

Journal of Materials Chemistry A

## Supporting information

### **A new perspective of the ruthenium ion: Bifunctional soluble catalyst for high efficiency Li-O<sub>2</sub> batteries**

Seon Hwa Lee, Won-Jin Kwak and Yang-Kook Sun\*

Department of Energy Engineering, Hanyang University, 133-791, Republic of Korea.

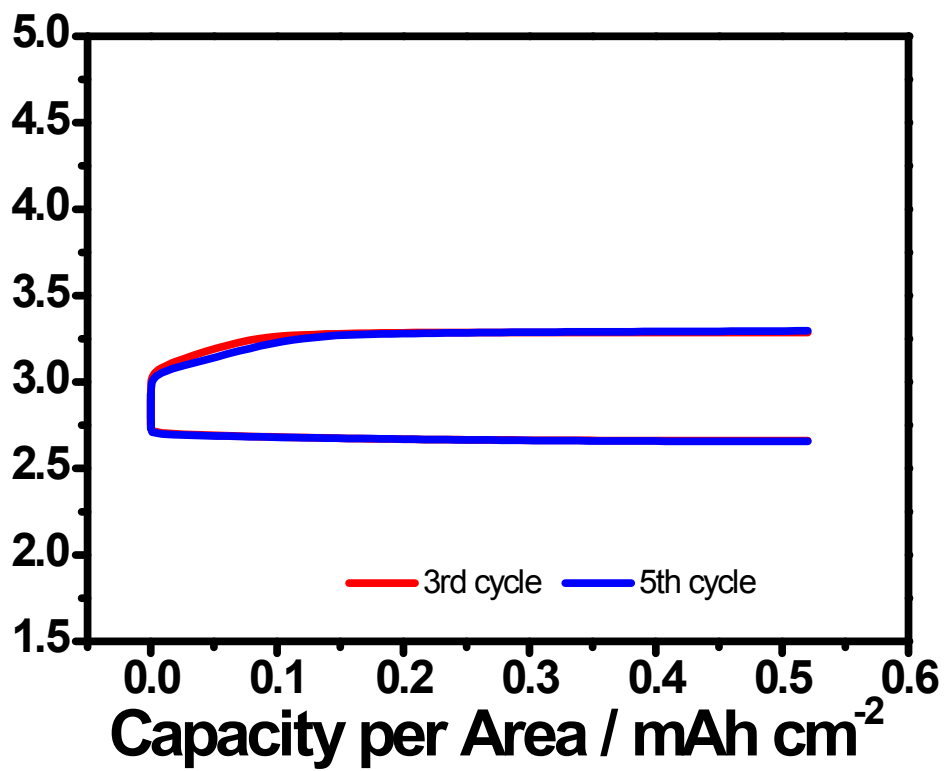
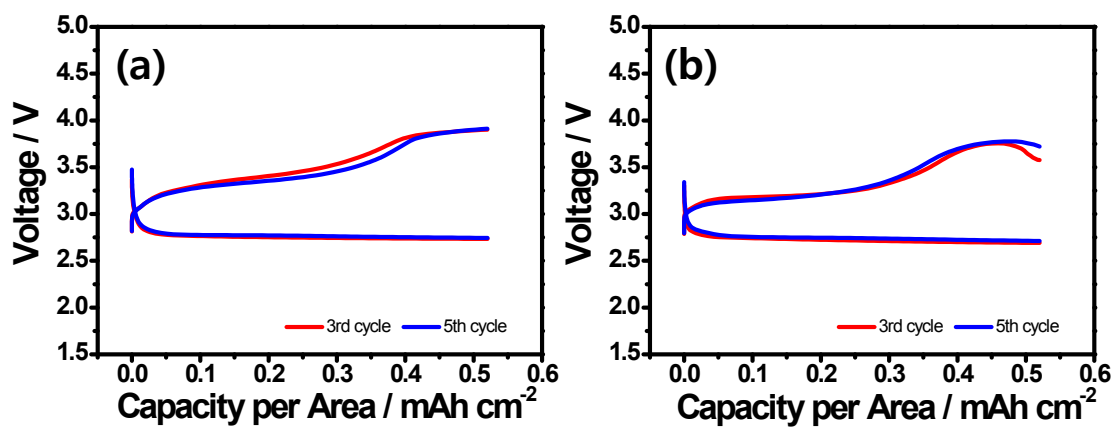
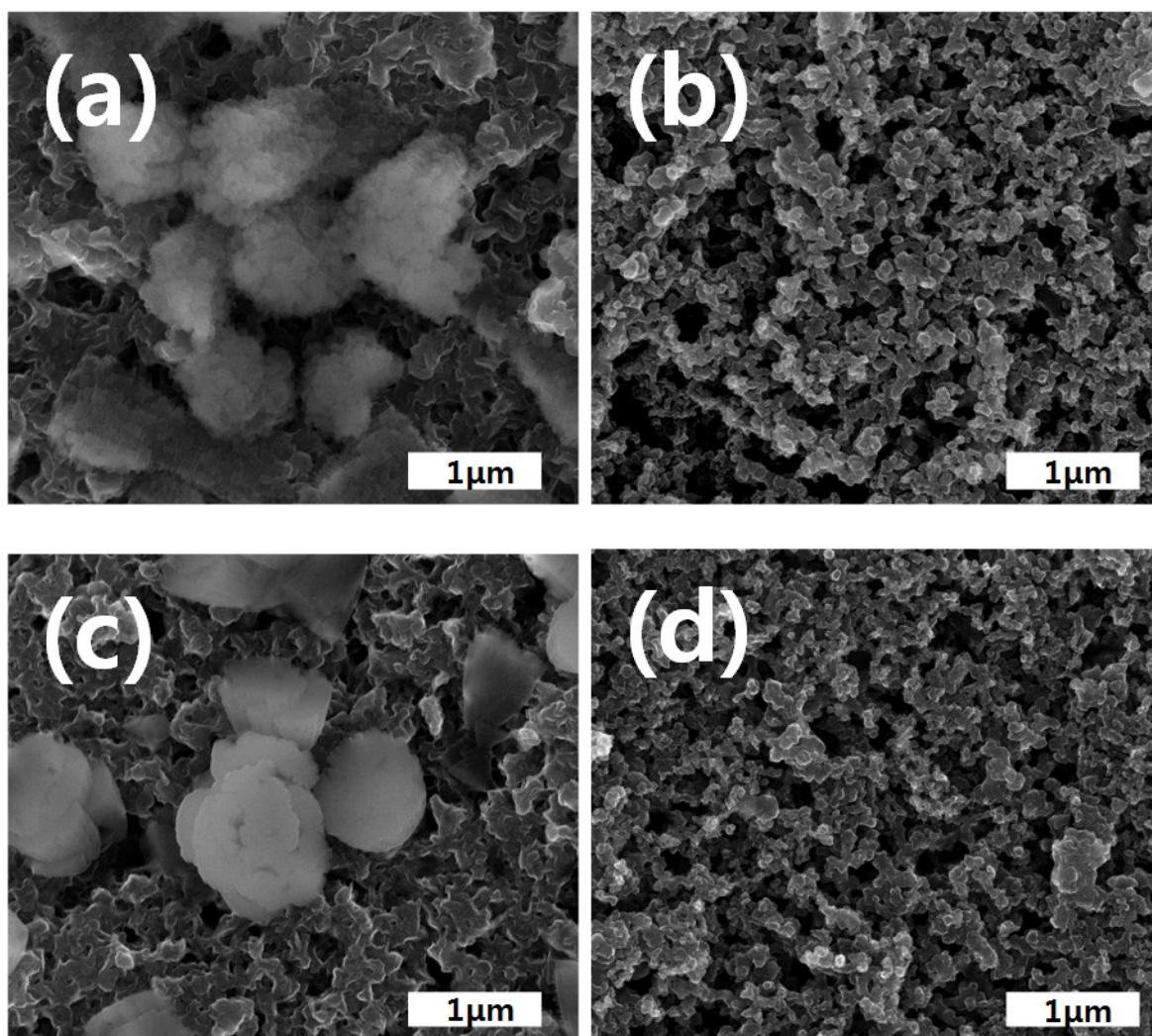


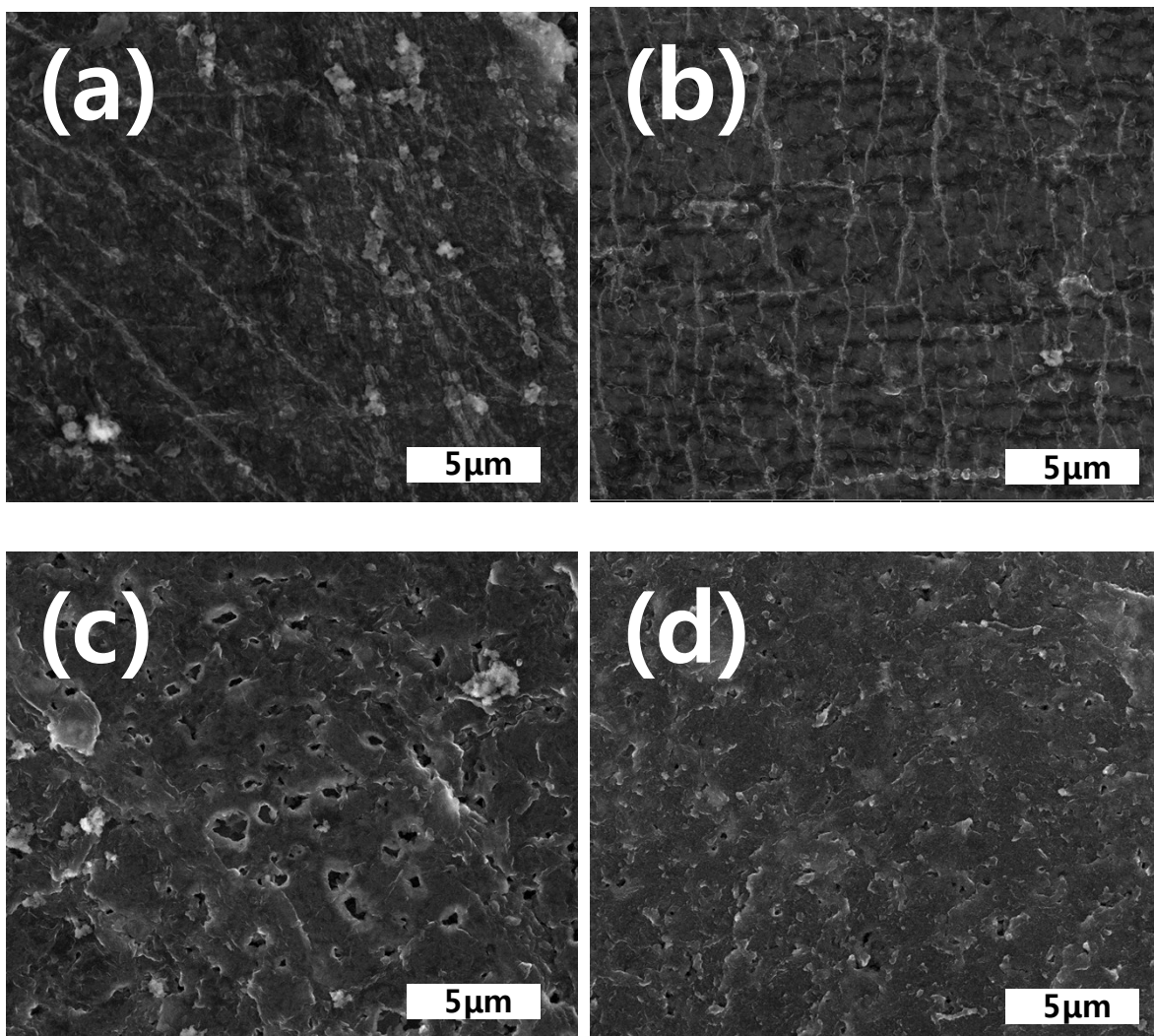
Fig. S1 Galvanostatic behavior of Li-O<sub>2</sub> batteries using 0.1M LiBr +1 M LiTFSI in DMSO.



**Fig. S2** Galvanostatic behavior of Li-O<sub>2</sub> batteries using different electrolytes: (a) 0.01 M RuBr<sub>3</sub> + 1 M LiTFSI in DMSO and (b) 0.05 M RuBr<sub>3</sub> + 1 M LiTFSI in DMSO.



**Fig. S3** The SEM images of cathode after cycling with 0.1 M  $\text{RuBr}_3$  + 1 M LiTFSI in DMSO: (a) after 10<sup>th</sup> cycle discharge, (b) after 10<sup>th</sup> cycle charge , (c) after 30<sup>th</sup> cycle discharge and (d) after 30<sup>th</sup> cycle charge.



**Fig. S4** The SEM images of Li- metal anode after cycling with 0.1 M  $\text{RuBr}_3$  + 1 M LiTFSI in DMSO : (a) after 10<sup>th</sup> cycle discharge , (b) after 10<sup>th</sup> cycle charge , (c) after 30<sup>th</sup> cycle discharge and (d) after 30<sup>th</sup> cycle charge.