Electronic Supplementary Information

The potential for long-term operation of a lithium–oxygen battery using a non-carbonate-based electrolyte

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Experimental details

The air (O_2) electrode was prepared by pasting a mixture of Ketjen black (KB, EC 600JD, Ilshin Chemtech) and Kynar 2801 binder at a weight ratio of 8:2 onto Ni mesh. The Li–O_2 cell was constructed by stacking lithium metal (3/8-in diameter), a glass fiber separator (Whatman GF/D microfiber filter paper, 2.7-μm pore size), and the air electrode in sequence. TEGDME with 1 M $LiPF_6$ was used as an electrolyte in a Swagelok cell. All of the electrochemical tests were carried out using a potentio-galvanostat (WonA Tech, WBCS 3000, Korea) in an oxygen atmosphere (770 Torr), which was constantly maintained by a throttle valve at room temperature. In a controlled experiment, the charge cutoff was limited to 4.2 V, and the discharge cutoff was constrained to 500 mAh g^{-1} with 3 hours limitation. All of the capacities were calculated based on the initial weight of KB in the electrodes. The air electrode at each step was measured by X-ray photoelectron spectroscopy (XPS, Thermo VG Scientific, Sigma Probe, England).

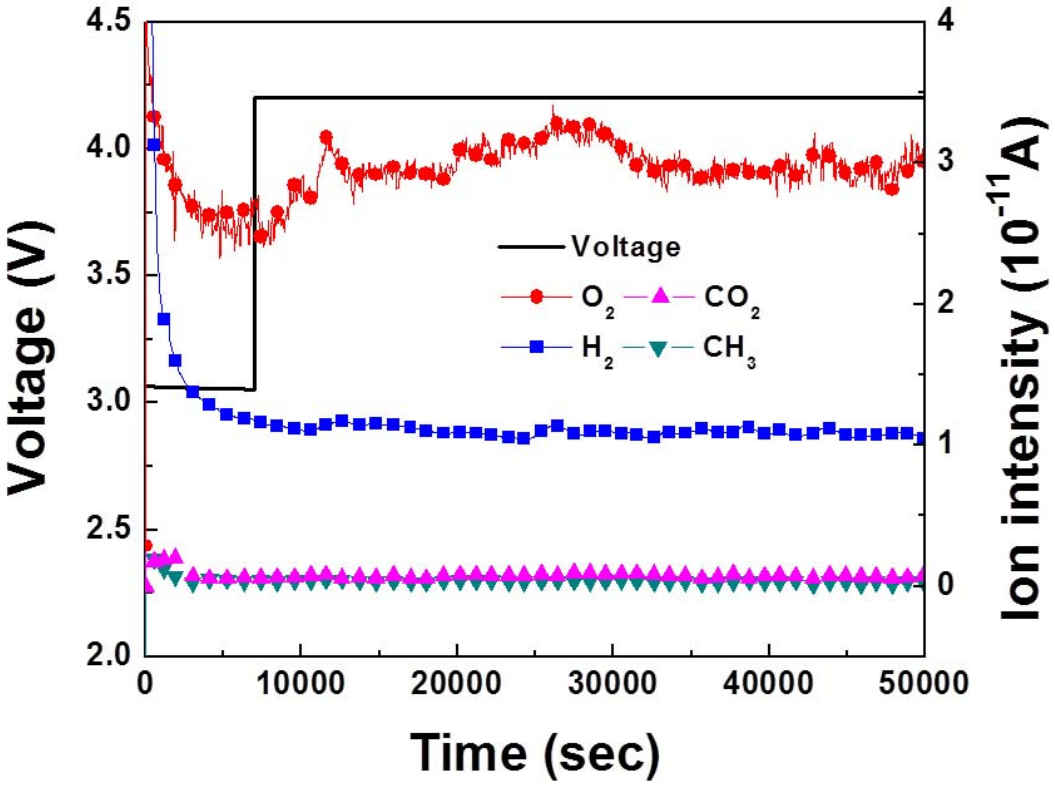

Figure S1. Gas evolution result of Li-O_2 cell during charge.

Gas analysis was carried out to investigate the gas evolution by Differential electrochemical mass spectrometry (DEMS). DEMS was composed of a mass spectrometer (MS) (HPR-20, Hiden Analytical) and a potentio-galvanostat. The cell was discharged in advance, and then, charged at a constant voltage of 4.2 V. Before the gas analysis, the DEMS cell was fully relaxed with Ar for 2h. The gases from the cell during charge were swept into a MS. The result proves that the oxygen gas starts to evolve with the initiation of a charge process. The major evolving gas type is oxygen, and the signals of other gases such as H_2, CH_3, CO_2 were significantly lower. In particular, the evolution of CO_2 gas is negligible, which indicates that the decomposition is mainly from Li_2O_2 not from Li_2CO_3.