

Cell Reports Physical Science, Volume 7

Supplemental information

**Design and production trade-offs
in lithium-ion batteries from cell formats
to electric vehicles**

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SUPPLEMENTAL INFORMATION

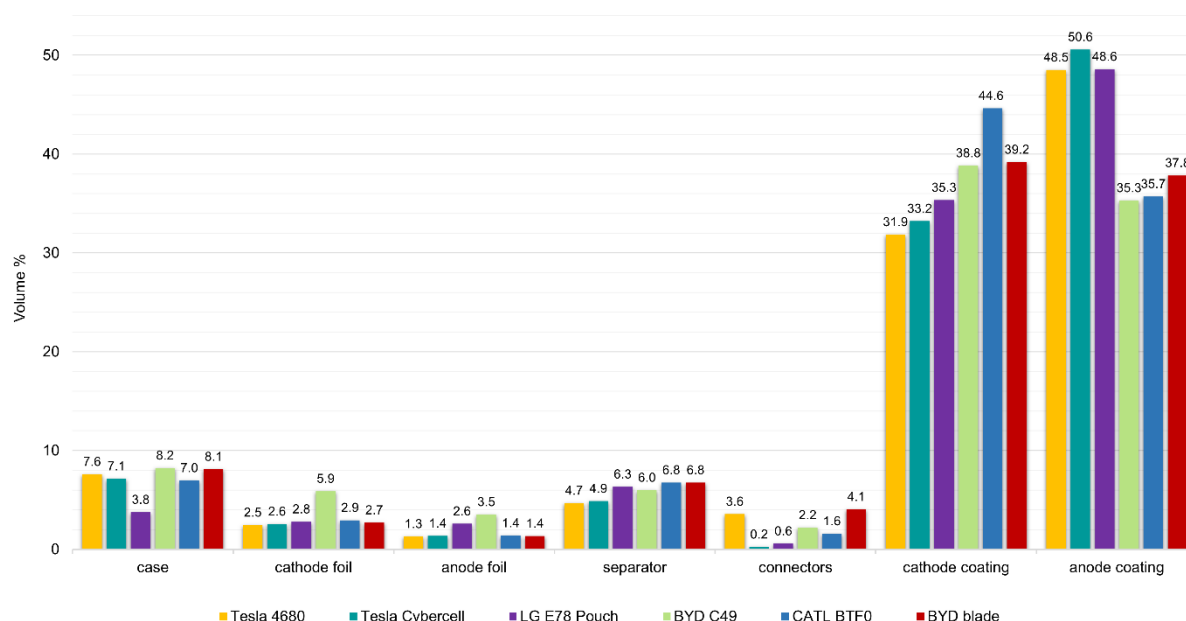


Figure S1. Volumetric distribution of cell components, showing the contribution of active and inactive materials to overall available internal volume. Values are calculated from teardown-based CAD models of each battery cell.

Specifications	4680	Cybercell
Nominal Voltage (V)	3.7	3.7
Nominal Capacity (Ah)	23.35	26
Nominal Energy (Wh)	86.5	95.2
Gravimetric Energy Density (Wh/kg)	244	272
Volumetric Energy Density (Wh/L)	643.3	716
Cycle Life	2000	2000
Cathode Chemistry	NMC811	NMC955

All data are taken from manufacturer data and literature sources ^{31,77}.

Table S1. Cylindrical cells metrics and specifications.

Metrics	4680	Cybercell
Diameter (mm)	46	46
Height (mm)	80	80
Can thickness (mm)	0.6	0.35
Cu tab disk thickness (mm)	0.2	-
Cu tab disk diameter (mm)	44	-
Al tab disk thickness (mm)	0.2	0.1
Al tab disk diameter (mm)	40	40
Plastic disk thickness (mm)	0.65	-
Volume (L)	0.133	0.133
Mass (kg)	0.355	0.35
Can shell weight (g)	70	49

All data are taken from public teardown and literature sources ^{14,23,29–32,77}.

Table S2. Differences in geometry, cell architecture and components of cylindrical cells.

Component	4680 Vol*	4680 Vol %	Cybercell Vol*	Cybercell Vol %	Delta V (%)
Case	8738	7.60	7881	7.15	-9.8
Cathode foil	2826	2.46	2826	2.56	0
Anode foil	1496	1.30	1496	1.36	0
Separator	5379	4.68	5379	4.88	0
Connectors	4100	3.57	300	0.27	-92.7
Cathode coating	36616	31.86	36616	33.21	0
Anode coating	55764	48.52	55764	50.57	0

*The volume is expressed in mm³.

The volume of each component is calculated by the authors from reconstructed CAD models.

Table S3. Volume distribution in cylindrical cells.

Specifications	BYD Blade	CATL BTF0	BYD C49
Nominal Voltage (V)	3.2	3.2	3.2
Nominal Capacity (Ah)	135	161	100
Nominal Energy (Wh)	432	515	320
Gravimetric Energy Density (Wh/kg)	160	166	163
Volumetric Energy Density (Wh/L)	424	356	331
Cycle Life	3000+	≥3500	≥6000
Cathode Chemistry	LFP	LFP	LFP

All data are taken from manufacturer data and literature sources ^{22–24,96,109}.

Table S4. Prismatic cells metrics and specifications.

Metrics	BYD Blade	CATL BTF0	BYD C49
Length (mm)	960	280	160
Height (mm)	90	82	121
Width (mm)	12	63	50
Case thickness (mm)	0.3	1	1.1
Electrode sheets/ windings	26 cathode, 27 anode	40 windings, 2 rolls	~ 130*
Volume (L)	1.04	1.4	0.97
Mass (kg)	2.63	3.1	1.96

*Calculated value from teardown-based CAD model reconstruction.

All data are taken from public teardown and literature sources ^{22–24,49,96,109}.

Table S5. Differences in geometry, cell architecture and components of prismatic cells.

Component	BYD Blade Vol*	BYD Blade Vol %	CATL BTF0 Vol*	CATL BTF0 Vol %	BYD C49 Vol*	BYD C49 Vol %
Case	60000	8.1	78060	6.97	70000	8.2
Cathode foil	24536	2.7	32978	2.94	50000	5.9
Anode foil	12740	1.4	15510	1.38	30000	3.5
Separator	50907	6.8	75675	6.76	90000	6.0
Connectors	30000	4.1	17800	1.59	18720	2.2
Cathode coating	290000	39.2	500000	44.64	300000	38.8
Anode coating	280000	37.8	400000	35.71	330000	35.3

*The volume is expressed in mm³.

The volume of each component is calculated by the authors from reconstructed CAD models.

Table S6. Volume distribution in prismatic cells.

Specifications	LG E78 Pouch
Nominal Voltage (V)	3.65
Nominal Capacity (Ah)	78
Nominal Energy (Wh)	289
Gravimetric Energy Density (Wh/kg)	265
Volumetric Energy Density (Wh/L)	609
Cycle Life	≥3000
Cathode Chemistry	NMC712

All data are taken from manufacturer data and literature sources ^{114,115}.

Table S7. LG Chem E78 Pouch cell metrics and specifications.

Metrics	LG Chem E78
Length (mm)	545 mm (535 mm without tabs)
Width (mm)	98 mm
Height (mm)	9.12 mm
Pouch bag thickness (μm)	144
Electrode sheets	18 cathode, 19 anode
Tab cross-section (mm ²)	22.5
Volume (L)	0.438
Mass (kg)	1.101

All data are taken from public teardown and literature sources ^{19,25,114}.

Table S8. Geometric parameters and dimensions of LG Chem E78 pouch cell.

Component	Volume*	Volume %
Case	17017	3.76
Cathode foil	12663	2.80
Anode foil	11734	2.59
Separator	28662	6.33
Connectors	2600	0.57
Cathode coating	160000	35.35
Anode coating	220000	48.60

*The volume is expressed in mm³

The volume of each component is calculated by the authors from reconstructed CAD models.

Table S9. Volume distribution in LG Chem E78 pouch cell.

Metrics	Model Y (4680)	Cybertruck (Cybercell)	Atto 3 (BYD blade)	Model 3 (BTF0)	CLA 200 (BYD C49)	ID 3 (LG E78)
N. Voltage (V)	340.4	710.4	384	339.2	614.4	394.2
N. Capacity (Ah)	210.2	182	135	163.3	100	156
Grav. energy density (Wh/kg)	161	171	145	126	120	162
Vol. energy density (Wh/L)*	150	175	190	127	125	165

*Volumetric Energy Density is calculated by the authors based on estimated battery pack volume. The data reported in table are from manufacturer data, teardown and literature sources ^{29,75–93}.

Table S10. Battery packs metrics.