Synthesis of single crystalline spinel $LiMn_2O_4$ nanowires

Promising materials for the positive electrode of a high rate Li ion battery

How to improve the specific power density of the rechargeable lithium ion battery has recently become one of the most attractive topics of both scientific and industrial interests. The spinel $LiMn_2O_4$ is the most promising candidate as a cathode material because of its low cost and nontoxicity compared with commercial $LiCoO_2$. Moreover, nano-structured electrodes have been widely investigated to satisfy such industrial needs. Among all of the nano-structures, single crystalline nanowire is the most attractive morphology because the nonwoven fabric morphology constructed by the single crystalline nanowire suppresses the aggregation and grain growth at high temperature, and the potential barrier among the nanosize grains can be ignored. Here we first synthesized high quality single crystalline cubic spinel $LiMn_2O_4$ nanowires based on a novel reaction method using $Na_{0.44}MnO_2$ nanowires as self-template. These single crystalline spinel $LiMn_2O_4$ nanowires show excellent performance at high rate charge-discharge process such as 100C with both a relative flat charge-discharge plateau and excellent cycle stability.

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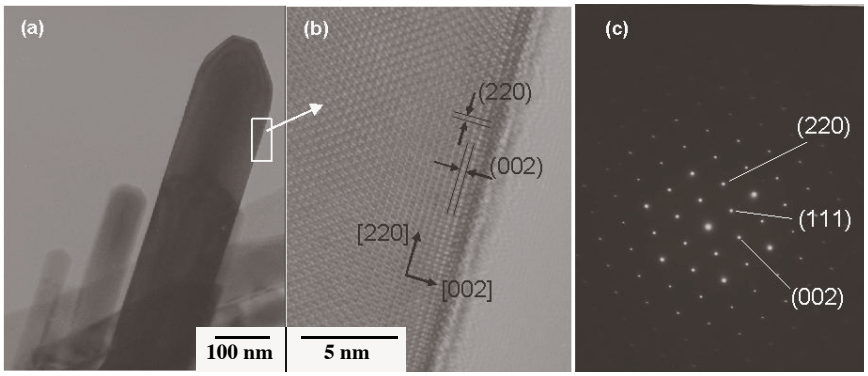

Transmission electron microscope (TEM) image (a,b) of single crystalline spinel $LiMn_2O_4$ nanowire and electron diffraction pattern (c)

Octave-spanning optical frequency comb using mode-locked fiber laser

Fiber comb

Recent developments in fiber based frequency combs have made them the preferred link between optical and microwave frequencies. This is due to their robustness and cost-effectiveness. We have developed fiber based frequency combs at the National Metrology Institute of Japan and achieved long-term measurements of over 1 week. We are collaborating with a company and developing an "optical frequency counter". We believe this will be an important tool for optical communications and industries.

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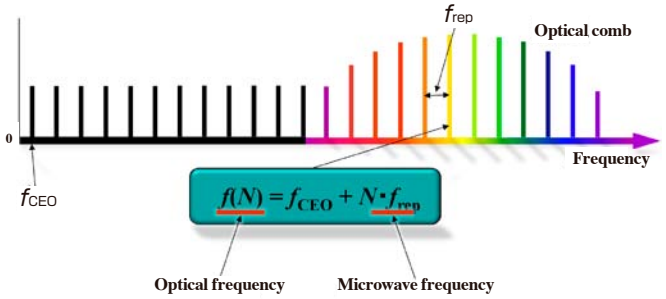

Optical frequency comb equally spaced on the frequency domain
The shaded lines are real modes of the comb, and the others are the virtually extended modes.