As the world moves increasingly toward electricity based fuel, one important aspect is storage of that energy. Solar cells can only generate power during daylight hours and electric cars need to bring the electricity with them. The need for high performance batteries is higher than ever.

Lithium ion batteries satisfy these needs and LTS supplies Lithium X-Y-Z Oxide cathode materials in coin cells as well as our typical targets, powders, and shapeless pieces.

When evaluating battery materials, the factors of importance are

Energy Density: the amount of energy stored per unit weight or sometimes per volume.

Specific Power: the speed you can deliver that energy.

Lifespan: how many charge-discharge cycles can the battery sustain before chemical changes render it too weak to function.

Cost: self explanatory. We should also consider

Safety since lithium has a tendency to cause fires without proper circuit controls,

Durability against high and low temperatures and idle time, and

Recharge Rate.

Established in 1989 and based in New York, LTS has been pushing boundaries in the development and implementation of high-purity optical coating materials since its inception.

LTS produces high purity and high performance materials for the optics and fiberoptics, electronics, automotive, aerospace, medical, defense, crystal growth, and fuel cell industries, and are constantly developing new products and applications for our clients. We pride ourselves on our superb materials quality: whether it's a standard formulation or researching and developing new chemicals and compounds, we work to provide you with products unparalleled in their respective industries.

Our research and development team comprises experts in chemistry, chemical engineering, mechanical engineering, materials science, vacuum engineering, and high-caliber machining. Our production process is vertically integrated from raw materials procurement to the final finishing process, giving us precise control in creating materials to exact specifications.

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Optical Coatings from Concept to Commercialization (OC^3)

Lithium-ion Battery Chemicals

LTS Research Laboratories, Inc.

Lithium-ion Battery Chemicals

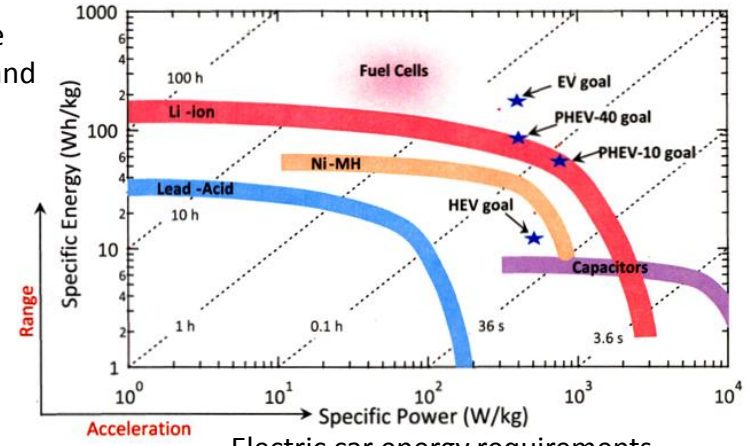
High-powered Energy Storage

Lithium complex oxide sputtering targets, evaporation pieces, and powder, produced by LTS Research Labs

Lithium Ion batteries are rechargeable, have high energy densities, low memory-effect, and low passive charge loss.

They are heavily utilized in
portable electronics such as flashlights, phones and laptops,
power tools,
electric vehicles including cars and aircraft and **backup power sources**.

The particular needs of the application will influence which material should be used. There are tradeoffs to be considered between Total Capacity, Power, and Longevity

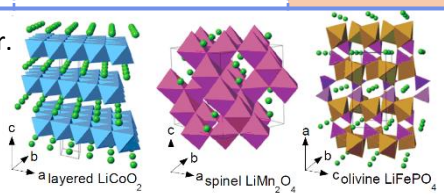


Electric car energy requirements

EV – Electric vehicles
HEV – Hybrids
PHEV – Plug-in Hybrids
(Combustion Engine ≈ 2500 Wh/kg)

	Structure	Potential [V] (versus Li/Li⁺)	Physical Density [g/cc]	Specific Capacity [Ah/kg] (theoretical/practical)	Specific Energy [Wh/kg]	Maximum Discharge Rate [C-rate]	Lifespan [cycles]	Cost	Safety & Durability
$LiNiO_2$	Layered	4.2	4.71	220/160	640	1	200	medium	medium
$LiCoO_2$	Layered	3.9	5.10	272/145	520	1	700	medium	medium
$LiMn_2O_4$	Spinel	4.1	4.31	148/105	410	1-10	500	medium	medium
$LiFePO_4$	Olivine	3.45	3.60	170/155	540	1-25	2000	medium	highest
$Li(Ni_{1/3}Mn_{1/3}Co_{1/3})O_2$	Layered	3.8	4.7	272/200	760	1-2	1000	medium	medium
$Li(Ni_{0.8}Co_{0.15}Al_{0.05})O_2$	Layered	3.8	4.7	300/200	680	1	700	low	medium
$Li_4Ti_5O_{12}$	Spinel	1.55	3.73	175/145	230	10	5000	low	highest

Notes: C-rate is the allowable fraction of capacity discharged per hour.
Carbon is the typical anode to the above cathode materials.
$Li_4Ti_5O_{12}$ may be used as an anode or cathode.



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