Electronic supplementary information

The controlling synthesis and improved electrochemical cycleability of Mn-doped α-Fe_2O_3 hollow porous quadrangular prisms as lithium-ion battery anodes

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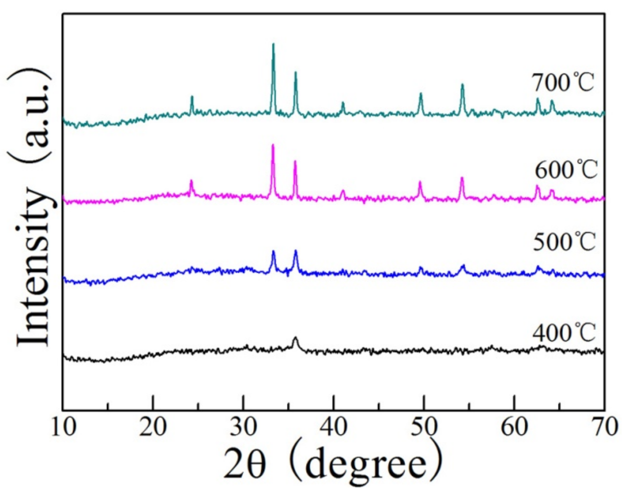

Fig. S1 XRD patterns of $Fe_{1.7}Mn_{0.3}O_3$ samples obtained at various calcination temperatures.

Comparing the crystallinity of each sample shown above, the calcination temperature of oxalate precursors should be selected at 600 °C or higher.

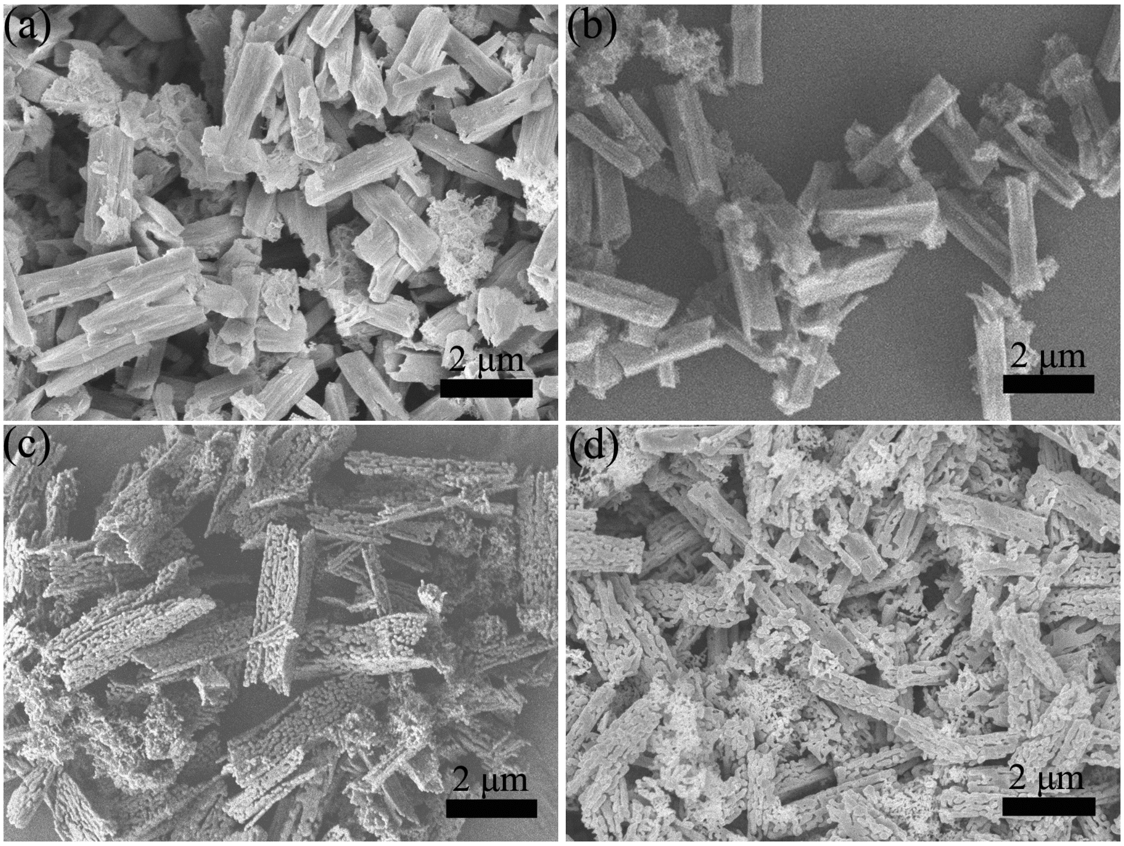

Fig. S2 SEM images of $Fe_{1.7}Mn_{0.3}O_3$ samples obtained at a calcination temperature of (a) 400, (b) 500, (c) 600 and (d) 700 ^{o}C.

The solid-state transformation of MC_2O_4 to M_2O_3 (M = Fe-Mn) mainly replicates the skeletons of precursor, however, the release of gaseous CO_2 and CO could hardly endow the oxides with a porous feature when operated at a low calcination temperature of 400 or 500 ^{o}C (Fig. S2-a, b). Furthermore, when calcined at 700 ^{o}C, parts of resulting quadrangular prisms become cracked and their porous skeletons became vague in appearance owing to crystal fusion probably (Fig. S2-d). Therefore, the optimal calcination temperature of Mn-doped $FeC_2O_4{\cdot}2H_2O$ precursor was selected at 600 ^{o}C.

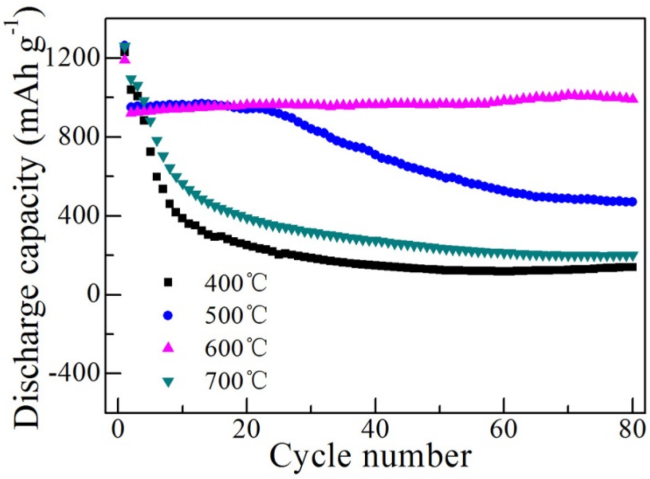

Fig. S3 Cycling performances of $Fe_{1.7}Mn_{0.3}O_3$ samples, obtained at various calcination temperatures, operated at 200 mA g^{-1} in the voltage range of 0.01-3.0 V.

When used as the active substances of a Li-ion battery anode, the initial specific discharge capacities of these oxides obtained at 400, 500, 600 and 700 ^{o}C are 1231.2, 1262.6, 1189.9 and 1260.6 mAh g^{-1}. By comparison, the sample sintered at 400 or 700 ^{o}C shows rapid capacity decay and gives the 80^{th} reversible value of 139.9 or 202.1 mAh g^{-1}; the discharge capacity of the powdered oxide obtained at 500 ^{o}C is nearly stable from the 2nd to 20th cycles and then gradually reduces to 470.1 mAh g^{-1} at the 80th cycle; while the M_2O_3 (M = Fe-Mn) product collected at 600 ^{o}C exhibits a high cycling durability and retains a high reversible capacity of 1000.0 mAh g^{-1} over 80 discharge-charge cycles.

In a word, the comparative cycling performances of $Fe_{1.7}Mn_{0.3}O_3$ samples furthermore confirm that the optimal calcination temperature of Mn-doped $FeC_2O_4 \cdot 2H_2O$ precursor is 600 ^{o}C.