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Electronic supplementary information

Lithium rhenium (VII) oxide as novel material for graphite pre-lithiation in high performance Lithium-ion capacitors

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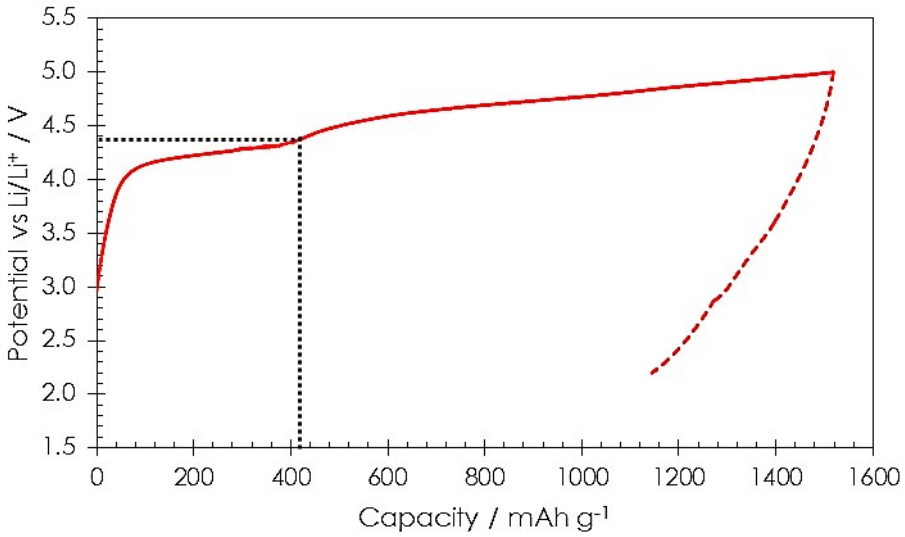

Fig. S1 Extraction profile of lithium ions from a LRO/AC composite electrode. Lithium is extracted up to ca. 4.3 V vs Li/Li^+. The second plateau above 4.5 V vs. Li/Li^+ can be related to side reactions such as electrolyte oxidation or rhenium oxide decomposition.

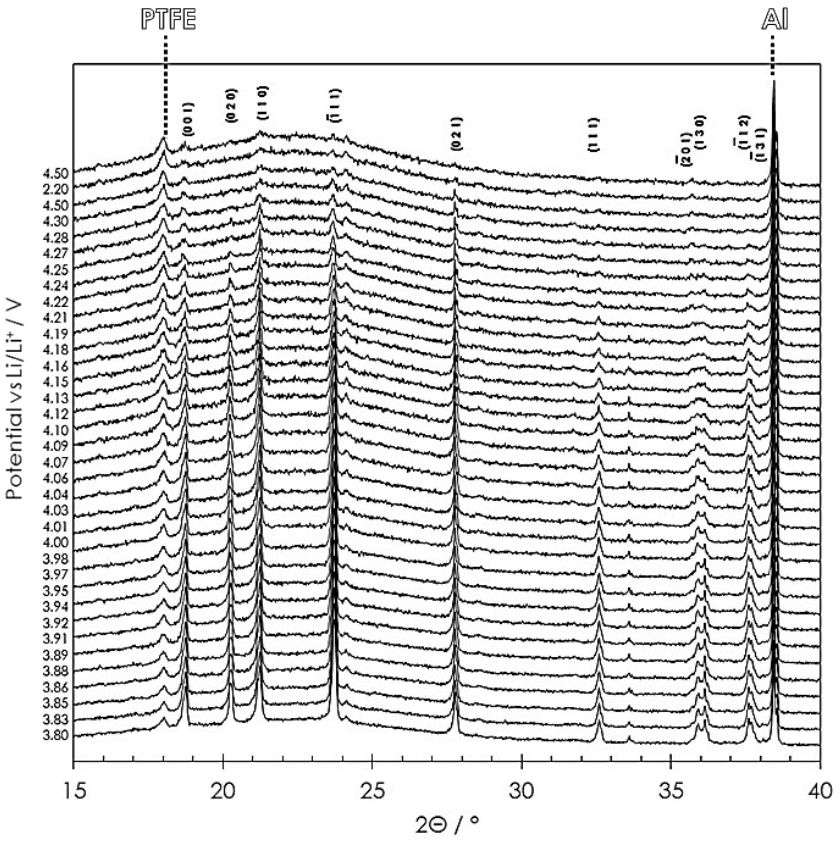

Fig. S2 *In-situ* XRD analysis showing the effect of lithium ions extraction from LRO and resulting amorphization. Each pattern corresponds to data acquired at different potentials indicated on the Y axis. The peaks marked with Miller indices represent the LRO phase. The peaks corresponding to the cell components (aluminium foil, PTFE) are indicated.

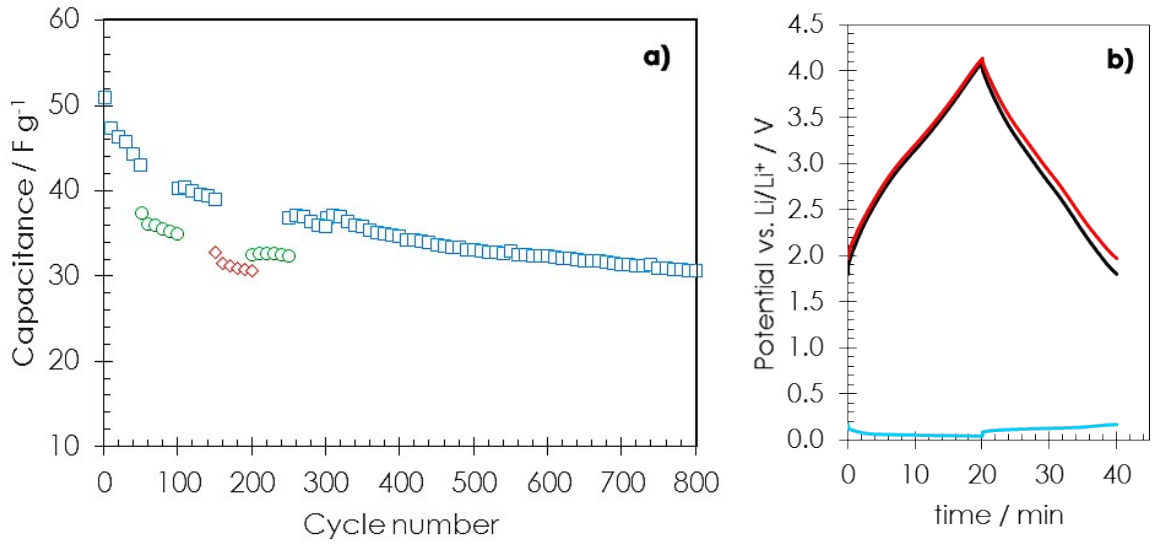

Fig. S3 a) Cycle life of the LIC in the voltage range from 1.80 to 4.10 V at different current values of 250 mA g^{-1} (blue squares), 500 mA g^{-1} (green circles) and 650 mA g^{-1} (red diamonds); b) galvanostatic charge/discharge profiles of positive electrode (red line), negative graphite electrode (blue line) and cell (black line), showing that the potential of the positive electrode reaches 1.97 V vs. Li/Li^+ when the cell voltage is 1.80 V. Such low potential may cause the formation of a S.E.I. on the surface of AC at the positive electrode and can be at the origin of poor cycle life.

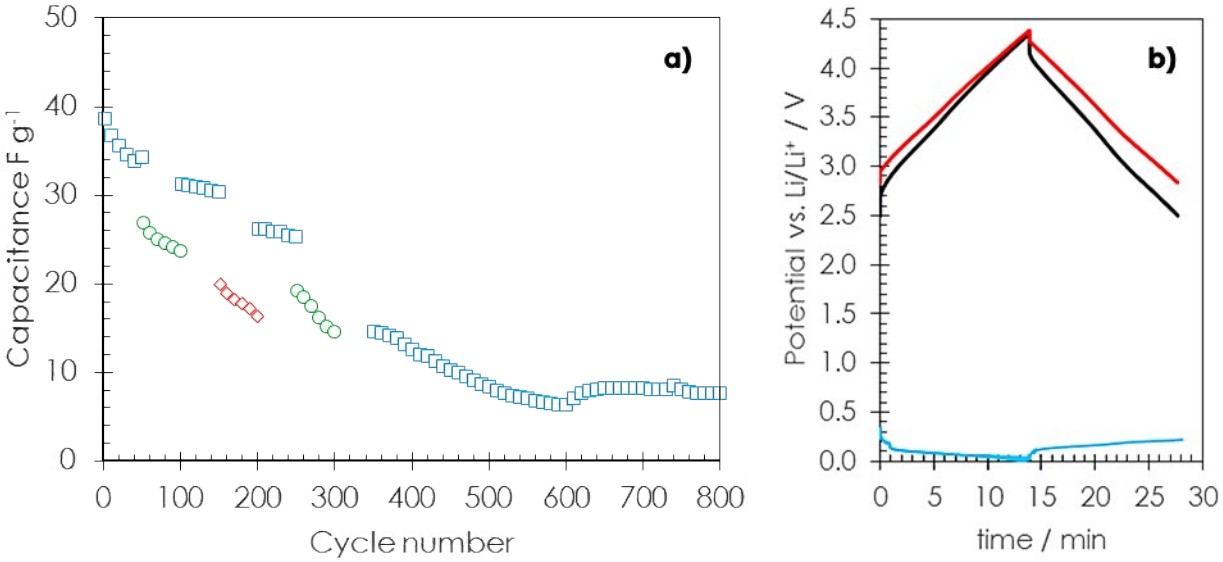

Fig. S4 a) Cycle life of the LIC in the voltage range from 2.50 to 4.30 V at different current values of 250 mA g^{-1} (blue squares), 500 mA g^{-1} (green circles) and 650 mA g^{-1} (red diamonds); b) galvanostatic (250 mA/g) charge/discharge profiles of positive electrode (red line), negative graphite electrode (blue line) and cell (black line), showing that the potential of the positive electrode reaches values higher than 4.20 V vs. Li/Li^+. Such high values may cause side oxidation reactions of the LRO/AC positive electrode and be at the origin of poor cycle life.