A Flexible of Macroporous Pd@C Composite Air Electrode for High-Energy Nonaqueous Lithium Oxygen Batteries

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Recently, Li-O_2 batteries have attracted a considerable amount of interest as an alternative energy storage system for the next generation electrical energy storage, since they possess a much higher theoretical specific energy density (3505 Wh kg^{-1}) [1].Although important progress has been made by many authors, significant challenges remain. Two significant challenges of Li-O_2 battery are gap between the charge and discharge voltage and reversible cycle life[2].

To resolve this problems, the air electrode structure and the electrocatalysts play important roles. Here, a flexible of Macroporous Ketjen black and Metal Pd (Pd@C) composite air cathode is reported, in which the Pd can act as efficient electrocatalysts, and the macroporous Ketjen black can provide space for Li_2O_2 to deposit and also promote the electron transfer. The electrochemical results on the Pd@C composite air electrode show a 0.81V lower charging plateau and a 0.08 V higher discharging plateau than those of pure Ketjen blank air electrode, with a discharge capacity of nearly 5500mAh g^{-1}(composite) under a current density of 0.1 mA/cm^2 during the initial discharge. Excellent cycling performance that more than 50 cycles with capacity limited to 1000 mAh g^{-1}), reversible capability effeciency are 100%. Therefore, this hybrid material is a promising candidate for use as a high energy, long-cycle-life, and low-cost cathode material for lithium oxygen batteries.

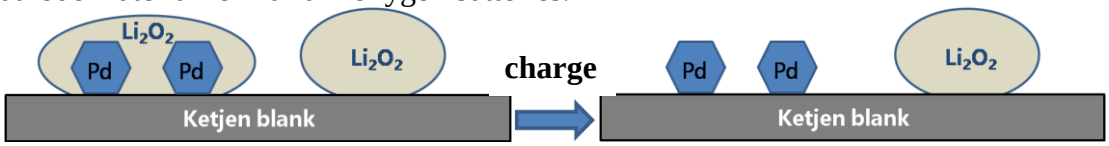

Figure1.Schematic of the nanostructured cathode architecture. This figure shows the the palladium nanoparticles and the nanocrystalline lithium peroxide, all of which contribute to lowering the overpotential.

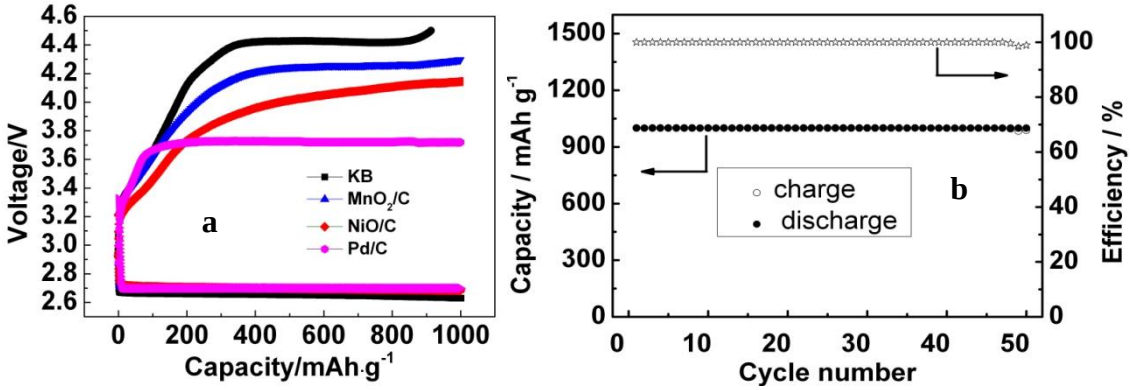

Figure 2. (a) Comparison of the first discharge–charge curves of the Ketjen black, MnO_2/C, NiO/C, and Pd/C at 0.1 mA cm^{-2} , with a capacity limited to 1000 mAh g^{-1} (b)Comparison of the cycling performances of Pd@C macroporous electrode.

References:

[1] W. J. Kwak, K. C Lau, C. D Shin,K. Amine, L. A Curtiss, Y. K Sun. NANO, 9(2015): 4129-4137.
[2] P. G. Bruce, S. A. Freunberger, L. J. Hardwick, J, M Tarascon. Nature Materials, 10(2012): 20:29.