Valence® Technology, Inc.

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Saphion® "Safety – Built In"

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EMEA Sales Director

Version: 15th November 2005

Corporate Overview

1989: Founded as a R&D company focused on Lithium-ion polymer technology
>600 issued and pending patents worldwide

2002: New management team from Dell, emphasis on Sales and Marketing

2003: Launched Saphion® Lithium-ion technology: First phosphate based battery chemistry on the market

2003: Launched first N-Charge™ Power System: Consumer product showcasing Saphion technology

2004: Launching K-Charge™ & U-Charge™ Power System: Large format energy storage system.

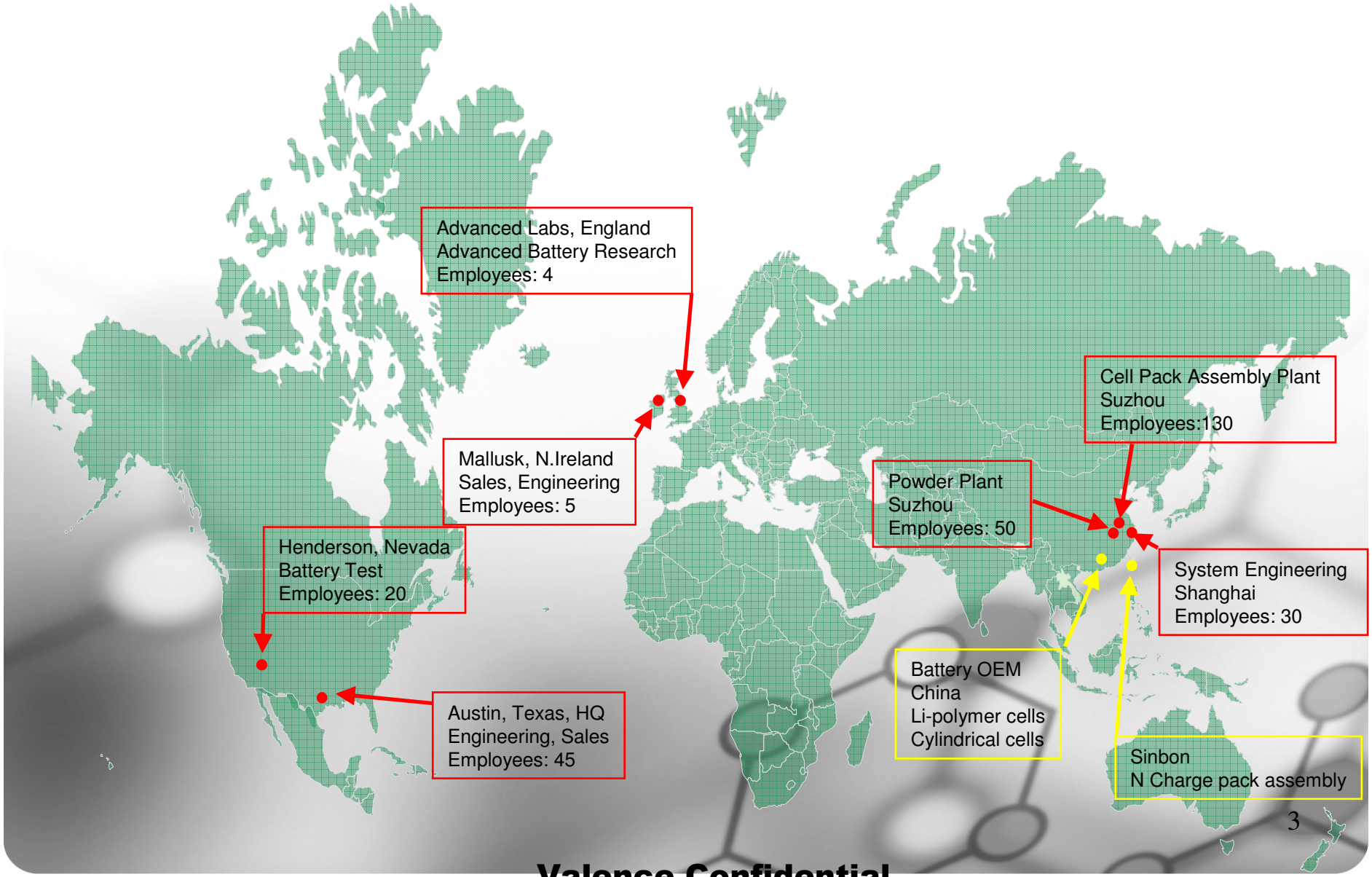
2004: Move into the cell pack markets with the IFR 18650 and P545 cells.

2004: Set up Valence owned powder plant and pack assembly factory in China

2004: Set up EMEA Sales Office, in Mallusk, N.Ireland

2006: Q1 Launch of U Charge high volume production

Valence Locations & Partners



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Saphion Technology & Safety

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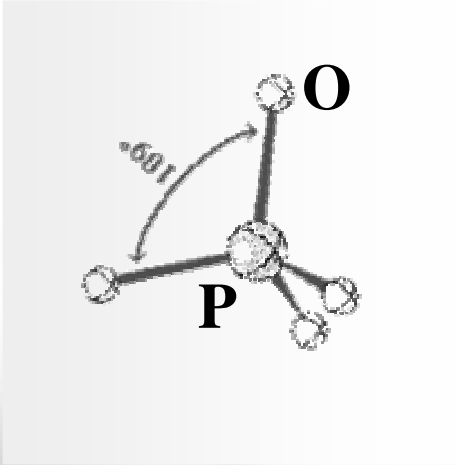
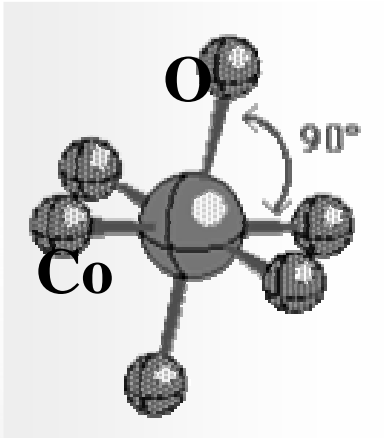
The PO_4 advantage

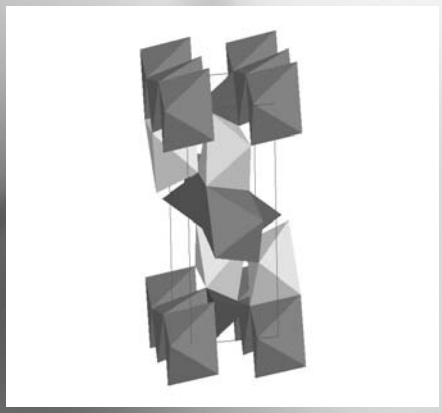


In $LiCoO_2$: Co-O : 1.91A

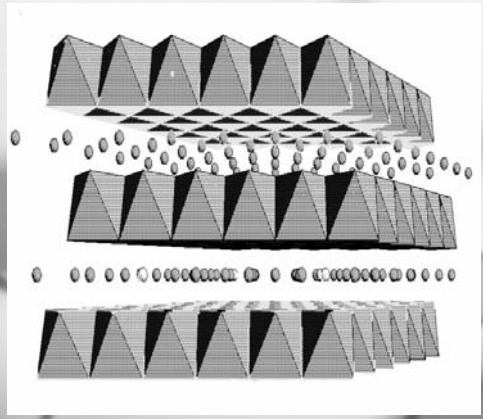
In Saphion P-O : 1.63 A



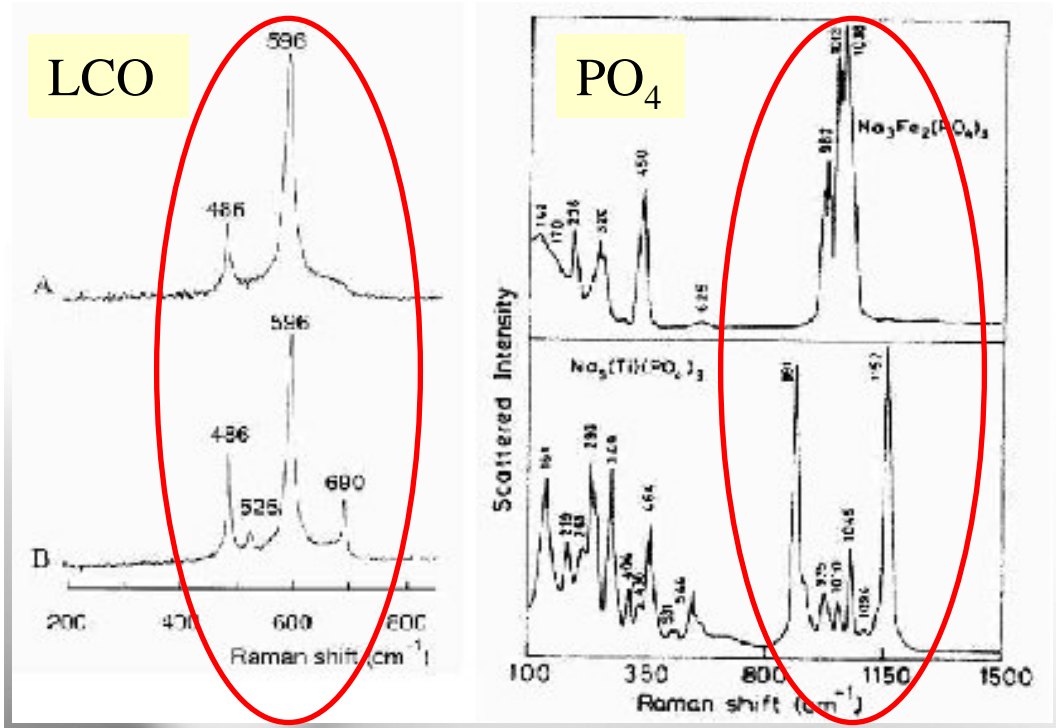
Coordination and location determine bond distance and strength



Tightly bound Oxygen = safety



Relative bond energies



Raman Spectroscopy stretching bands:

P-O : 1100 cm^{-1}

Co-O (LCO): 540 cm^{-1}

The P-O bond is stronger than the Co-O bond.

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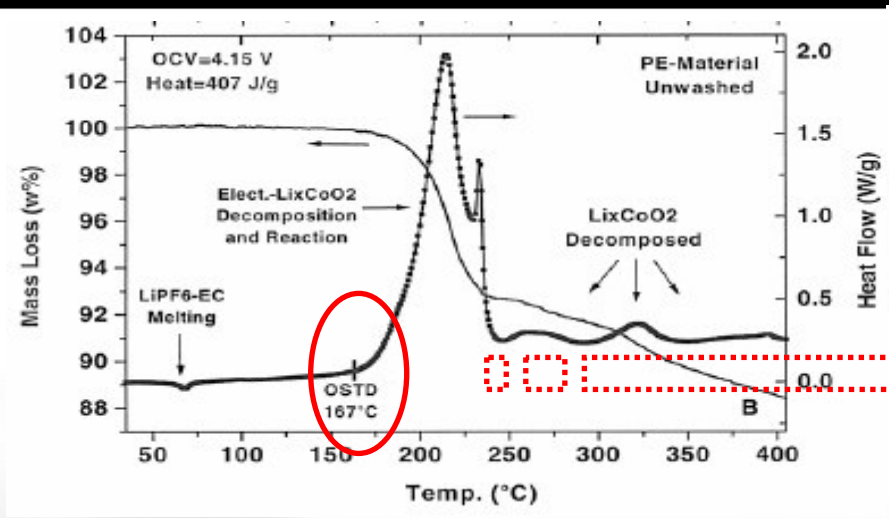
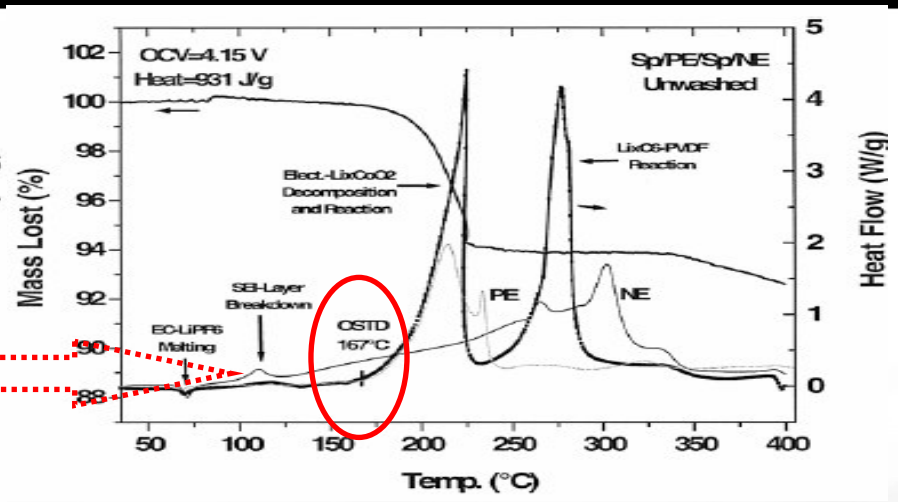
$LiFePO_4$ vs. $LiCoO_2$: DSC





$LiCoO_2$ only **Whole cell**

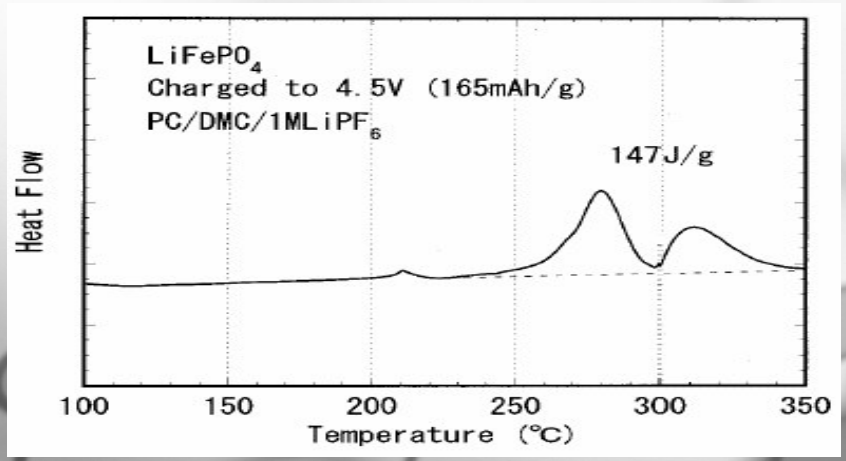
JES 146(9) Maleki et al. (Motorola): commercial $LiCoO_2$/graphite cell charged to 4.2V

$Li_{0.5}CoO_2 \longrightarrow 0.5LiCoO_2 + 1/6Co_3O_4 + 1/6O_2$

$Co_3O_4 \longrightarrow 3CoO + ½\ O_2$

$LiCoO_2$: large exotherm onset at 147°C results in cell safety problem

$LiFePO_4$ exotherm smaller and onset at much higher temperature



JES 148(3) Yamada et al.

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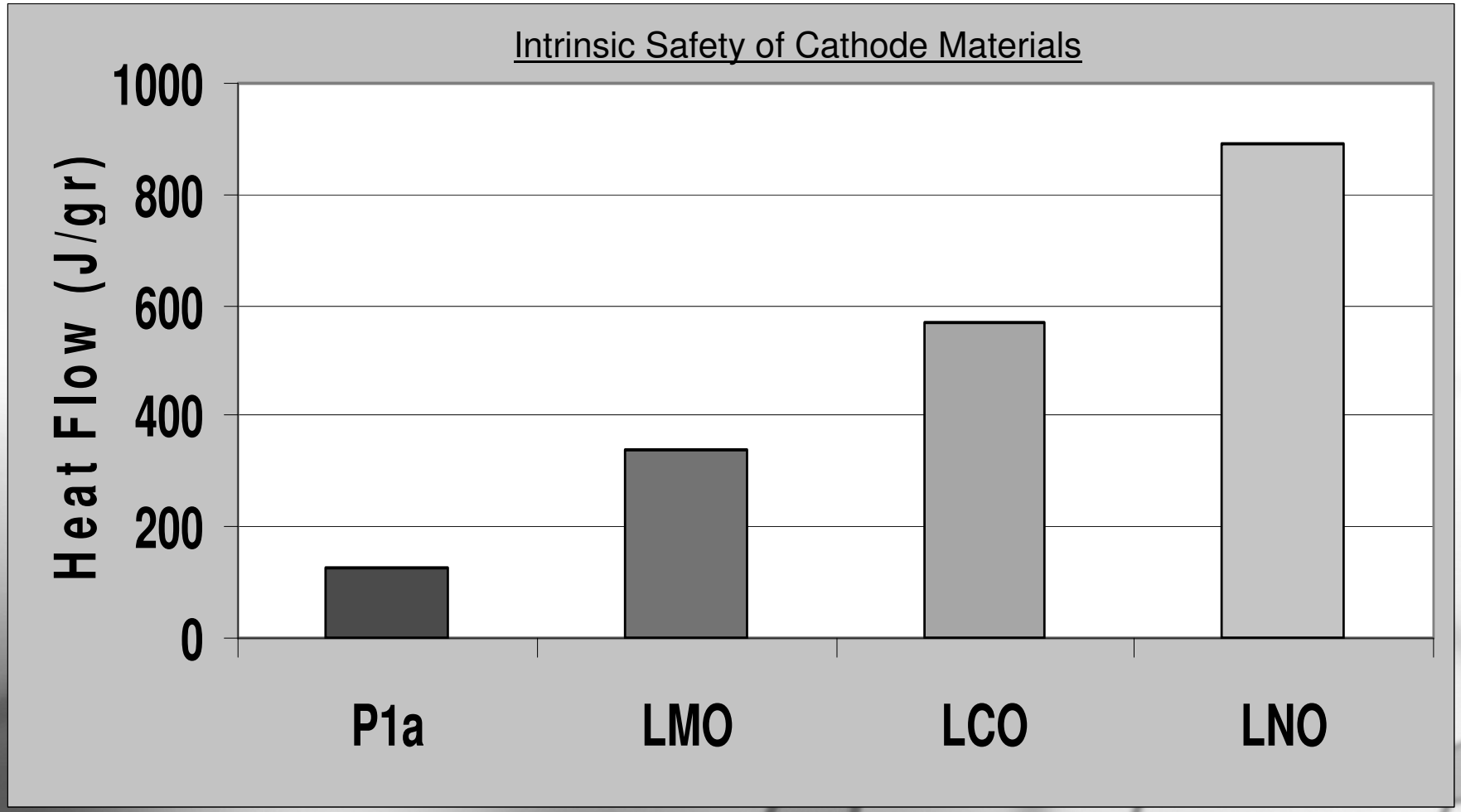
Various Chemistries Reactivity



Theoretical basis for safety advantages of phosphates

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Phosphate Safety Comparison Video

http://www.valence.com/SafetyVideo.asp

Phosphate remains thermally stable under extreme abuse

Abuse Characterization Summary

Abuse Test

Abuse Requirements

UL1642 Third Edition (april 26, 1995), latest ammendment Jun 24, 1999

Test		Description	Saphion	LCO
Electrical Tests				
section 10	short curcuit test			
	at room temp	connect terminals with wire <0.1mOhm	Pass	Pass
	at 60C	connect terminals with wire <0.1mOhm	Pass	Pass
section 11a	Abnormal Charge [a]	3 times recommended charge rate for 48hr minimum	Pass	Pass
Mechanical Tests				
section 12	crush	applied load of 13kN between flat plates	Pass	Pass
section 13	impact	drop 20lbs from 2 ft onto 5/8in diameter bar	Pass	Pass
section 14	shock	75G initial, 125-175G peak	Pass	Pass
section 15	vibration	ramp 10-55-10Hz in 90 minutes, 1.6mm excursion	Pass	Pass
Environmental Tests				
section 18a	heating (hot box)	ramp to 150C, hold for 10 minutes	Pass	Pass
section 18b	temperature cycling	ramp temp between -40 and 70C, 10X	Pass	Pass
section 18c	altitude simulation	6hrs at 11.6kPa	Pass	Pass

Abuse Characterization

Test	Description	Saphion	LCO
Nail Penetration	JSBA standard	Pass	Fail
Round Bar Crush	slow crush to deform cell to induce short	Pass	Fail
Series/Parallel testing	simulate proposed battery design		
3 parallel Nail penetration	do safety devices in cell stop propagation	Pass	Fail
4 series NP on during charge	do safety devices in cell stop propagation	Pass	Fail
Hot Box (extended)	UL hot box with 150C hold	Pass	Fail
additional failsafe testing	application test to fail		

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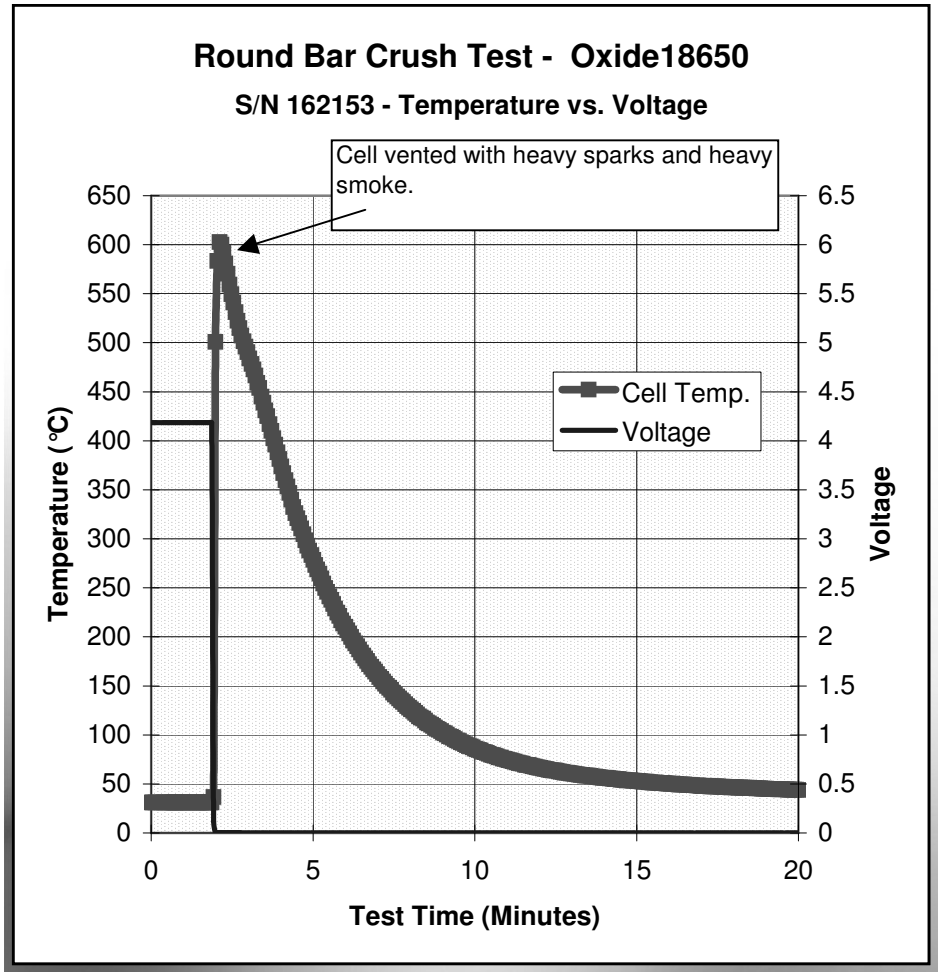
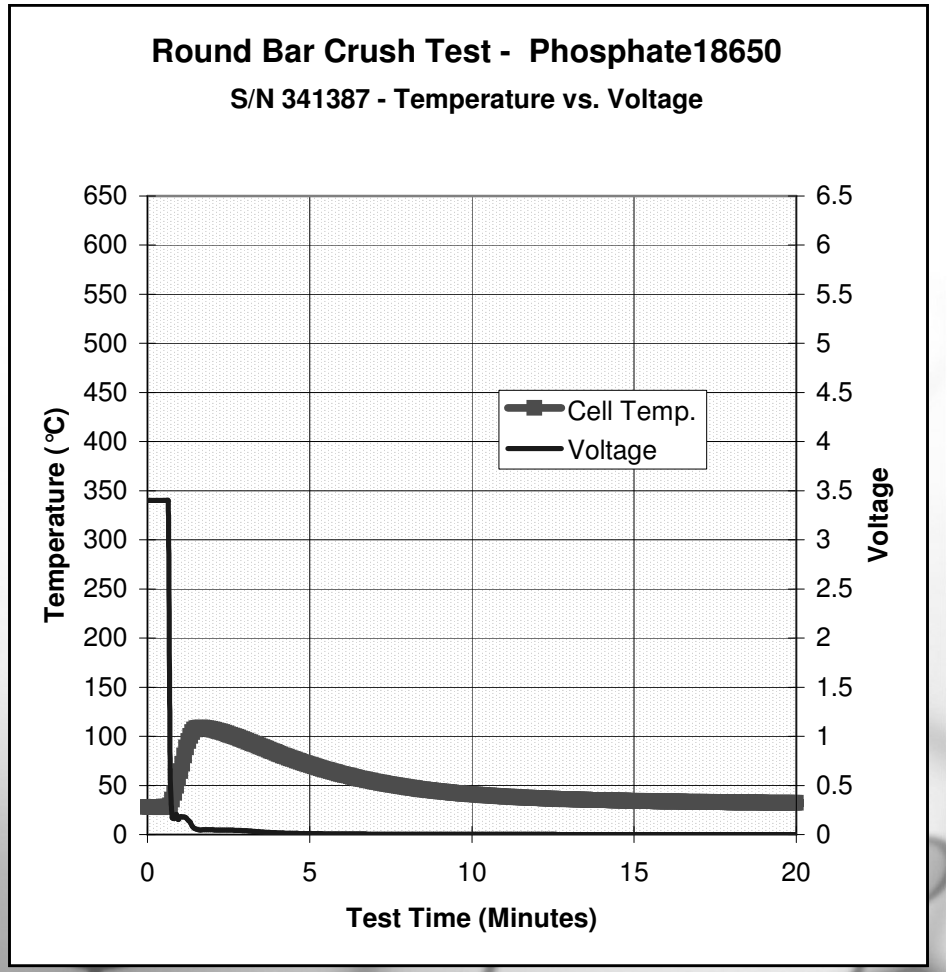
Round Bar Crush Test





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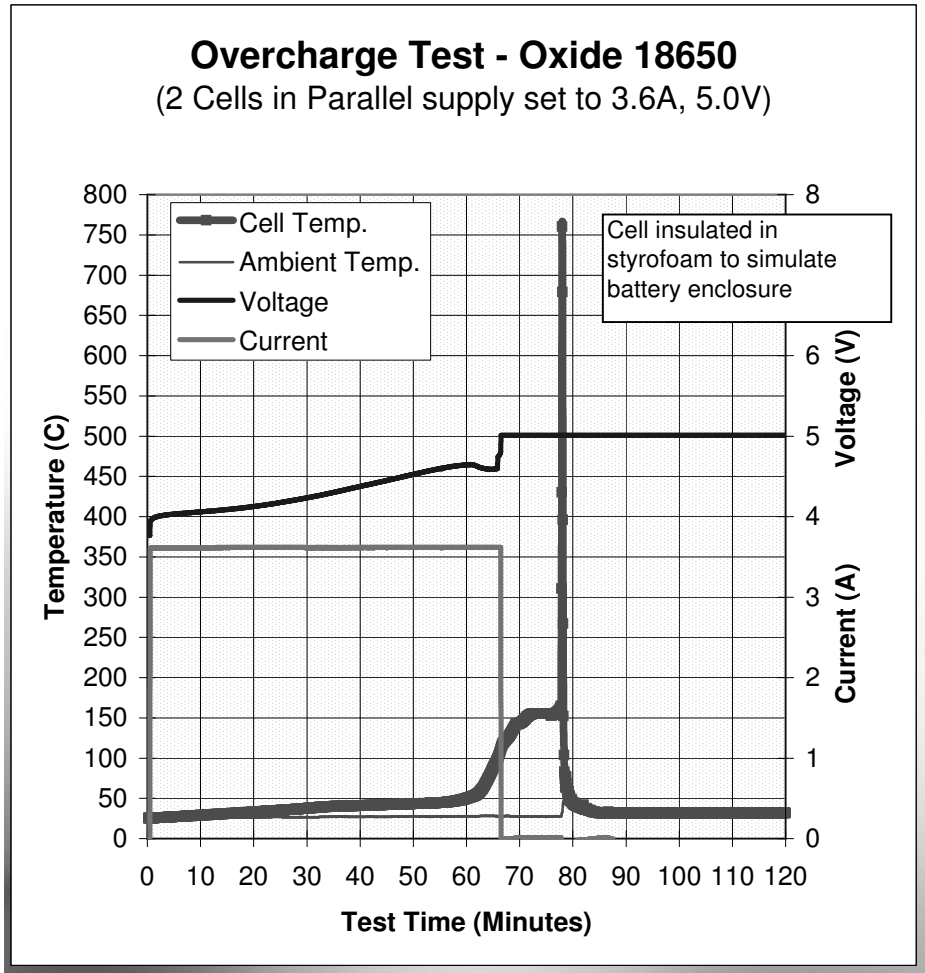
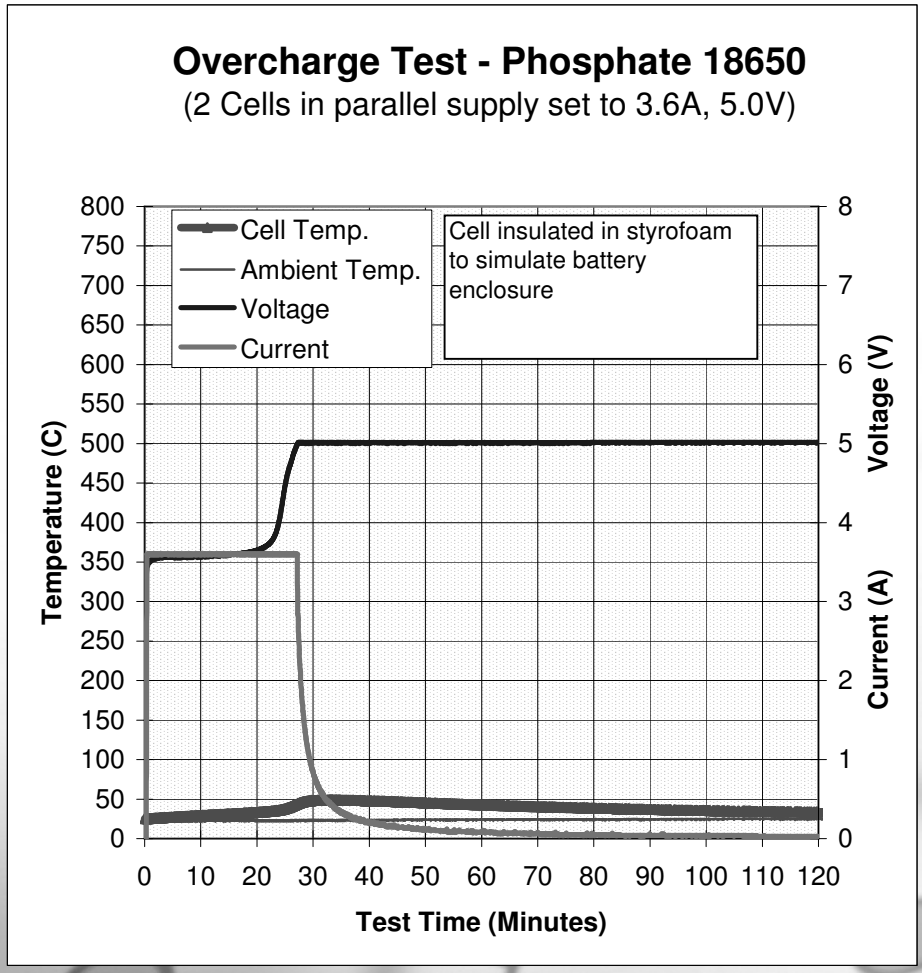
Overcharge Test





Excess Lithium in cobalt cells causes cell to continue to charge until "safety" device is activated. Despite this activation, the cell goes into thermal runaway 15 minutes later, reaching 760C.

Saphion® cells have NO excess lithium. After fully charging, the cell quickly reaches the 5V setpoint and the current tapers. The temperature reaches only 50C.

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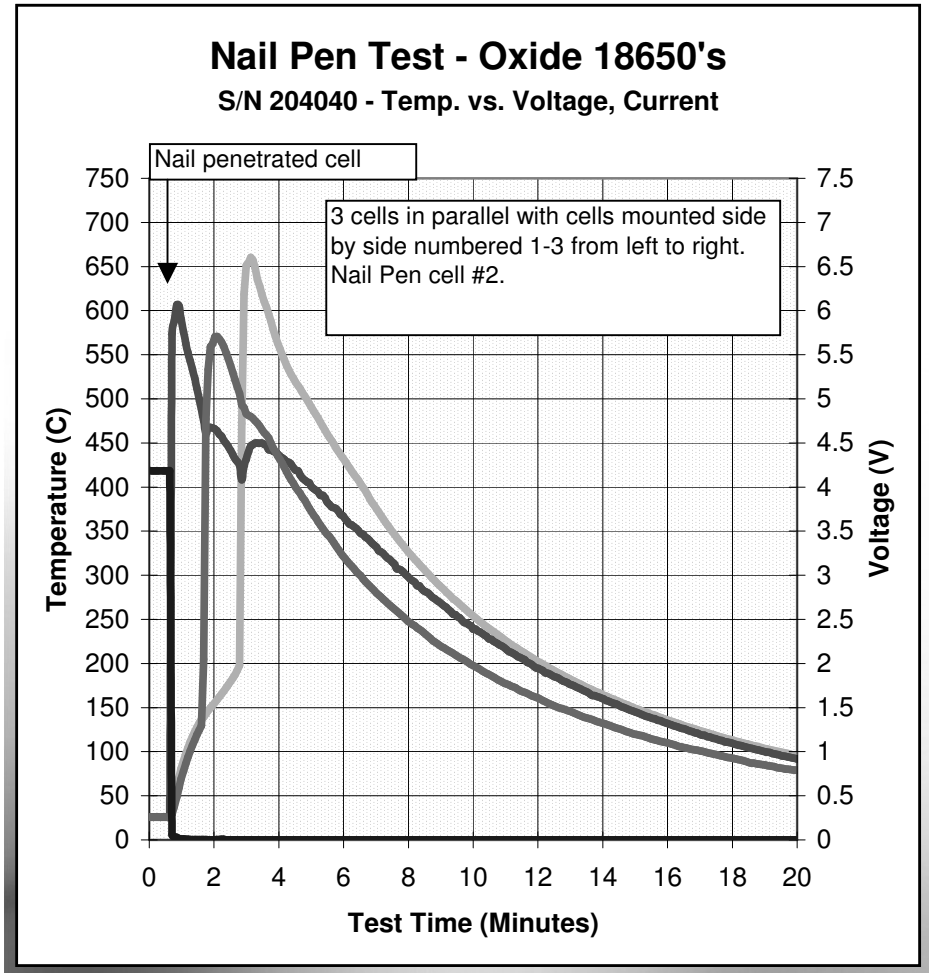
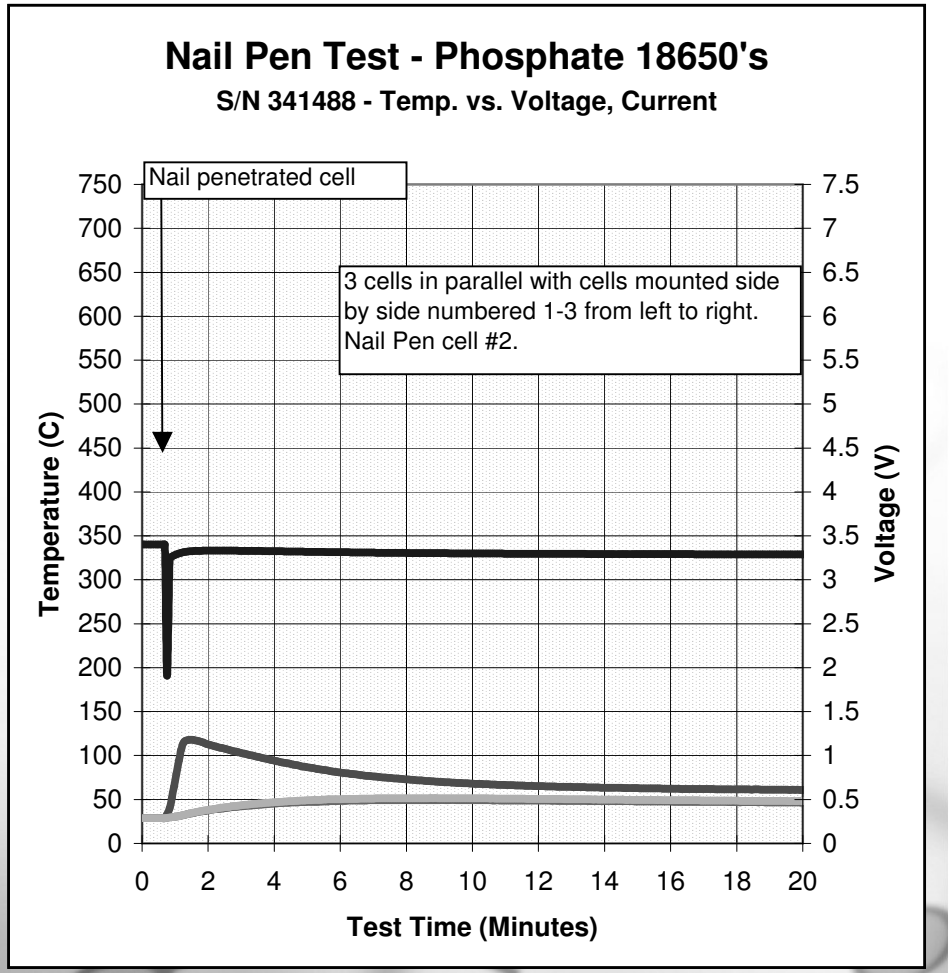
Nail Penetration Test





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Valence Products

Products and Segments

Backup Power
KWh - MWh

Portable Power
50 – 300 Wh

Motive Power
500 – 85000 Wh

U-Charge

OEMs and Pack Builders

Cells

N-Charge

K-Charge

Watt Hours

N-Charge™ Power System Family

A family of power sources to facilitate complete mobility

Sleek polymer models for thin and light notebooks

Modular and scaleable models for DTR and mainstream notebooks

Lightweight and compact for ultimate portability

Uses notebook PC adapter for recharging

Provides fast recharge and long cycle life

U-Charge™ Power System

A lightweight, high-energy alternative to conventional lead acid batteries designed for wheelchairs, scooters, ebikes and more…

High performance, intelligent, reliable batteries

Safe, environmentally friendly, Saphion® Lithium-ion technology

Low maintenance, long cycle life = Lower lifetime costs!

Twice the runtime and 1/3 less weight compared to Lead Acid

Fits easily into established 12V and 24V platforms

K-Charge™ Power System

Kilowatt to megawatts of energy storage for the utility, network and vehicular markets

High performance, intelligent, reliable batteries

The safest Lithium-ion technology available

Flexible form factor

Less volume and lower weight

Fast recharge time, excellent cycle life

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Valence Technology & Segway

Segway Pack Technical Data

Max Dimensions (l x w x h) mm	360 x 150 x 82
Weight	5.5 kgs
Cell Used	Valence Saphion IFR 18650e
Number of cells per pack	92
Pack Capacity	400 Wh
Continuous Current	16 Amps *
Peak Current	30 amps

* Rated value, however 30A continuous has been tested with no ill effects.