Metal Borate Synthesis Process

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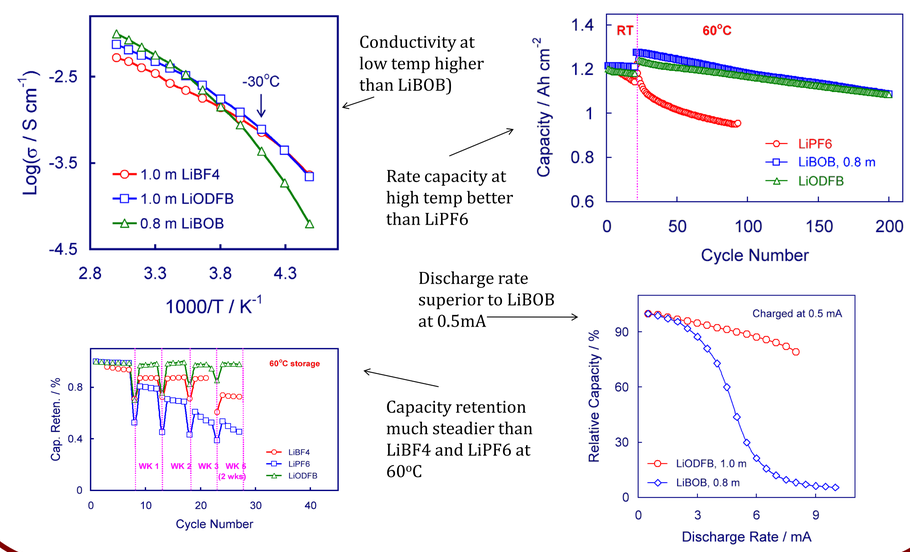
Technology Overview

This is a synthesis process for $LiBF_2C_2O_4$ (LiODFB,), a new salt alternative to $LiPF_6$, with better performance characteristics in cold and warm environments and higher safety margin against abusive operating conditions

- The method can be used to synthesize other ammonium borate salts for use in double layer ultracapacitors
- The method is simple to practice and adaptable for mass production

Outstanding Performance of LiODFB



Proof of Concept

- Demonstrated the synthesis of LiODFB in lab scale (10-100 g per lot)
- Tested LiODFB based electrolytes in coin cells
- Synthesis of LiODFB has been reduced to practice: BF_3 etherate is added to dried $Li_2C_2O_4$and milled in solid state, followed by heating at 100°C to110°C to remove ether and complete the reaction. Recrystalization of the crude product using linear carbonate solvent yields high-purity LiODFB.
- Currently TRL-5 level - synthesis process used successfully to create functioning battery prototypes

Technology Advantages

Invention advantages:

- Lower cost and better thermal stability as compared with the current $LiPF_6$ standard salt
- Provide longer cycle life at high temperatures than the existing $LiPF_6$ salt
- Provide higher power capability at lower temperatures than LiBOB salt
- Use either as sole lithium salt or as a solid salt additive

LiODFB does not:

- Add cost while increasing cell overall performance
- Require additional steps for the production line of Li-ion batteries

Technology Differentiation

- Significantly extend operation temperature range (-30°C to 60°C) of Li-ion batteries compared to standard Li-ion cells (about -20°C to 40°C) without any adverse impacts
- Capacity retention nearly 50% better than LiPF6 at high temperatures (60°C) after nearly 30 cycles
- Increases power capability at low temperatures (-30°C) by minimizing loss in conductivity notably as compared to LiBOB
- Rate capacity at high temp (60°C) about 20% better than LiPF6 after 100 cycles

Technology Agreements

A collaboration between the inventor team and the commercialization partner can speed the development to the market, which is most readily be done through a PLA or a CRADA

Therefore, the inventors are seeking a Patent License Agreement and/or a Cooperative Research and Development Agreement

This technology is currently at TRL 5, and it has been issued a patent (US Patent 7,820,323)

Technology Applications

Commercial:

- Hybrid electric vehicles (HEV) and other high energy density applications
- Portable electronic devices , such as high power drills, laptop computers, GPS
- About $11 billion Li-ion market worldwide in 2010
- Ultracapacitors, about $275 million in international markets

Military:

- Soldier power for a longer life rechargeable Li-ion batteries, e.g., BA-2590
- Military hybrid electric vehicle applications to reduce fuel consumption and reduce the need for dangerous logistical refueling operations
- Military electronics

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