

BATTERY MATERIALS: INDUSTRIAL EVOLUTION FOR Li-ION AND POST Li-ION TECHNOLOGIES

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Our objective is to show the evolution of materials used in lithium-ion batteries in parallel with the development of new applications and market demands. From a unique initial system (graphitized carbon/LiCoO₂) introduced in 1991, more than ten are now available. They have been developed to fulfil the market requirements of portable applications exclusively in a first period and also for industrial applications from the 2000'.

Evolution is driven by demands of specific and volumetric energy increase (longer autonomy of portable devices or vehicles), safety, and cost decrease. Industrial applications have more stringent additional requirements: long or very long life cycling and/or calendar, high power, operation in extreme temperatures.

Manufacturers have a set of basic materials and play on blends, core/shell, surface layers, voltage range or additives to optimize for their application. Basic positive active materials are lithiated lamellar oxides, manganese spinel or olivine structures. The principal negative active material remains graphite but lithium titanate occupies a few niche markets.

Processing science is essential to draw the best of materials. A few examples will be shown concerning porosity of electrodes or surface treatment of separator or the need of large voltage stability windows electrolytes.

After many years of continuous improvements, the need of a breakthrough in specific energy leads researchers to investigate systems such as lithium-sulfur or lithium-air, promising for low power applications.

Reference:

[1] Ch. Pillot , Future trends in the rechargeable battery market, ICBR 2015, Montreux, 23-25 sept. 2015.