High Electrochemical Li Intercalation in Titanate Nanotubes

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Abstract:

Titanate nanotubes and Ni doped titanate nanotubes were synthesized by hydrothermal method using rutile powders as starting materials. The electrochemical lithium storage of the nanotubes were investigated by cyclic voltammetric methods, and the crystal structure of the titanate nanotubes were computed by the density functional theory (DFT). The microstructure and morphology of the synthesized nanotubes were characterized by X-ray diffraction (XRD), high resolution transmission electron microscopy (HR-TEM). Titanate nanotubes were composed of $H_2Ti_2O_5 \cdot H_2O$ in accordance with DFT calculation and had outer and inner diameters of ~10 nm and 6 nm, and the interlayer spacing was about 0.65−0.74 nm. Also, Ni dopants were completely doped in the nanotube matrix. The undoped and the Ni doped nanotubes showed initial electrochemical lithium discharge capacity of 303 and 318 mAh/g, respectively; however, the Ni doped nanotubes revealed poor reversibility due to a large interlayer spacing compared with the undoped nanotubes. On the other hand, the undoped nanotubes exhibited good cycling performance because of the open-end and rolled layers with suitable spacing. The relationships between morphology and electrochemical properties have been discussed.

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