Tunneling Holes in Microparticles to Facilitate the Transport of Lithium Ions for High Volumetric Density Batteries

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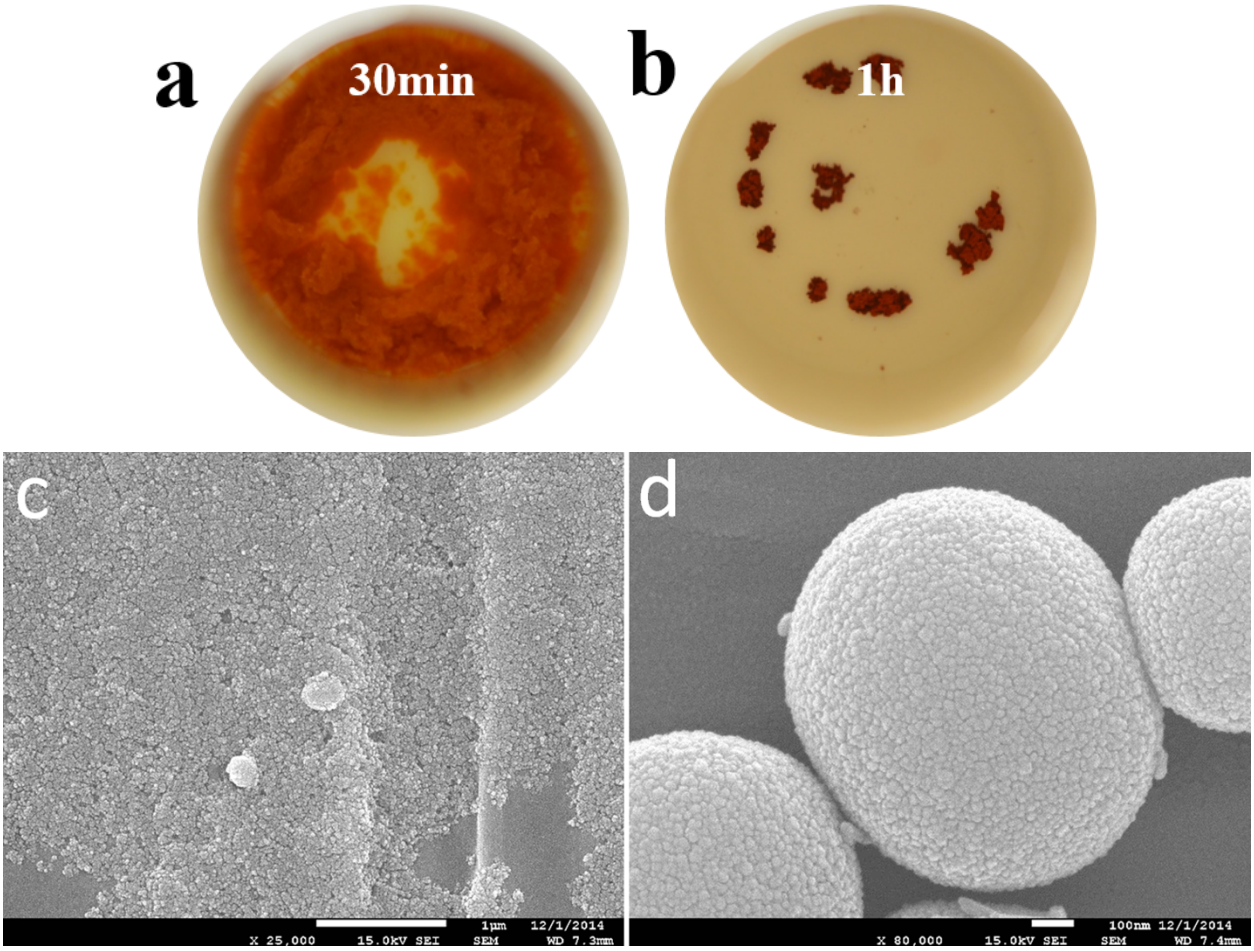

Figure S1. The optical images show that (a) cloudy solid in orange color formed after 30 min of reaction and the solid is the precursor of Fe_2O_3, and (b) the Fe_2O_3 aggregates in typical red color

formed after a reaction time of 1 h. The clear transparent solvent in reactor after 1 h, which was different from the dark yellow of $FeCl_3$ solution before reaction, indicates conversion of dissolved Fe^{3+} ions in solution to precipitate Fe_2O_3. The color of solid product did not further change with longer reaction time, possibly, due to the formation of solid Fe_2O_3. (c) and (d) Additional SEM characterization of the sample in (a) and (b), respectively.

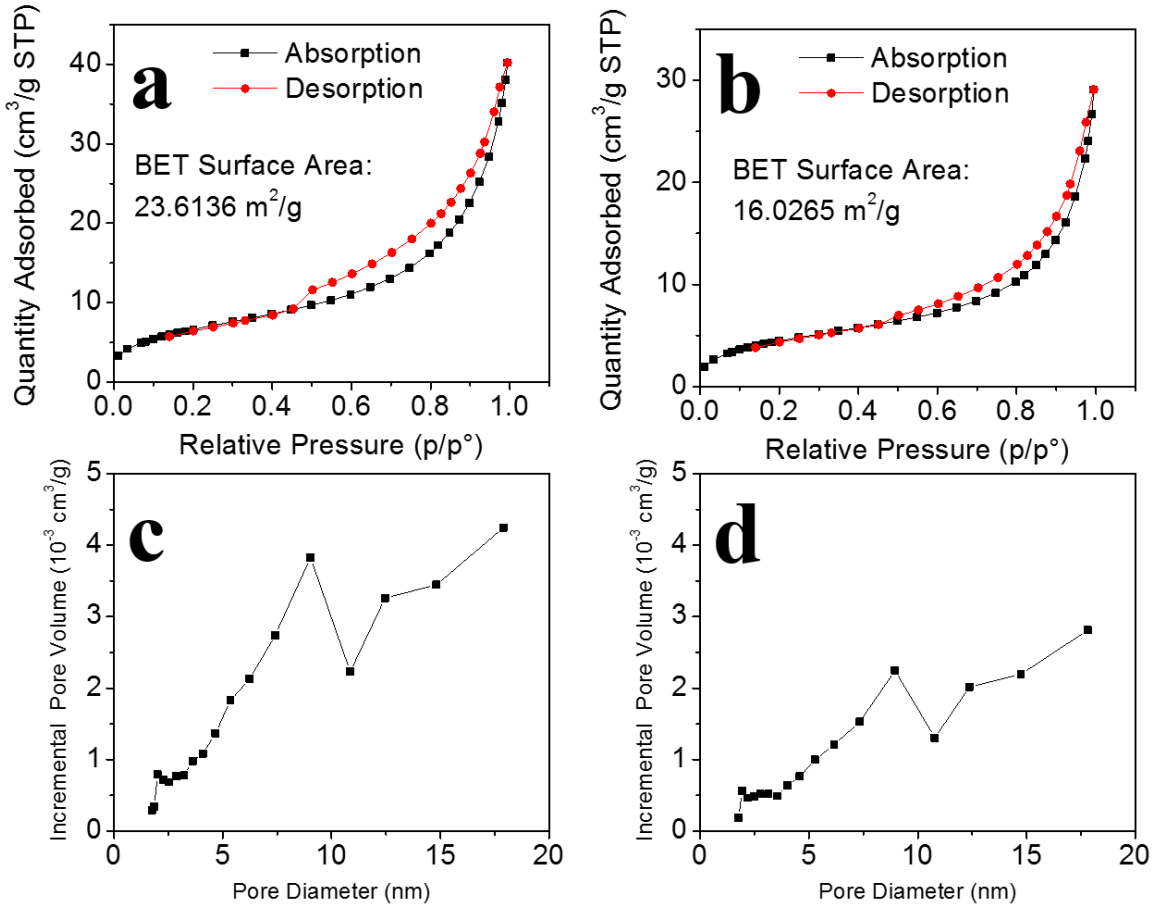

Figure S2. BET analysis by N_2 gas adsorption-desorption isotherm of α-Fe_2O_3 (a) solid beads and (b) beads with tunnel-like hole; pore size distribution of α- Fe_2O_3 (c) solid beads and (d) beads with tunnel-like hole;

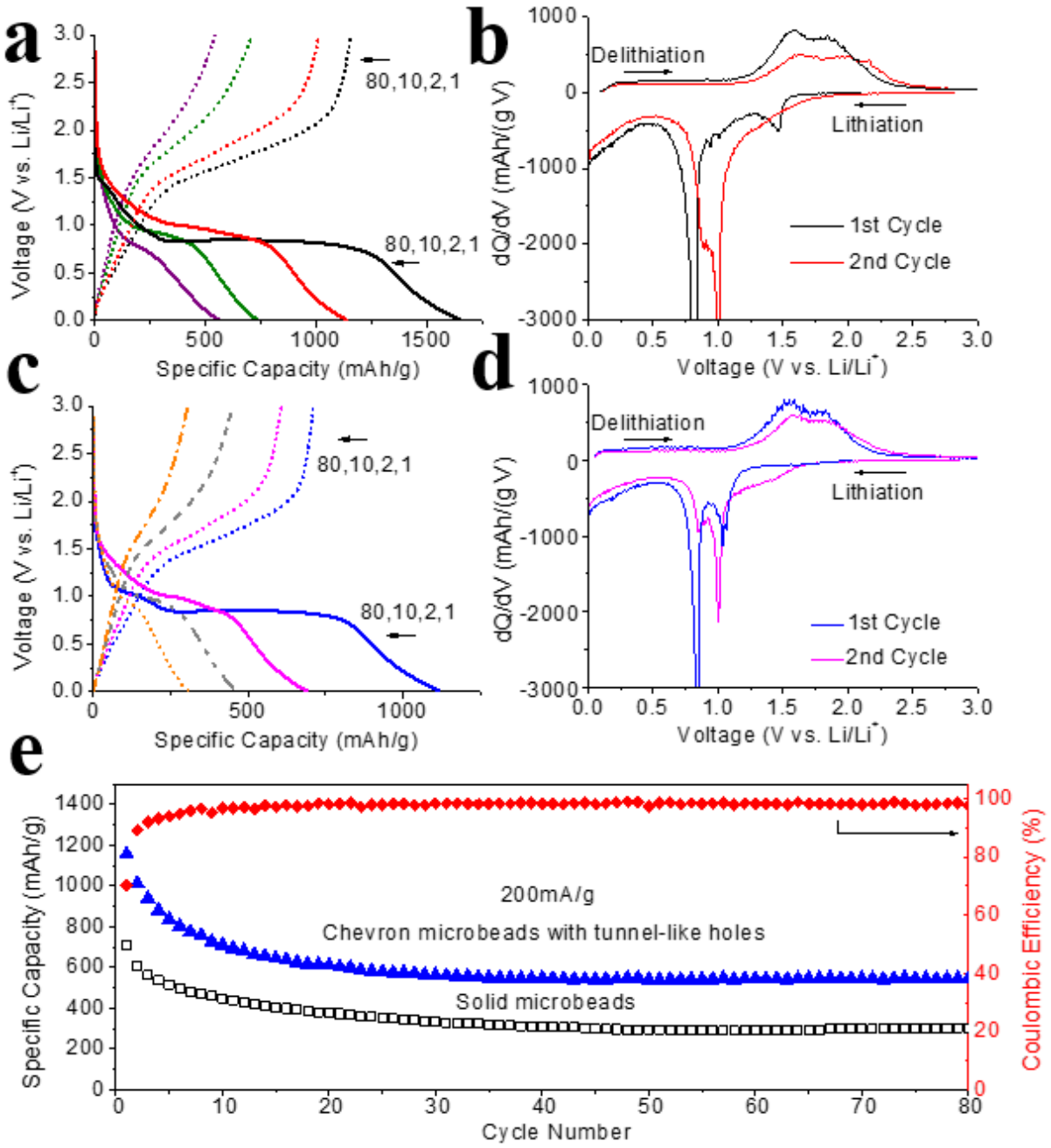

Figure S3. Electrochemical performance of α-Fe_2O_3 micro chevron beads with tunnel-like holes and α-Fe_2O_3 solid microbeads in terms of specific capacity: (a) charge-discharge profiles for the 1st, 2nd, 10th and 80th cycles and (b) dQ/dV vs. V plot for the first two cycles of chevron microbeads; (c) charge-discharge profiles for the 1st, 2nd, 10th and 80th cycles and (d) dQ/dV vs. V plot for the first two cycles of solid microbeads for comparison. (e) cycling performance of α-

Fe_2O_3 chevron microbeads and the corresponding solid microbeads for 80cycles. The conventional unit of mAh/g is used here.

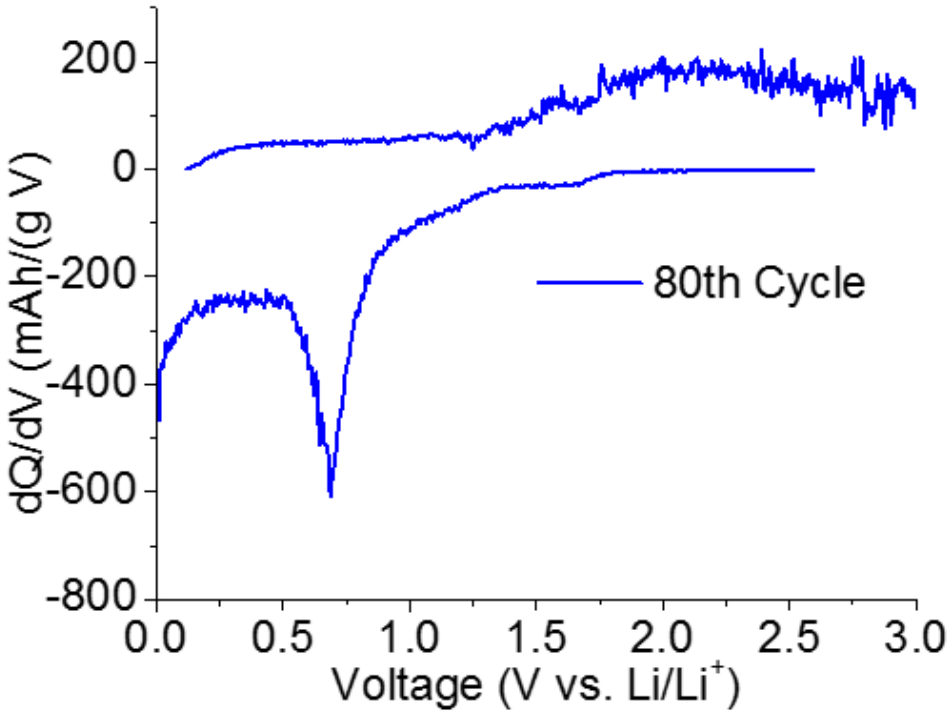

Figure S4. dQ/dV vs V. plot of 80th cycle for the microbeads with tunnels.