

Li-Ion LCO/NCA/NMC/LFP Pouch Cells Market 2022

September 2022

Shmuel De-Leon

Shmuel De-Leon Energy, Ltd.

www.sdle.co.il

shmuel@sdle.co.il

Li-Ion Cells Different Packaging But the Same Chemistry

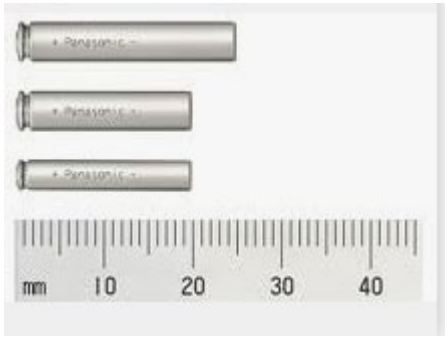
1. Hard Case Cylindrical
2. Hard Case Prismatic
3. Hard Case Button/Coin
4. Hard Case Pin
5. Soft Case prismatic
6. Soft Case Special Shape
7. Soft Case Cylindrical
8. Soft Case Button











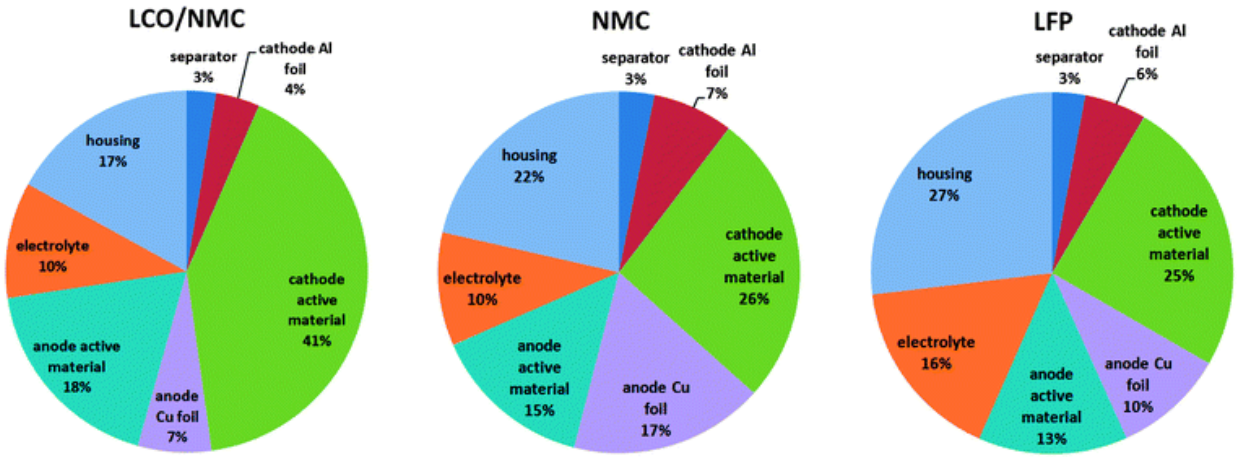






Li-Ion Rechargeable Systems

Technology	Anode	Cathode
Lithium Cobalt Oxide 3.6V	Graphite – Gr/Si	LCO
Lithium Manganese Oxide Spinel 3.8V	Graphite – Gr/Si	LMO
Lithium Nickel Manganese Cobalt 3.7-3.8V	Graphite – Gr/Si	NMC(111, 532, 622, 811)
Lithium Nickel Cobalt Aluminum 3.65V	Graphite – Gr/Si	NCA
Lithium Iron Phosphate 3.2V	Graphite	LFP
Lithium Titanite Oxide 2.3/2.4V	LTO	NMC, LMO, LFP



Pouch Cells Advantages

1. High volumetric energy density 750-800 Wh/l (LCO for consumer electronics).
2. Prismatic and Thin – Better utilize pack volume.
3. Easy to custom made any special size needed.
4. Wide operating voltage range 4.45 – 3.0/2.5/2V.
5. Wide power density range (High energy, Medium Power, High Power).
6. Good cycle life ~500-4000 Cycles.





Pouch Cells Advantages

7. Low self-discharge ~ 1% per month.
8. Quick charge is possible (<=3C).
9. Better thermal behavior – Easier to cool.
10. Large cells format automatic mass production lines ensure cost & quality.
11. Special cells possible: Curved, Ultra-Thin, High-Rate, High-Low Temp., High Voltage, Fast Charging.
12. Main packaging for Solid Electrolyte, High Silicon Anode, Lithium Metal Anode cells.





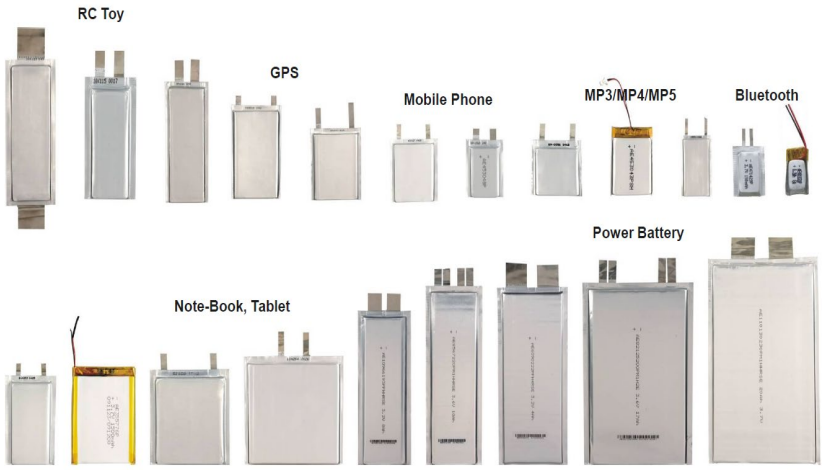




Pouch Cells Limitations

1. Expansion/Construction while charge and discharge.
2. Swelling/Gazing.
3. Required special order – Not off the shelf.
4. Few small format cells fully automatic production Line manufacturers (Low Quality, High Cost).
5. No include internal safety layers like Vent, CID, Fuse, PTC but can be protected alternatively with BMS.



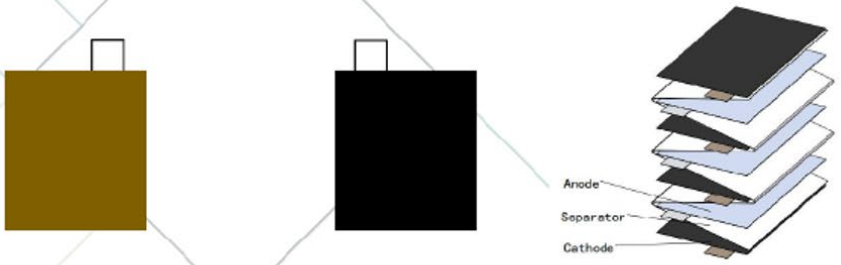


3 Cell Manufacturing Types

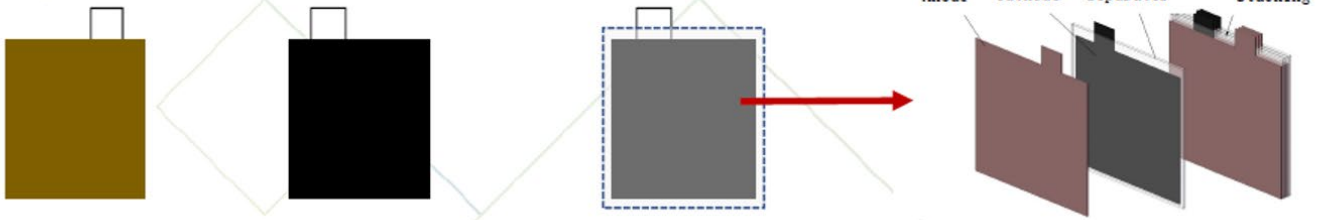
Type1 Winding



Type2 Z-Stacking



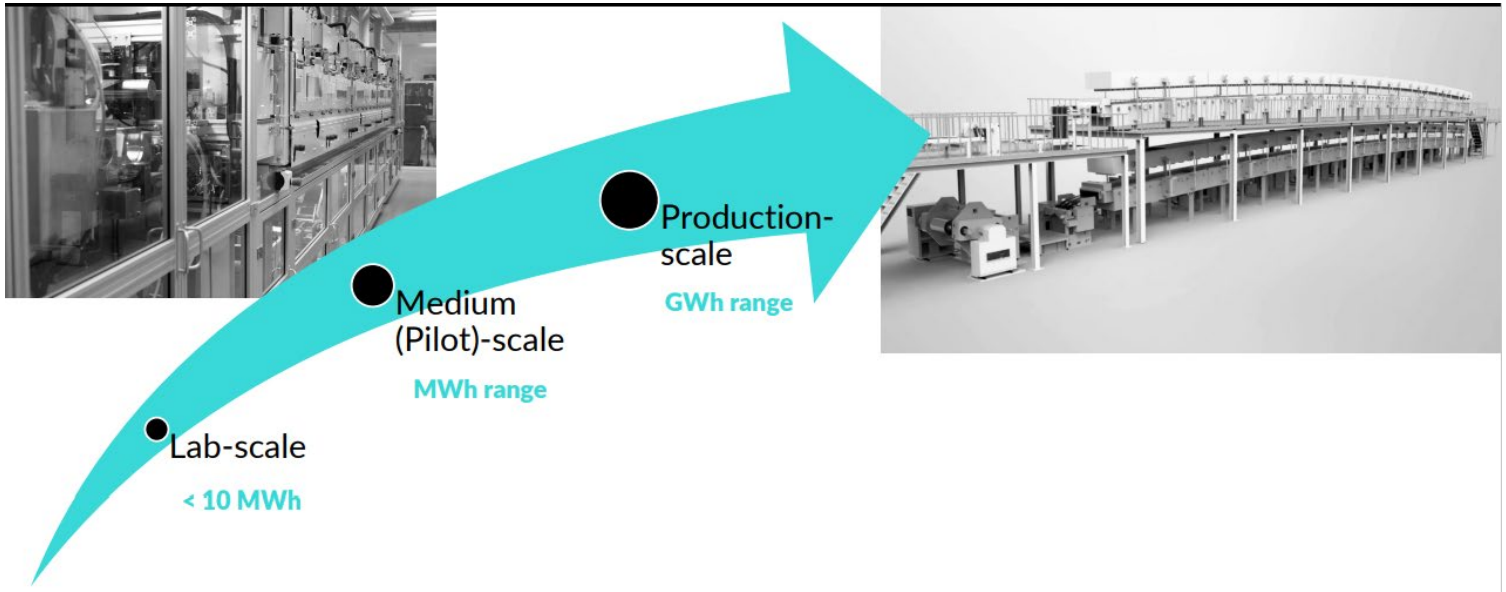
Type3 Enveloping



- 3 battery types are physically different but chemically and energy density are quite the same.
- Small format cells mainly done by winding.
- Large format cells done mainly on Z-Staking and enveloping.

Pouch Cells Production Lines

1. Pouch cells production lines (Lab, Prototype, Mass production) cost less then hard case lines.
2. Pouch cells production lines can support different cells size (Larger flexibility in size production).
3. Li-Ion cells developers typically select pouch cells production lines as the default cells form for lab scale development.



Consumer Electronic special Shaped Cells

1. **Flexibility - Cells can meet special sizing required by small applications.**





Li-Ion Liquid Electrolyte Pouch Cells

1. Early days pouch cells use gel polymer electrolyte.
2. Now majority of the cells made use liquid electrolyte as part of efforts to increase energy density, power and reduce cost.
3. These cells face higher swelling concern and more fire risk since electrolyte is flammable.
4. Electrolyte connectivity is higher in compared to the gel version allows better charge discharge power.





Ballooned Li-Ion Pouch Cells (Swelling - Gassing)

1. High temperature operation or storage (> 60°C).
2. Low state of voltage during discharge (< 3v).
3. High state of voltage during charge (>4.25 v).
4. Much more severe when cell makers are not keeping strictly dry air condition along production line or not vacuuming properly the cell hydrogen generated after the first charge.

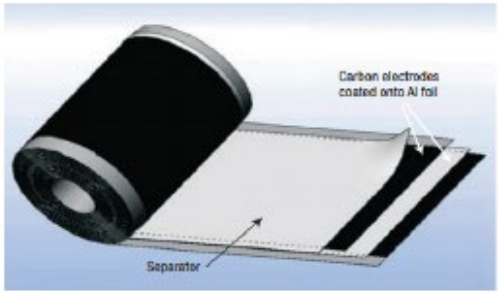


Form a hydrogen gas release inside the cell !!!



Li-Ion Cylindrical Pouch cells

Comparing the battery with different pack way.





Soft package





Customized design

Hard package





Standard design

ENERGY VERY ENDURE

Li-Ion Button Pouch cells

Rechargeable Button-Cell Battery

Grepow has been researching, developing and manufacturing batteries for more than 20 years. We have provided energy solutions for large OEMs, high-tech applications, including Bluetooth headsets for smartphones, earbuds, watch, thermometer, healthcare devices, wireless sensors, salter scales, flashlight, and network infracture.



- Ordinary standard type: -20 ℃ to 60 ℃
- High temperature type: -20 ℃ to 80 ℃
- Standard and customized solutions
- Low temperature type: -50 ℃ to 50 ℃
- From prototype to serial production
- Certified





GREPOW
RECHARGEABLE BATTERY

Li-Ion Pouch Cells Manufacturers Leaders in China (LCO, NMC, NCA)

Companies	Prismatic	Cylindrical	Button	Web Site	Curved	High rate	High Temp.	Low Temp.	High Voltage	Fast Charging	UL Certification File
A123 Systeme (Waxiang) - (China, USA)	V			http://www.a123systems.com/		V					
Amperx Technology (ATL) - (China)	V			https://www.atlbattery.com/		V			V	V	MH27725
Dongguan Perfect Amperex Technology - (China)	V	V	V	http://www.patlcell.com/en/		V	V				MH62489
Ganzhou Farasis Energy - (China)	V			https://www.farasis.com/							
Guangzhou Great Power Energy & Technology - (China)	V			http://www.greatpower.net/							MH27311
Hangzhou Future Power Technology - (China)	V			http://www.ftbattery.com/							MH30047
Harbin Coslight Power - (China)	V			http://www.coslight.cn/							MH28264
Huizhou Everpower Technology - (China)	V	V		http://www.htkjbattery.com/	V				V		MH47773
Jiangsu Cel Battery - (China)	V	V		http://www.celbattery.com/							MH48615
Shenzhen EPT Battery - (China)	V			http://www.ept-battery.com/		V	V	V	V		MH49349
Shenzhen Grepow Battery - (China)	V		V	https://www.grepow.com/	V	V	V	V	V	V	MH48772
Shenzhen HighPower technology - (China)	V			https://www.highpowertech.com/		V	V	V	V	V	MH46844
SVOLT Energy - (China, Germany, USA, Koea, Japan, India)	V			https://www.svolt.cn/		V					
Tianjin Lishen Battery Joint Stock - (China)	V			http://en.lishen.com.cn/		V			V		MH27663
Zhangzhou Yoku Energy Technology - (China)	V			http://www.yokuenergy.com/	V	V			V	V	MH29381
Zhuhai CosMX Battery - (China)	V			http://www.cosmx.com/		V			V		MH49033

92 Li-Ion Pouch Cells Manufacturers covered in our battery market report, Li-Ion Pouch Cells Market Review 2022, https://www.sdle.co.il/products/market-research-reports/

Leading Li-Ion Pouch Cells Manufacturers out of China (LCO, NMC, NCA)

Companies	Web Site	UL Certification File
Electrovaya - (Canada)	https://electrovaya.com/	MH26505
Enerdel - EnPower - (USA)	https://enerdel.com/	
Enertech International - (Korea)	http://www.enertechint.com/	MH1214
Envision AESC - (USA, UK, Japan, China)	https://www.envision-aesc.com/en/	
Kokam - (Korea)	https://kokam.com/	MH27732
Leclanche - (Germany)	https://www.leclanche.com/	
LG Energy Solutions - (Korea)	https://www.lgensol.com/	MH19896
Prime Batteries - (Romenia)	https://primebattery.eu/	
SK Innovation - (Korea)	http://eng.skinnovation.com/	MH49525
Tohoku Murata Manufacturing - (Japan)	https://corporate.murata.com/	MH12566
XALT Energy - (USA)	https://www.xaltenergy.com/	

92 Li-Ion Pouch Cells Manufacturers covered by our battery market report, Li-Ion Pouch Cells Market Review 2022, https://www.sdle.co.il/products/market-research-reports/

Leading Li-Ion LFP Pouch Cells Manufacturers

Manufacturers/Developers	Web Site
A123 - (China)	http://www.a123systems.com
Amita Technologies - (Taiwan)	http://amitatech.com
Auto Energy Technology - (China)	http://www.auto-energy.cn/
CM Partner - (Korea)	http://cmpartner.com
Cosmx - (China)	http://www.cosmx.com
FAAM - (Italy)	http://faam.com/
Hefei Guoxuan High-Tech Power Energy - Gotion - (China)	https://www.gotion.com.cn/
Heter Electronic Group - (China)	http://www.hetercell.com
Liacon - (Germany)	https://liacon.com/
Microvast - (China)	http://www.microvast.com
Yuntong Power - (China)	http://www.yuntong-batt.com

25 LFP Pouch Cells Manufacturers covered by our battery market report, Lithium Iron Phosphate Rechargeable Battery Market Review 2022,
https://www.sdle.co.il/products/market-research-reports/

Pouch Cells Production Capacity Forecast

1. Consumption of Li-Ion pouch batteries, especially in Asia Pacific countries such as China, India, and South Korea, among others, is expected to grow at an above-average rate of 10% CAGR during the 2022-2030.
2. We see Demand growth for pouch LI-Ion cells in the automotive industry.
3. Li-Ion Pouch cells market is facing shortage due to materials supply chain problem.
4. Pouch cells market is dominant by Korean - Chinese cell makers LG Energy, SK Innovation, ATL, CATL, SVolt.
5. Pouch cells segment include ~92 cell makers (Hard case cylindrical~65, Hard case prismatic~25).
6. Technology R&D progress: More silicon at the anode, High voltage of 4.5V, Solid state solutions.

2022 Pouch Cells Market Shortage Root Causes

1. Increase in use of pouch cells in automotive and ESS industries.
2. Covid effect – Periodically Production capacity reduction during 2020-2022.
3. Long time for production capacity expansion – 2-3 years for existing cell makers, 3-4 years for newcomers.
4. Shortage on battery raw materials - All li-ion cells production capacity expansion use the same materials.





What to Expect?

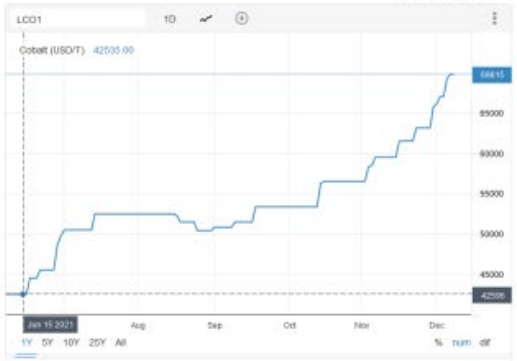
1. **Severe shortage in pouch cells with cell pricing increase for at least for 2-3 years until new production capacity will be release.**
2. **Production expansion mainly lead by LG Energy & Chinese manufacturers that can fast increasing production capacity (Strength market position of Chinese manufacturers).**



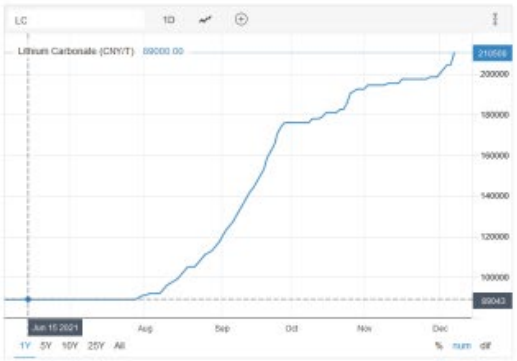
Cell Cost

1. **Majority of companies increase cells cost by 25-40% from 1/1/2022 due to material cost increase.**

Cobalt

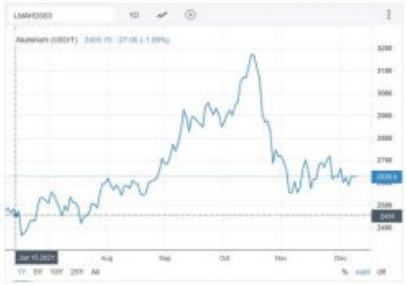


Lithium

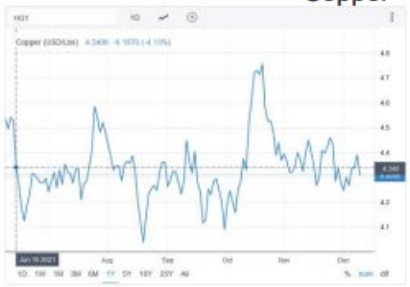


	Jun-15-2021	Dec-09-2021	Change
Cobalt (USD/T)	**$42,596**	**$69,815**	**64%**
Lithium (CNY/T)	**$89,043**	**$210,500**	**136%**
Aluminum (USD/T)	$2,456	$2,628	7%
Copper (USD/kLbs)	$4,340	$4,322	0%
Nickel (USD/T)	$17,770	$19,962	12%

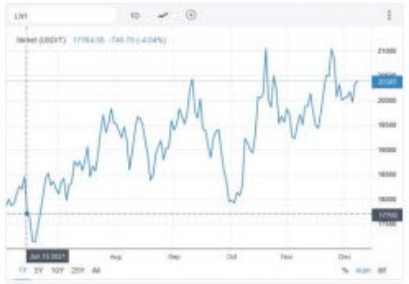
Aluminum



Copper



Nickel







Shmuel De-Leon Energy, Ltd.
Mazal Arie 10, Hod-Hasharon, Israel 45309
Tel/Fax: 972-77-5010792, Mobile: 972-52-8601517
www.sdle.co.il, www.batteriesdatabase.com
shmuel@sdle.co.il

Information in this report was obtained by:

1. **Public web sources.**
2. **Shmuel De-Leon Battery/Energy Sources DataBase ® (Includes 15,000 cell PDF data sheets).**