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Lei Wang, Fen Wang, Jianfeng Zhu, Xin Zhang, Yi Tang, Xing Wang



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**Synthesis and electrochemical performance of three-dimensional ordered
hierarchically porous $\text{Li}_4\text{Ti}_5\text{O}_{12}$ for high performance lithium ion Batteries**

Lei Wang, Fen Wang *, Jianfeng Zhu *, Xin Zhang, Yi Tang, Xing Wang

School of Materials Science & Engineering, Shaanxi University of Science & Technology, Xi'an 710021, Shaanxi, P.R. China.

Abstract

In this work, a three-dimensional ordered hierarchically porous (3DOHP) $\text{Li}_4\text{Ti}_5\text{O}_{12}$ that possesses inner-particle mesopores resulting from a soft template method and a three-dimensional ordered macroporous (3DOM) $\text{Li}_4\text{Ti}_5\text{O}_{12}$ using polystyrene spheres as a hard template have been synthesized. Both 3DOM $\text{Li}_4\text{Ti}_5\text{O}_{12}$ and 3DOHP $\text{Li}_4\text{Ti}_5\text{O}_{12}$ have ordered macropores and interconnected skeletons with a regular periodicity revealed by SEM and TEM observations. The specific surface area of 3DOHP $\text{Li}_4\text{Ti}_5\text{O}_{12}$ is up to $135 \text{ m}^2 \text{ g}^{-1}$ which is much higher compared with that of 3DOM $\text{Li}_4\text{Ti}_5\text{O}_{12}$ because of the existence of inner-particle mesopores. Attributed to the higher surface area and smaller crystal grain size, more excellent cycle performance and rate capability are obtained for 3DOHP $\text{Li}_4\text{Ti}_5\text{O}_{12}$ compared to 3DOM $\text{Li}_4\text{Ti}_5\text{O}_{12}$. In addition, the hierarchically porous structure of 3DOHP $\text{Li}_4\text{Ti}_5\text{O}_{12}$ can meet rapid insertion and deinsertion of lithium ion even at extremely high rate. It is apparent that 3DOHP $\text{Li}_4\text{Ti}_5\text{O}_{12}$ has a lower total resistance and faster Li^+ diffusion coefficient

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