

Electronic Supporting Information

A High Capacity Li-Ion/ Li-Oxygen Hybrid Cathode[†]

Duo Wang,^a Yue Shen,^{*a} Kunlei Hong,^a Qian Huang^b and Yunhui Huang^{*a}

^{a.} *State Key Laboratory of Materials Processing and Die & Mould Technology, School of Materials Science and Engineering, Huazhong University of Science and Technology, Wuhan 430074, P. R. China. E-mail: shenyue1213@mail.hust.edu.cn;*

huangyh@mail.hust.edu.cn

^{b.} *School of Computer Science and Information Engineering, Hubei University, Wuhan 430062, P. R. China*

LCO Synthesis: Stoichiometric amounts of lithium nitrate (LiNO₃, Sigma Aldrich, ≥99%) and Cobalt(II) nitrate hexahydrate (Co(NO₃)₂•6H₂O, Sigma Aldrich, ≥98%) were mixed in aqueous solution in which cotton is soaked. Then, the precursor solution containing the cotton was put into an oven and pre-heated at 80°C for 12 h and the dried precursor was then heated further to 400°C for 1h. Subsequently, the sample was rapidly annealed (10°C/min) from room temperature to 800°C using a rapid thermal process. The sample remained at 800°C for 6 h in air.

Electrochemistry measurements: The hybrid electrodes, which consisted of LiCoO₂, Super P and polyvinylidene fluoride, were combined in a 85:10:5 wt.% ratio, respectively, and mixed with N-methyl-2-pyrrolidone (NMP). The resulting slurry was then coated onto a stainless steel mesh current collector. The electrodes were vacuum dried at 120°C for 24 hours and then transferred to an Ar filled glove box without exposure to air. Typical loading of LiCoO₂ composite electrodes was 4mg/cm² on a 8 mm diameter stainless steel mesh current collector. CV tests were performed on an electrochemical workstation (CHI760E, CH Instruments, Shanghai, China) with a two electrode setup. The lithium metal foil was used as the counter electrode and the reference electrode. Coin cells were assembled in the argon-filled glove box with oxygen and water contents less than 1 ppm. The galvanostatic discharge and charge performance of the batteries were conducted on a LAND CT2001A battery system in a plastic box filled with high purity oxygen flow.

Morphology and composition characterization: The morphology and microstructure of the prepared materials were characterized by scanning electron microscopy (SEM, FEI, Sirion 200). X-ray photoelectron spectroscopy (XPS) measurements were performed on a VG MultiLab 2000 system with a monochromatic Al Ka X-ray source (Thermo VG Scientific).

The influence of the Super P ratio:

Super P has bigger surface area than LiCoO_2 . It is good for the LOB mechanism. If we decrease the amount of super P, the LOB part of capacity decreases greatly.

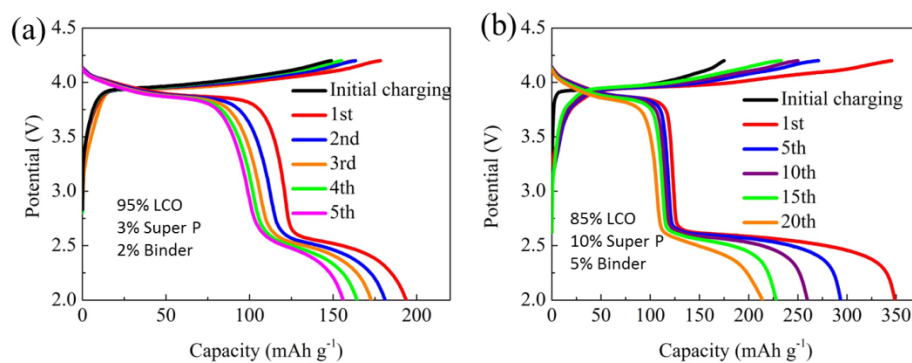


Figure S1. The galvanostatic charge/discharge curves of the LCO cathodes with different Super P weight ratio.