

# Electrolyte for Secondary Battery Technology and Market Forecast

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## Abstracts

Recently, the conferences have been mentioned as a major topic of Green Growth. While the dominated energies in 20 century such as oil, fossil fuel are fading, the new green renewable energy is expected to be introducing in 21st century. The earth and the plants on the earth would no longer exist because of global warming and destruction of environment caused from fossil fuels. The photovoltaic, wind power, hydro, nuclear plants and others are mentioned as the next renewable energies but there are difficulties in transportation and in constant energy productive capacity. To handle with these problems, 'The energy storage technology' is coming to the fore. Many mentioned the fossil cell and metallic alloy for hydrogen storage as the plan for energy storage technology, but considering of technical maturity and economics, the secondary battery is seen as the most practical alternative. Especially, among the commercialized secondary batteries, the lithium secondary battery would be visible outcome with the highest energy density per weight and volume. The secondary batteries is used for cell phone, laptop and small-size IT device so far, but it is expected to be promising alternative of green energies used as storage of renewable energy and main source of electric vehicle, EV,

Chemical cells, one of the secondary batteries, include lead cell, Ni-Cd, Ni-MH, lithium ion cell and super capacitor. Since the introduction of 'Li-ion cell' with organic electrolyte transition metal oxide in Anode, carbon in Cathode in 1991, it is used for laptop, cell phone and portable electronic instrument power supply because of high energy density. So, with the rapid spread of portable electronic instrument, the Li-ion cell market has been growing rapidly. Also, from the viewpoints of thin, large-sized, and safety improvement with market diversity, lithium ion cell using high molecule electrolyte has been practical. The electrolyte of secondary cell which takes currently highest market share for mobile IT is an medium making Li-ion move from positive to negative in case

of recharging and move from negative to positive in case of recharging (Li-ion moves the opposite way in case of recharging). In other words, this is system for conversion from chemical energy to electric energy by oxidation-reduction reaction. The material for cathode and anode, electrolyte and separator in secondary cell is important not only for cost but also for performance. The above picture is a diagram showing us the structure of cylindrical Lithium secondary cell and how to charge/recharge inside of cell.

The used organic electrolyte is in state of dissolving of constant concentration lithium salt in mixture of ethylene carbonate, propylene carbonate and dimethyl carbonate, ethylmethyl carbonate, diethyl carbonate.

As you can see in the next picture, an electrolyte exist positive and negative ions in solvent. These ions move from positive to negative pole with current, then the electric current flows and we can see the light bulb on. A non-electrolyte, in the second picture, cannot lead the electric current because there is no ion in solvent.

The ion conductance, in room temperature, of liquid electrolyte is maximum  $10^{-2}$  S/cm, the electrolyte, its self, has 0 ~ 5V(vs. Li/Li+) electrochemical protective film. Even though LiPF<sub>6</sub> (lithium hexafluorophosphate) in electrolyte is low stability for heat and easy to burn, it is still used for the most Li-ion cell. As the interest of the material, flame retardancy as the means to improve the safety of the battery, becomes increasing, we has been actively working on research and development to replace existed organic electrolyte. Required conditions of electrolyte used for lithium ion cell should be (1) high ion conductance, (2) chemical, electrochemical stability on electrode. (3) wide usable temperature range (4) stability for heat (5) low cost.

The electrolyte, as showed at the bottom picture, takes 15% of total material costs and the main businesses in domestic are Panaxetec and Techno semi-chem.

This report on electrolyte for lithium secondary cell is complied with recent researches and business trends. In particular, it is with the development trend of business working on the most issued flame retardant for future cell. Panaxetec and Techno semi-chem are actively manufacturing now but actually core materials of electrolyte are mostly imported. It contains market demand forecast until 2014.

## **Strong Points**

Worldwide electrolyte report for Li-ion secondary cell

Included the recent trend of flame retardant material which is one of the most issues for future cell.

Bible of electrolyte with all technique

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**\*\*This report contains 120 references, 86 diagrams and 19 tables.**

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