

# 挤压试验 crush test

- 挤压试验理由 Foundations of crush test
- 一些试验验证 some test and analysis
- 试验规程 procedure of crush test

# 挤压试验 Crush test

## ★ 挤压试验的必要性：Necessity of crush test

1. 国际上现行的几个标准基本都有挤压的测试。

All of the current several standard in the world have the crush test.

★ 2. 实际案例显示，车辆发生碰撞时电池有挤压变形的可能，电池在不同的安装部位，承受的挤压力大小不同；电池在不同挤压形式下，承受的挤压力也不同

The battery may be crushed when car accident happens. The force of crush varies with the installation site and crush mode.

电池安装位置：所谓的安全区域，后备箱位置，前舱位置，商用车侧面行李箱位置等

Installation site: So-called safety area, trunk, front cabin, lateral trunk

在不同碰撞速度和不同碰撞形式下，不同安装位置的电池包以及电芯可能受到不同挤压力，产生不同变形量

The force of crush and deformation varies with the crush speed, crush mode and installation site.

# 挤压试验 Crush test

## 整车碰撞时电池的变形表现

Deformation performance of the battery in the vehicle impact

1、USNCAP\_63°、62km/h Mobile deformable barrier impact

Left side (impact side) install tray and edge of battery are undeformed; There is white traces of plastic extrusion on the sealing cover of Module 2#, but the overall is undamaged; The battery module, cables and connectors are undeformed and undamaged.

Left side (impact side) install tray of battery is undeformed, the maximum intrusion is about 56mm; The sealing cover is seriously damaged; The maximum intrusion of Module B1 is about 56mm, the intrusion is 4mm, 18mm, 40mm, 54mm from down to up, respectively.

**Cells of Module 2# and 5# is crushed**, shell welds of No.37 and 38 crack while the voltage are normal; The stents of emergency switch and cathode column crack.

# 挤压试验 Crush test

---

## 2.FMVSS 214/US NCAP\_75° 、 32km/h Pole side impact

Left side (impact side) install tray of battery is undeformed, the maximum intrusion is about 55mm; The sealing cover is seriously damaged; **Cells of Module 5# is crushed**, shell welds of No.37 and 38 crack while the voltage are normal; The sampling line of No.37 is broken; The rest of the connectors are undeformed and undamaged.

## 3. 32km/h 75-degree angled impact

After the impact, the left side of the tray has obvious concave; Two Module are damaged, involved in 6 cells; the relief valve of one cell is pushed out, and **some traces of electrolyte left**; Battery module fastening components are normal.

# 挤压试验 Crush test

## 数据收集和试验验证 Data collection and test

- 数据收集过程中，共收到16个企业的反馈，其中含有详细数据的为10个（磷酸铁锂4种，混合体系6种）；
- Received Feedback from 16 enterprises, containing 10 with detailed data(4 of LFP, 6 of mixed system);
- 另外选择国内外的10个产品进行了挤压试验，为三元材料或锰酸锂体系
- 10 products was chosen for crush test, NCM or LMO;
- 发生起火或爆炸的临界点挤压力范围在210-950kN之间；挤压变形量范围在10%-40%之间。
- The crush pressure range is between 210-950 kN at the critical point of fire or explosion, and the deformation range from 10% to 40%.

# 挤压试验 Crush test

## 数据收集和试验验证 Data collection and test

厂家反馈数据 data from enterprises

秘书处验证数据 data tested by secretariat

电池 battery	变形量 deformation	挤压力/kN force	电池 battery	变形量 deformation	挤压力/kN force
A	18.7%	316	K	30.4%	231.54
B	34%	270	L	20.8%	521.93
C	16%	295	M	10.1%	326.15
D	15.1	300	N	40%	323.99
E	34%	950	O	17.6%	392.23
F	13%	220	P	15%	439.53
G	17.2%	270	Q	20%	327.45
H	17.2%	210	R	30%	580.55
I	13.8%	350	S	30%	409.22
J	10%	600	T	25.8%	271.85



# 挤压试验 Crush test

## Test procedure:

- battery is fully charged;
- Radius of 75 mm half cylinder, the length of the cylinder is greater than the battery, but not more than 1 m;

Crush from the most vulnerable direction or perpendicular to the orientation of monomer battery.

The deformation is 30%, or pressure meet the requirements of table;

Keep for 10 min.

- 1h Observation.

**Requirement:** No explosion, no fire.

n	Pressure kN
1	200
2~5	100*n
>5	500

