Improved cycling behavior of modified ordered mesoporous SnO_2 anode materials for lithium ion battery

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Lithium ion battery is considered the most promising energy storage technology for mobile electronics and electric vehicles. Mesoporous material that consisted of particles containing nano-size pores separated by walls of similar size can deliver high rate power and high stability on cycling. In this report, we present simple and generic concept involving metal oxide with residual silica as stable and high capacity anode materials for Li ion battery. Specifically, highly ordered mesoporous SnO_2 with residual silica species for lithium ion battery was prepared using SBA-15 via nano-replication and simple etching processes with various concentration of etching solution. Remaining silica species are in the range of 0.9–17.4 wt%, which induce a nano-propping effect enabling the mesoporous SnO_2 material to remain stable up to 973 K without any significant structural collapse. More importantly, the optimum amount of residual silica species (3.9–6.0 wt%) results in a dramatic reduction in capacity fading. The observed, enhanced thermal stability with high capacity retention is derived from the residual silica species which acts as a physical barrier to prevent aggregation of Sn during the Li alloying and dealloying.