

## **Supplementary information**

### **Material Synthesis:**

The potassium hypochlorite oxidizing reagent was prepared from the starting sodium hypochlorite solution (Sigma-Aldrich reagent grade, with 10-15% of available chlorine). An estimated amount of 200 ml of NaClO solution was cooled by external ice-bath to approximate zero degree Celsius after which excess quantities of KOH pellets (DUKSAN reagent with 85% KOH, <2% K<sub>2</sub>CO<sub>3</sub>, <0.01% Cl) were added and stirred gradually to prevent the elevation of solution temperature. As the solution became over-saturated with excess KOH concentration, sodium cations and chloride anions were replaced by potassium cations and hydroxide anions, respectively, and co-precipitated with excess KOH. The mixture was then filtered using P-3 sintered Duran glass filter and yielded a concentrated and strongly alkaline solution of potassium hypochlorite.

A saturated solution of appropriate amounts of Fe(NO<sub>3</sub>)<sub>3</sub>·9H<sub>2</sub>O (Sigma-Aldrich ACS reagent >98%) and the as-prepared potassium hypochlorite solution corresponding to a Fe<sup>3+</sup>:ClO<sup>-</sup> molar stoichiometric ratio of 1:10 was stirred for an hour at 0°C, to facilitate the precipitation of potassium ferrate. The precipitate containing solution was filtered by Pyrex ASTM 10-15 Glass Filter Funnel and the blackish colored precipitate was collected and rinsed in 2 mol/L of KOH chilled solution. The filtering process was repeated twice during which the final filtration was allowed to proceed very slowly over a time period for 12h at room temperature. Since the filtering was done in open air and at room temperatures, which is apparently higher than synthetic temperature conditions, part of the Fe(VI) compound was transformed into lower Fe(III) compounds as indicated by the slurry color variation from black to deep brown color. After that, the slurry was rinsed again in 12 mol/L of KOH solution and was collected by the sedimentation

method to ensure apparently shorter time for filtration. The collected product was rinsed continuously by n-hexane (one time), isopropyl alcohol (one time) and ethanol (five times) to remove KOH and other impurities. Finally, the collected powder was dried overnight under room temperature vacuum (at 0.9 mBar).

**Additional discharge/charge characteristics of just conducting carbon (Ketjen Black) and TAB binder without any active material versus lithium in the voltage range 1.5-4.8 V.**

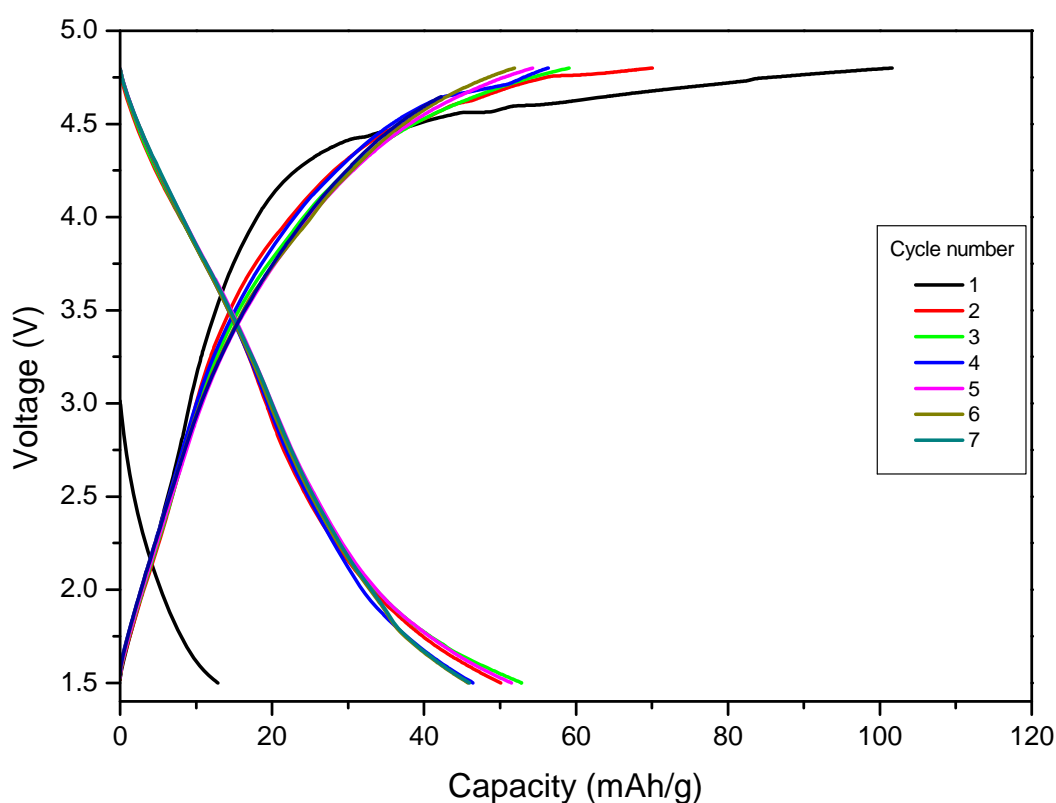


Fig. S1 Electrochemical voltage profile in the voltage range 1.5-4.8 V of just conducting carbon (Ketjen Black) and TAB binder without any active material versus lithium.