Fast Li^+ transfer achieved by carbon coating on $Li_4Ti_5O_{12}$ nanobelts

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Rechargeable batteries used in portable devices and electric vehicleS(EVs) and are considered to be the most promising candidate for energy storage system. To realize the energy storage system with rechargeable batteries, we should consider sustainable safety, cycle life, cost, and fast charge/discharge performance. In consideration of the above criteria mentioned, rechargeable lithium batteries are the best choice. However, safety and fast charge are the most urgent issues to be solved. Manganese-based transition metal oxides can be applicable for the positive electrode because of its reliable safety. For the negative electrode, there are several candidate materials. Among them, $Li_4Ti_5O_{12}$ is believed the best choice because of the abundance, zero-strain during charge and discharge at a long term, and safety, if the poor rate capability is improved. For the reason, we, here, report the fast Li+ transfer ability of $Li_4Ti_5O_{12}$(LTO) nanobelt.

Titanate nanobelts were synthesized by hydrothermal reaction of P25 in highly alkaline NaOH solution. Then the precipitates were transferred to a Teflon-lined stainless autoclave. After being heated at 180℃ for 48h, the resultants were washed several times with distilled water until the resulting pH reached neurtal, and then ion-exchanged in HCl aqueous solution. After the ion exchange, the obtained titanate nanowires were mixed with LiOH solution and it again was hydrothermally treated at100℃ for 24h in Tefron-lined autoclave. After washing by ethanol several times until pH7, the collected powders were dried at 60℃ in air and heat treated at 800-900℃ for 6h in air to obtain Li4Ti5O12 nanobelts. The products were coated by pitch in reduction atmosphere at 750℃ for 4h.

Single phase LTO and C/LTO show high crystallinity, which is evidenced by the sharp XRD peaks. Electrochemical test with Li-metal half cells in voltage range of 1-3V at 25℃ indicated that bare and carbon coated LTO were delivered a specific capacity of 174mAh g^{-1}, respectively, which is reached a theoretical capacity. Obviously, 30C, the carbon coated LTO exhibited superior performance to the bare LTO. Fast lithium ion transfer achieved at a high rate by carbon coating on $Li_4Ti_5O_{12}$ nanobelts surface. Also, we can be confirmed the possibility that it can be applied to sodium ion battery. Details will be discussed in the conference site.