Supplementary Information:

A binder-free carbonized bacterial cellulose supported ruthenium nanoparticles for Li-O_2 battery

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Experimental details:

The carbonized bacterial cellulose (CBC) was achieved by carbonizing roll-pressed paper-like BC aerogels sheet, freeze-dried from fresh BC hydrogels, at 1000°C for 1 hr under H_2/Ar mixed atmosphere in a tubular furnace. The Ru loaded CBC (CBC/Ru) were prepared by dipping BC aerogels in a certain amount of 0.76 $mmolL^{-1}$ $RuCl_3$ overnight, followed by the identical roll-pressed and carbonized processes for preparing bare CBC as described above, and the Ru loading was ca. 5wt.%. Both the as-prepared CBC and CBC/Ru membranes were punched into wafers in diameter of 12 mm with weight range from 0.3 to 0.6 mg, and the capacity was normalized by the total weight of electrode sheet. The as-obtained CBC and CBC/Ru were directly utilized as cathodic electrode in Li–O_2 batteries without using binder and conductive additives.

CR2032-type coin cells (as shown in Scheme 1 in the main text), assembled in a glove box filled with dry Ar, were applied to evaluate the electrochemical performances. Before assembling, the electrode material got dried at 80^{o}C overnight. Stainless steel supplied by Shenzhen Kejing Star Corp (Wisdom opto-electronic technology Ltd.) and polypropylene was used as current collectors and separator, respectively. Tetraethyleneglycol dimethyl ether (TEGDME) (from Aldrich) mixed with $LiCF_3SO_3$ in mol ratio of 4 : 1 was used as electrolyte. LAND 2001A Battery Testing Systems (Wuhan LAND electronics Co., Ltd, P.R. China) were utilized for electrochemical performances tests.

The morphology and surface area were characterized by scanning electron microscope (SEM) (SIGMA, ZEISS), transmission electron microscope (TEM) (JEM-200CX , JEOL), and Brunauer-Emmett-Teller (BET) (ASAP 2020HD88, Micromeritics), respectively. All the electrochemical measurements were carried out under room temperature, and the O_2 supplied for discharge was ultrapure O_2 (>99.995%, Jiangsu Institute of Metrology, Nanjing, P. R. China), and the concentration of H_2O was controlled to be lower than 0.1 ppm.

Results

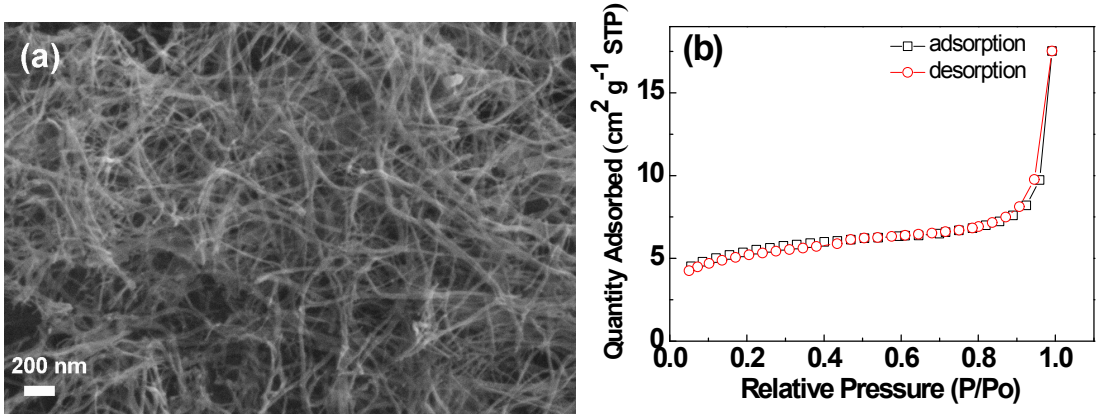

Fig. S1(a) SEM image of bare CBC, (b) N_2 adsorption-desorption curves of CBC.

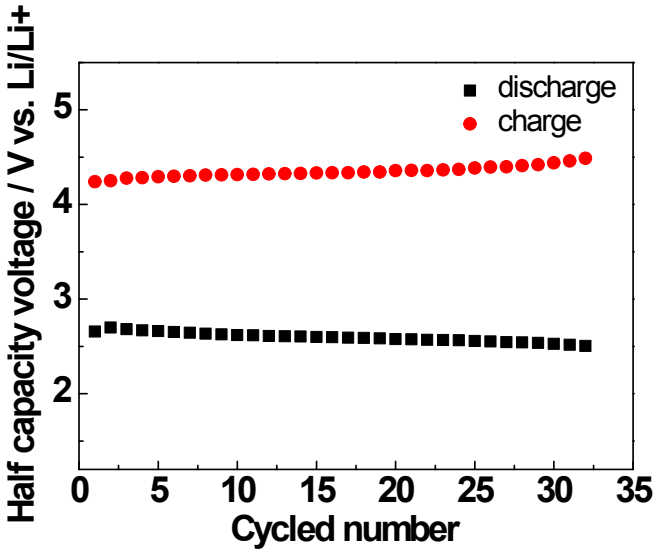

Fig. S2 The cycled number dependent half-capacity voltage of the cell from the test shown in Fig. 1b in the main text (black: discharge; red: charged).

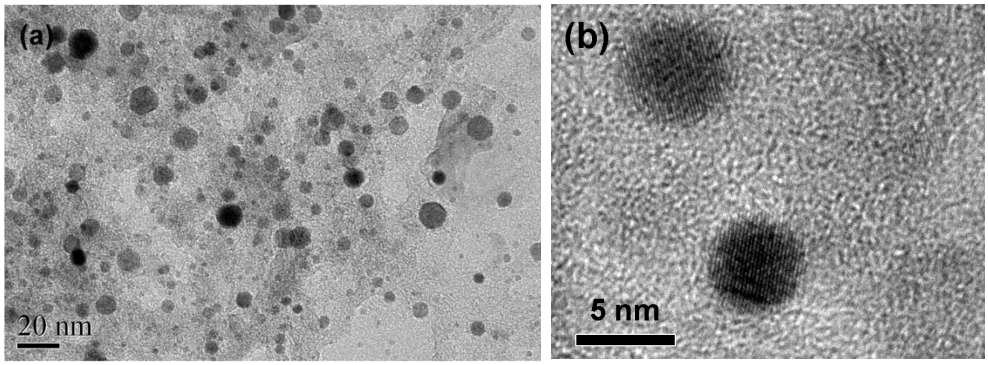

Fig. S3 TEM image (a) and HR-TEM (b) of CBC/Ru.

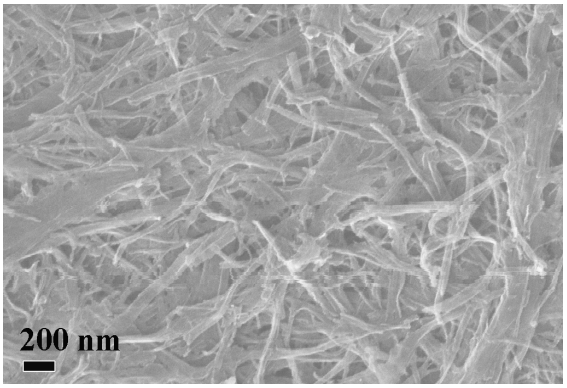

Fig. S4 SEM image of CBC/Ru after Li_2O_2 oxidation which was formed during discharge process at current density of 200 mA g^{-1}.