	1
O10	0.932(3)	0.322(3)	0.4046(19)	0.66(14)	1
O11	0.171(3)	0.177(3)	0.4309(18)	0.66(14)	1
O12	0.108(3)	0.356(3)	0.5755(17)	0.66(14)	1

**Refinement  
parameters**

$R_p$	8.08 (%)
$R_I$ (bragg)	5.37 (%)
$R_F$	3.91 (%)
$\chi^2$	0.306

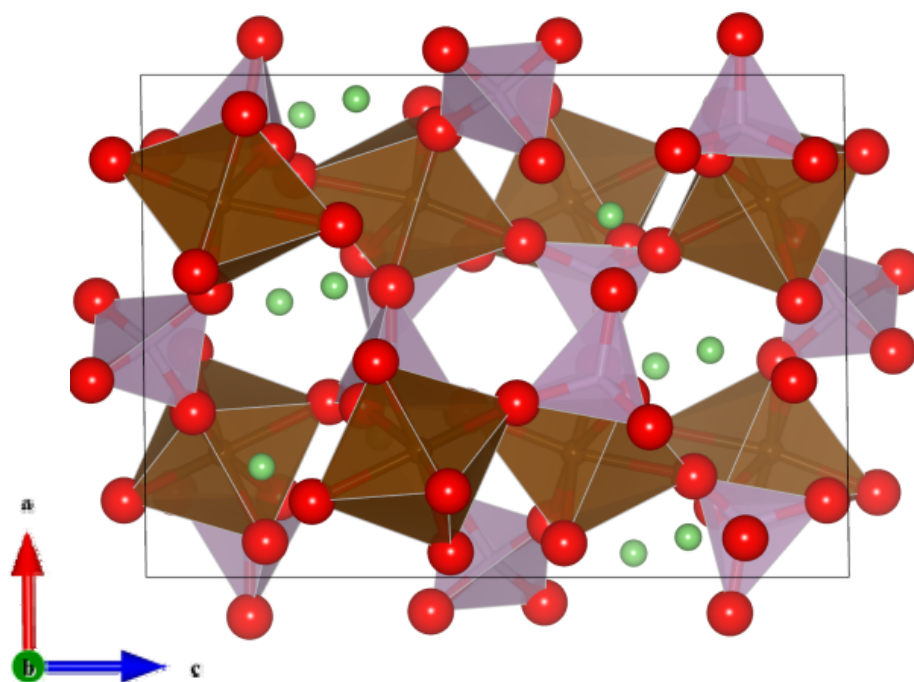
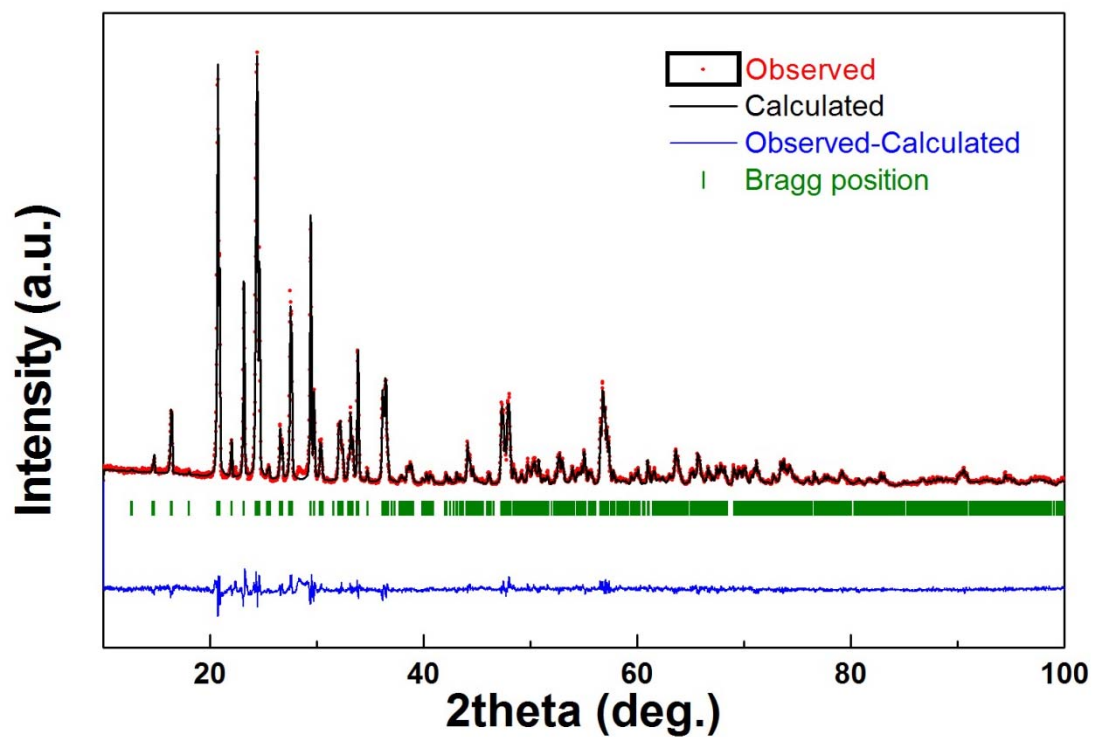
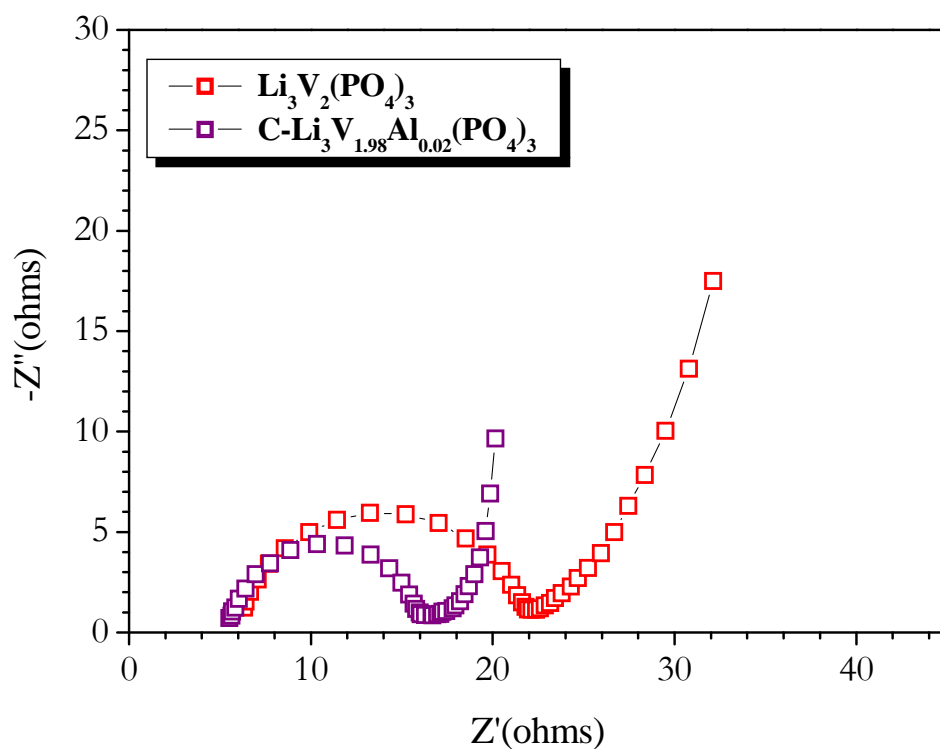


Fig. S2. Rietveld refined powder X-ray diffraction pattern of  $C\text{-Li}_3\text{V}_{1.98}\text{Al}_{0.02}(\text{PO}_4)_3$  with schematic representation of its molecular structure viewed along b axis



**Fig. S2.** Nyquist plots of (a)  $\text{Li}/\text{Li}_3\text{V}_2(\text{PO}_4)_3$  and (b)  $\text{Li}/\text{C}-\text{Li}_3\text{V}_{1.98}\text{Al}_{0.02}(\text{PO}_4)_3$  cells (adipic acid/total metal ions is 0.15). The Impedance measurement was recorded in the two electrode coin-cell configuration between 100 mHz to 100 kHz.