GS Li Rich Cathode

Electrode Material for Lithium Ion Battery

Lithium Rich Cathode Material

Environmental problems including climate change, global warming is caused by human activity and population explosion, and is becoming serious issues because of increase in greenhouse gases such as methane and carbon dioxide (CO_2). Replacing petroleum consuming car with hybrid, electric, and fuel cell cars is one of the way to reduce CO_2 emissions from automobiles. Also, building smart-grid society and replacing coal based thermal power generation, is another efficient way. Rechargeable battery is very important device since they can store electricity produced by sustainable energy sources such as wind power and solar cells. So far, lithium ion battery is one of the typical rechargeable battery in a modern society. Therefore, challenge to increase the capacity of lithium ion battery is an extremely important task.

For cathode material for lithium ion battery, necessary properties are high voltage, high capacity, good cycle characteristics with high durability, high charge discharge rate high current density and chemical, thermal stability etc… Not to mention when one considers about commercialization, low cost, synthesis outcome stability and efficiency of synthesis also needs to be carefully considered. Researchers have been challenging to make various type of cathode material for lithium ion battery so far. Transition metal oxide based chemical compound with layered rock salt structure, spinel type structure and olivine type structure etc… have been mainly attempted. Some of them are commercialized in the market and those are $LiCoO_2$, $LiNi_{0.33}Mn_{0.33}Co_{0.33}O_2$, $LiNi_{0.5}Mn_{0.2}Co_{0.3}O_2$, $LiNi_{0.6}Mn_{0.2}Co_{0.2}O_2$, $LiNi_{0.8}Mn_{0.1}Co_{0.1}O_2$, $LiNi_{0.8}Co_{0.15}Al_{0.05}O_2$ as layered rock salt structure, and $LiFePO_4$ have been also commercialized as olivine cathode material. These cathode materials indicate average voltage as 3 - 4 V and theoretical capacity as 170 – 280 $mAhg^{-1}$. And when one prepares as real battery for practical use, they often show 100 – 200 $mAhg^{-1}$ as capacity. Nowadays, people demands for cathode material with higher capacity and voltage in order to create lithium ion battery with stronger output power. As high voltage cathode, $LiNi_{0.5}Mn_{1.5}O_4$ as spinel structure cathode and Li_2CoPO_4F as olivine structured cathode have been under consideration. These materials show as high as 4.5V as average voltage and that is approximately 1 V higher than normal cathode. So that these high voltage cathode are under intensive research in the world.

Recently, lithium rich cathode as layered rock salt structure type electrode such as $Li_2Mn_{1/2}Ti_{1/2}O_2F$ and $Li_{1.2}Ti_{0.4}Mn_{0.4}O_2$ have been focused as they exhibit higher capacity than cathode materials which is in the market already. Molar ratio of lithium compared to transition metal in the lithium rich cathode material, is lager than 1. Its theoretical capacity is 380 - 460mAh/g and even in practical battery,

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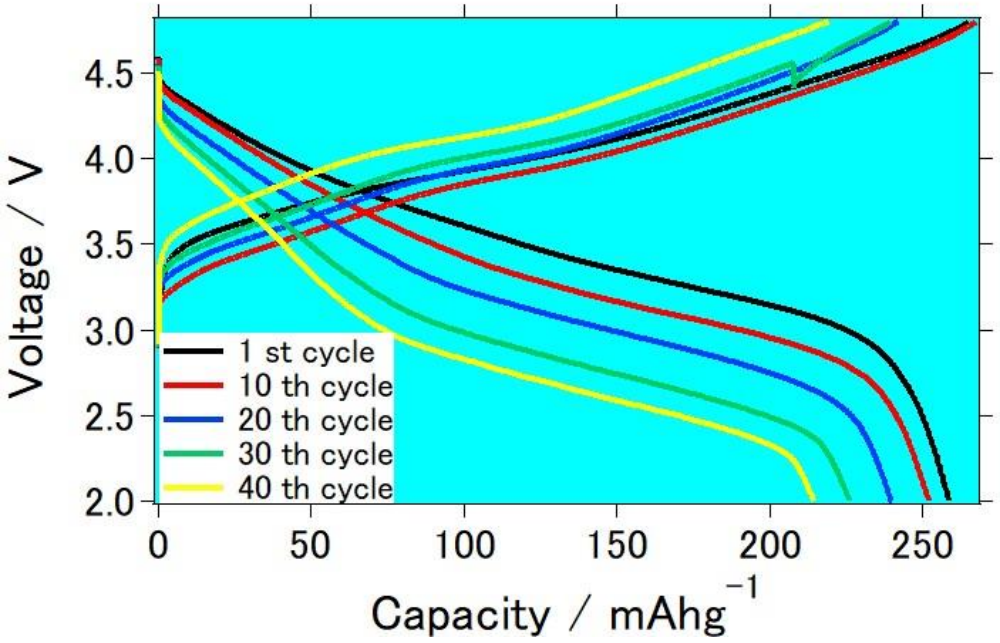
maximum of 320mAh/g of cell capacity can be obtained. Since they have about 100 mAh/g larger cell capacity than conventional cathode such as $LiCoO_2$, lithium rich cathode has been gathering much attention among researchers in the world.

This time, we have developed lithium rich cathode material with particular chemical composition. We had also prepared printable ink for aluminum electrical conductor with their lithium rich cathode. Testing battery was prepared with our lithium rich cathode, lithium metal as counter electrode, and general type carbonate-based electrolyte was used as an electrolyte. As a result, cell exhibited approximately 265 mAh/g as initial stage and became about 215 mAh/g after 50 charge-discharge cycles. This electrochemical measurement was performed with 0.1 C of charge discharge current at room temperature.

We will keep challenging to increase capacity and to obtain good charge discharge cycles, in order to create lithium rich cathode based lithium ion battery.



Electrolyte : 1M LiPF6 in EC / DEC (1/2) Potential window : 2.0 ~ 4.5 V

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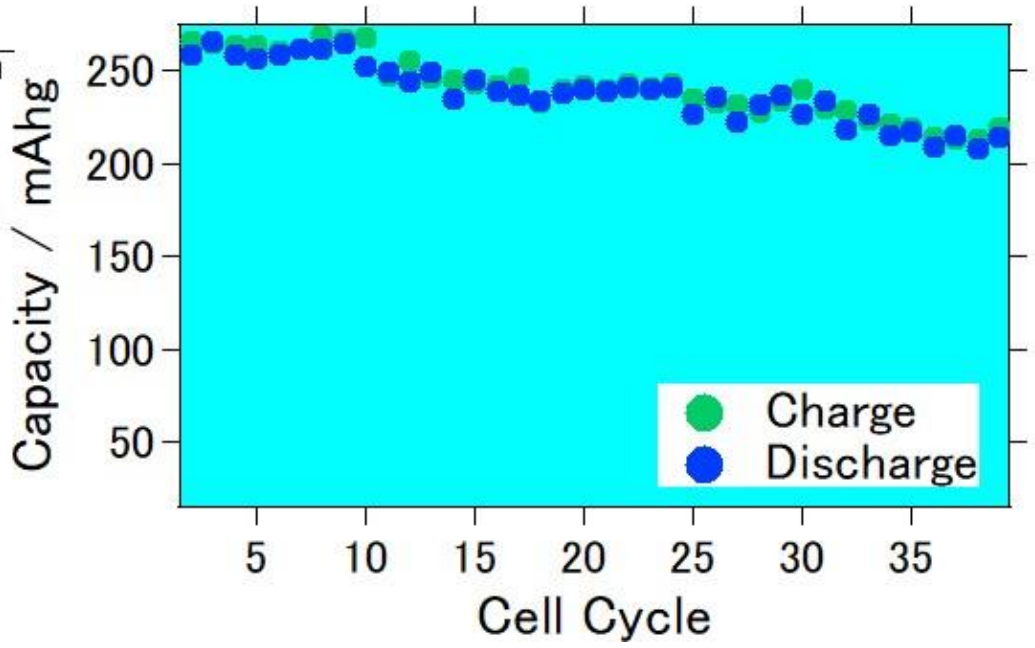

Please consult with us anytime including technical detail.

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