Supplementary Information

Highly stable cycling of lead oxide/copper nanocomposite as an anode material in lithium ion battery

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Section1: Cathode fabrication for full cell assembly

The cathode was prepared by blade coating a slurry contains 80wt.%$LiNi_{1/3}Co_{1/3}Mn_{1/3}O_2$(purchased from UBIQ Tech.Co.Ltd), 10 wt.% conductive Super P and 5 wt.% poly(vinylidene fluoride) binder in N-methyl-2-pyrrolidone on an aluminum foil, drying overnight at 120 °C in an oven, roller pressing the dried coated foil, and cutting out circular discs. The cells were cycled at 0.2 C rates (with respect to a theoretical capacity of 274 $mAhg^{-1}$) between 2.4 and 4.4 V on a multi-channel battery tester.

For full cell fabrication, prepared anode and cathode serving as working and counter electrodes along with Celgard 2600 separators soaked in electrolyte assembled inside the glove box. In the full cell, cathode materials are in excess amount compared to the anode materials. Galvanostatic cycling of the full cell was carried out between 0.05 -4.8 V at 0.2 C rate. Phase transitions occurring during the cycling processes were examined by scan rate of 0.1 mV/s cyclic voltammetry performed with a three-electrode glass cellat a between 0.05 -4.8 V.The electrolyte used was the same as that for the coin cell.

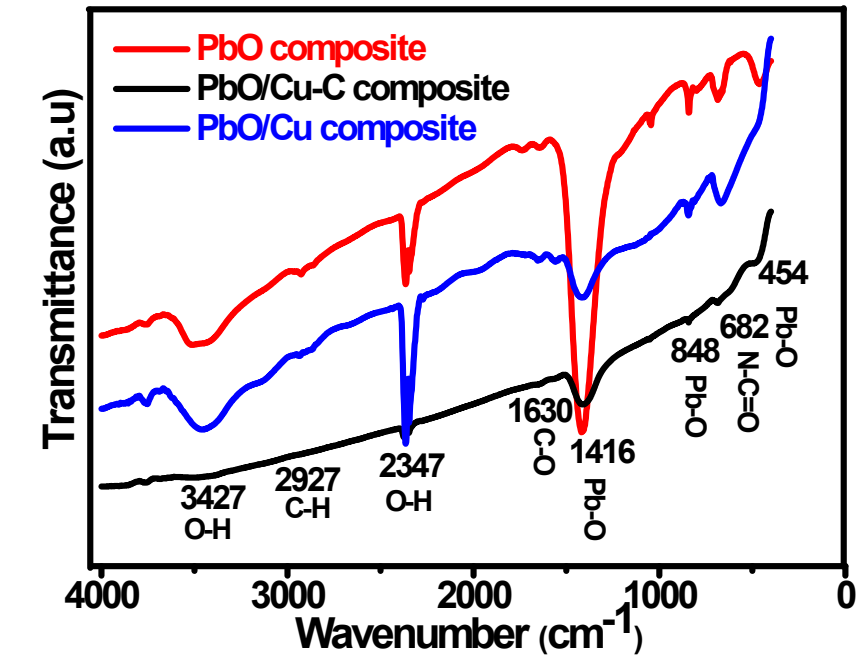

Fig. S1. FTIR spectra of different composites.

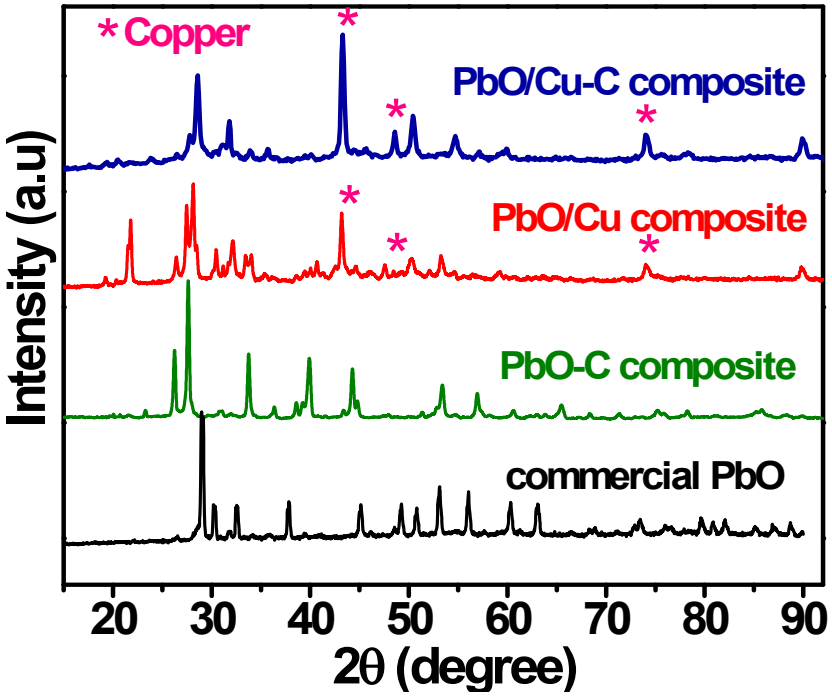

Fig. S2. XRD patterns of different materials.

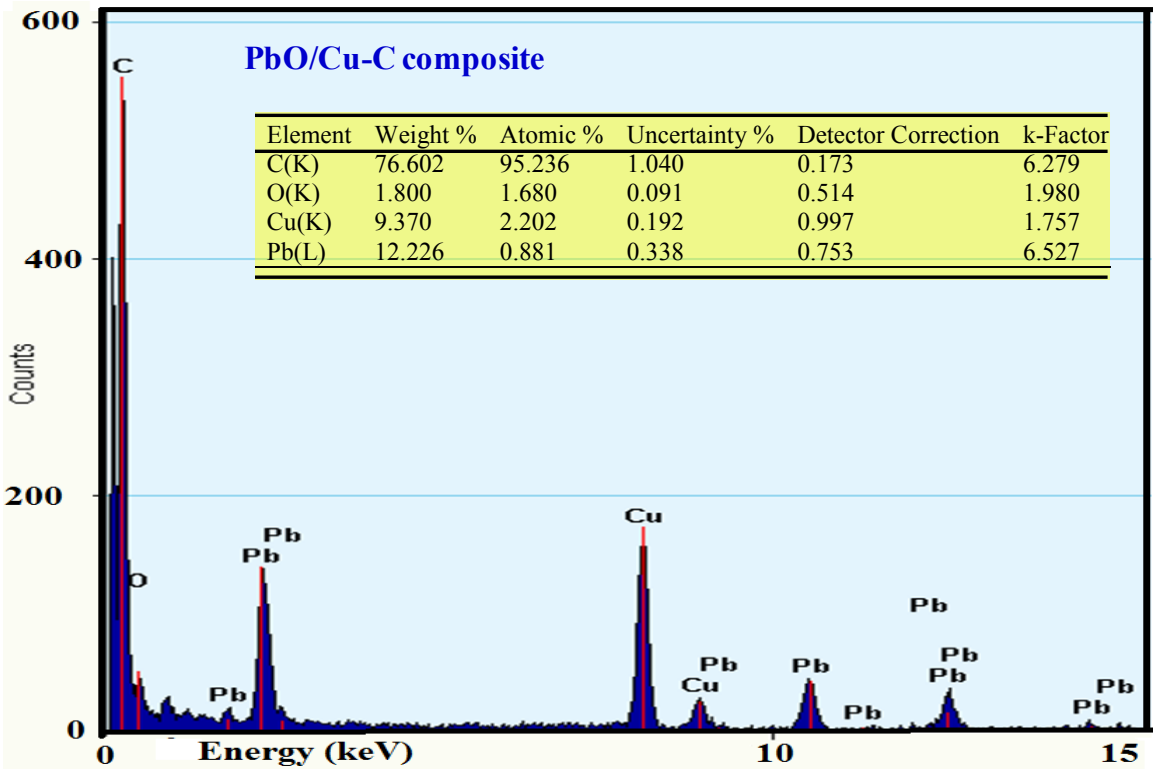

Fig. S3. EDAX images of PbO/Cu-C composite.

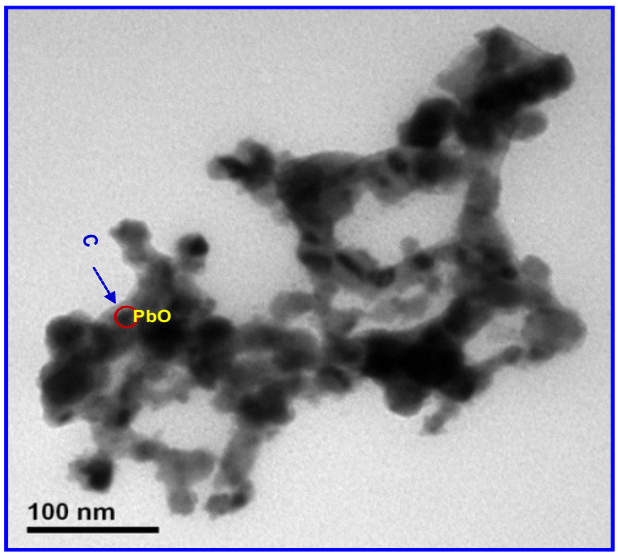

Fig. S4: TEM mage of prepared PbO-C composite.

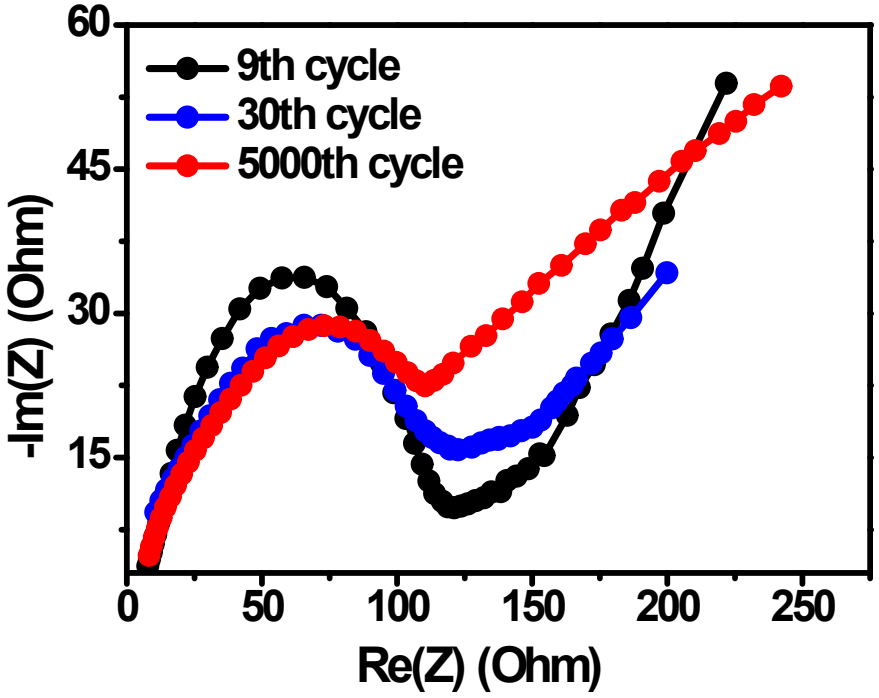

Fig. S5: Impedance spectra of PbO/Cu-C composite electrode for long cycles.

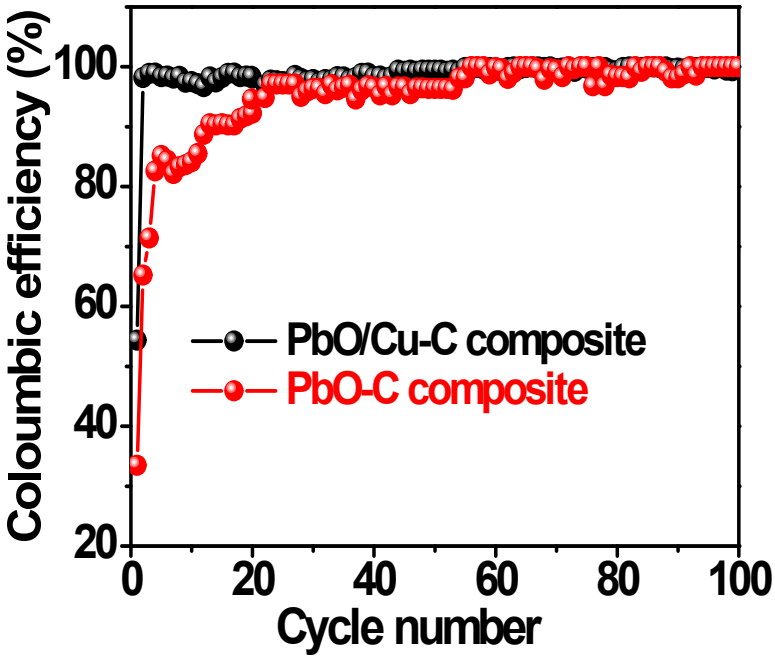

Fig. S6: The coloumbic efficiency of different composite electrodes for comparison.

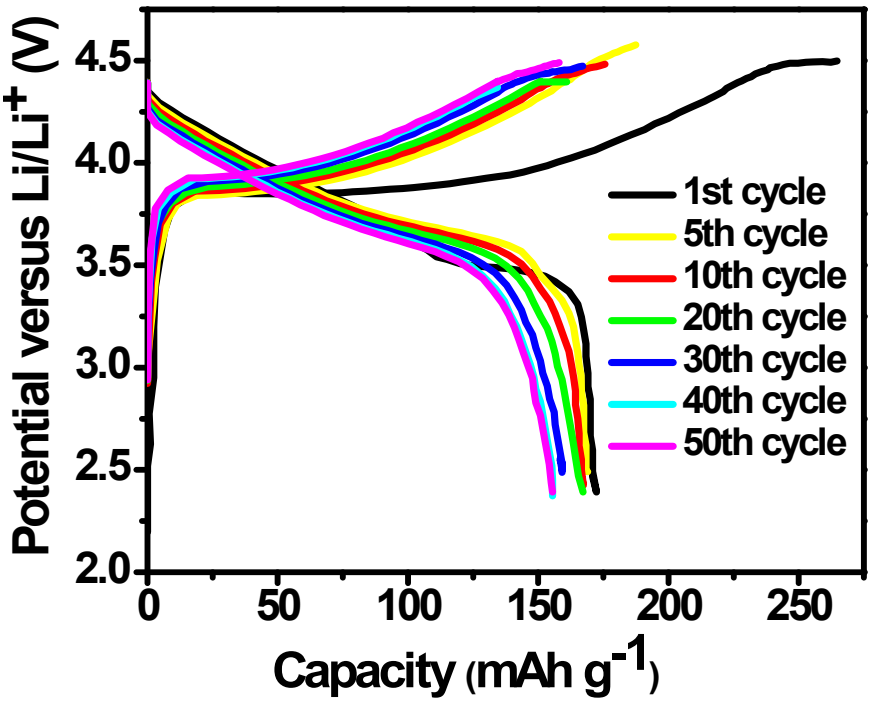

Fig. S7: Voltage profiles of $LiNi_{1/3}Co_{1/3}Mn_{1/3}O_2$ *vs.* Li/Li^+ in the voltage window 2.4-4.4 V at 0.2 C rate.

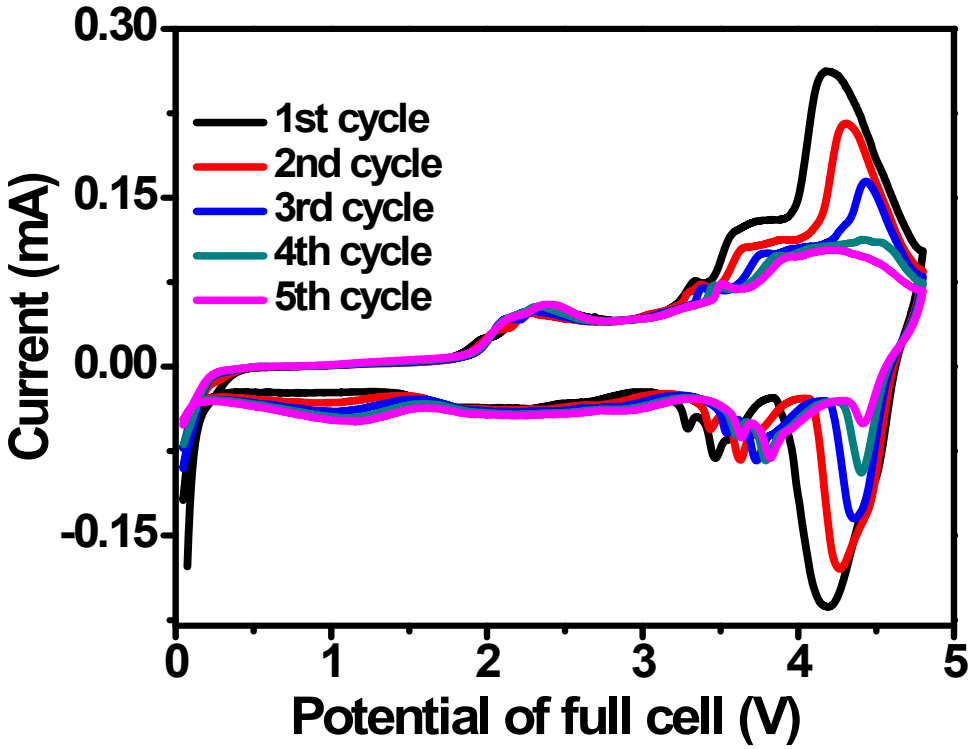

Fig. S8: Cyclic voltammograms of $LiNi_{1/3}Co_{1/3}Mn_{1/3}O_2$ *vs.* PbO/Cu-C composite recorded in the voltage window of 0.05 - 4.8 V at a scan rate of 0.1 mV s^{-1}.