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SUPPLEMENTARY INFORMATION

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Charging a Li-O_2 Battery Using a Redox Mediator

Yuhui Chen[1]†, Stefan A. Freunberger[1,2]†, Zhangquan Peng[1,3], Olivier Fontaine[1,4] and

Peter G. Bruce[1]*

[1] School of Chemistry, EastChem, University of St. Andrews, North Haugh, St. Andrews, Fife KY16 9ST UK.

[2] Current addresses: Institute for Chemistry and Technology of Materials, Graz University of Technology, Stremayrgasse 9, 8010 Graz, Austria.

[3] Current addresses: State Key Laboratory of Electroanalytical Chemistry, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, 5625 Renmin Street , 130022 Changchun, P.R.China.

[4] Current addresses: Institut Charles Gerhardt Montpellier, UMR 5253, Equipe Chimie Moléculaire et organisation du Solide, Université Montpellier 2, CC 1700, Place Eugène Bataillon 34095 Montpellier Cedex 5, France.

* To whom correspondence should be addressed. E-mail: p.g.bruce@st-andrews.ac.uk

† These authors contributed equally to this work.

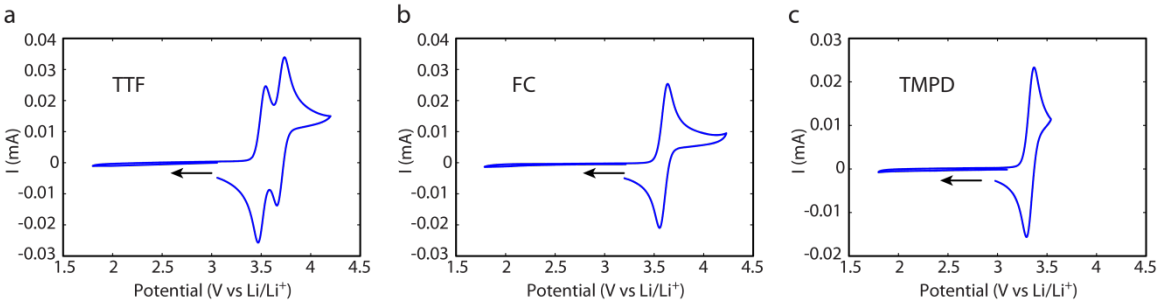

Fig. S1. Cyclic voltammetry of (**A**) TTF, (**B**) FC, and (**C**) TMPD; dissolved in 0.1 M $TBAClO_4$ in DMSO cycled under Ar at a gold electrode; rate 100mV/s. Both redox couples for TTF, TTF/TTF^+, TTF^+/TTF^{2+}, are shown.

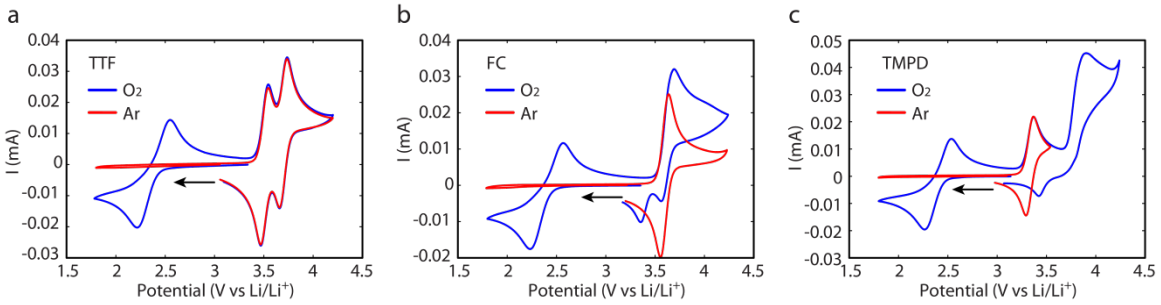

Fig. S2. Cyclic voltammetry of (**A**) TTF, (**B**) FC, and (**C**) TMPD; dissolved in 0.1 M $TBAClO_4$ in DMSO cycled under O_2 (blue curves) at a gold electrode; rate 100mV/s. CVs under Ar (red curves) from Fig S1 are shown for comparison. The redox process at ~2.25V corresponds to the O_2/O_2^- couple.

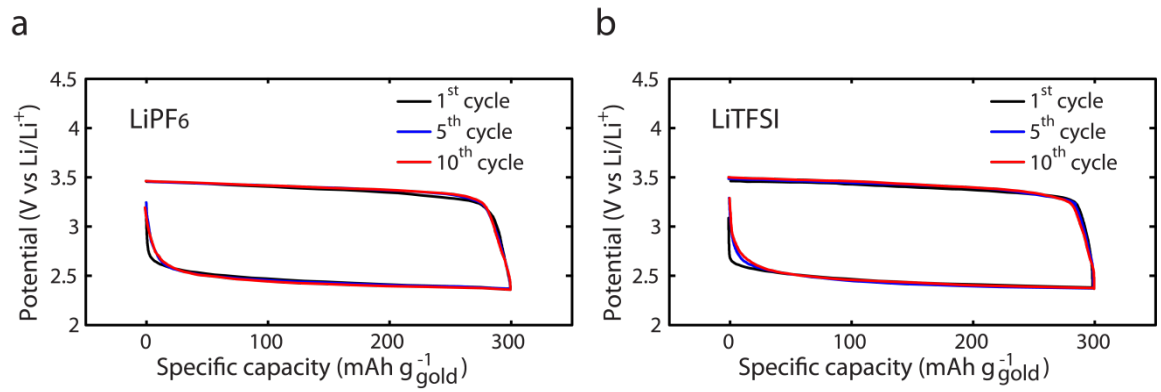

Fig. S3. Load curves for the 1st, 5th and 10th cycle, (**a**) 1 M $LiPF_6$ in DMSO and (**b**) 1 M LiTFSI in DMSO containing 10 mM TTF at a nanoporous gold electrode under O_2 at a rate of 0.313 mA cm^{-2}.

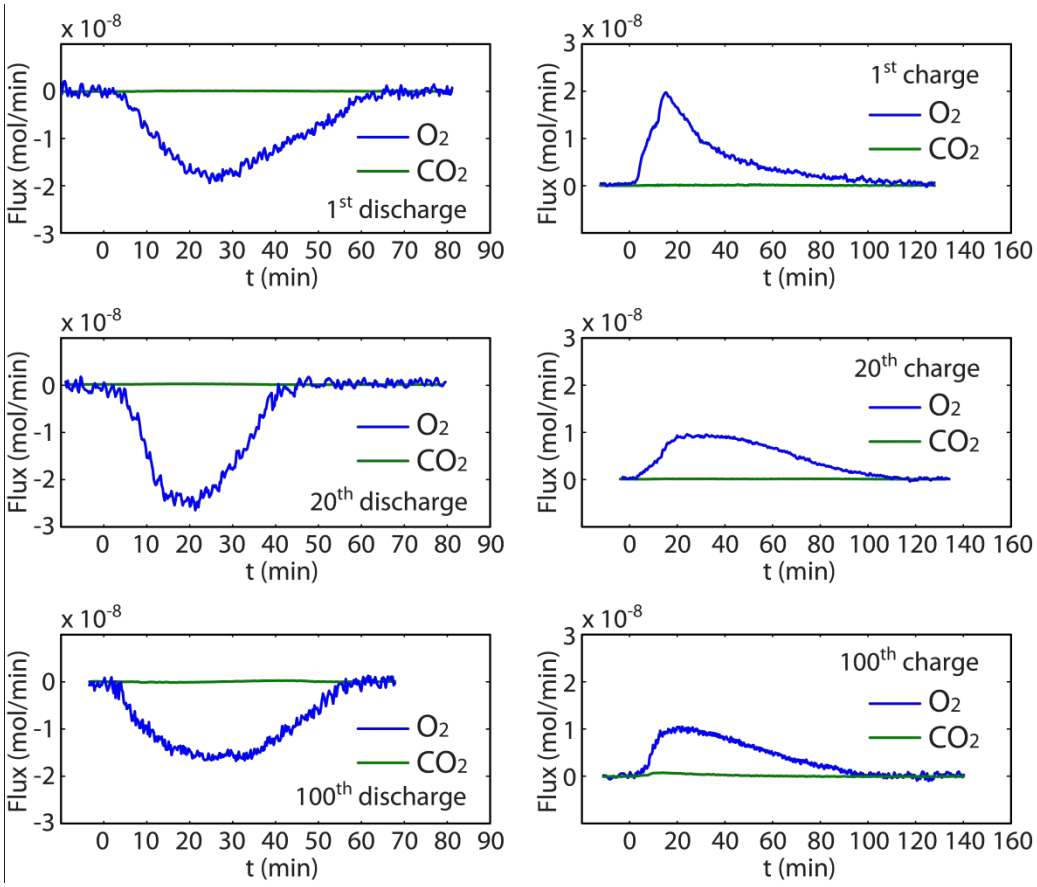

Fig. S4. *In-situ* DEMS for 1 M $LiClO_4$ in DMSO containing 10 mM TTF at a nanoporous gold electrode under O_2, cycled galvanostatically. Flow rate of carrier gas: 0.1 mL min^{-1}

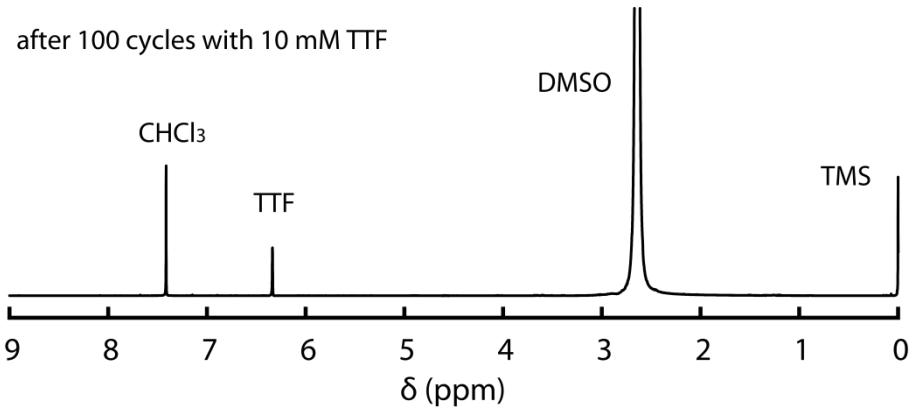

Fig. S5. ^1H NMR spectrum of solution extracted by washing the NPG electrode and separator with $CDCl_3$ after 100 cycles.