



**YONGGUI**

Stock name: Yonggui

Electric equipment

Stock code: 3 0 0 3 5 1

# 江苏永贵新能源科技有限公司

Jiang Su Yong Gui New Energy Technology Co., Ltd.

## 优秀的储能系统服务商

Excellent energy storage system service provider



# Company profile





# Introduction to Yonggui

Stock name: Yonggui  
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Yonggui Group was founded in 1973 with a registered capital of 300 million yuan and was listed on the Shenzhen Stock Exchange in 2012

More than 3000 current employees

Business scope: battery systems, connectors, door systems, gangways, pantographs, shock absorbers, axle counter signals, etc

4 R&D centers (Zhejiang Tiantai, Jiangsu Nanjing, Sichuan Mianyang, Shenzhen)





# Introduction to Yonggui

Stock name: Yonggui  
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Jiangsu Yonggui focuses on the application and development of lithium-ion battery systems

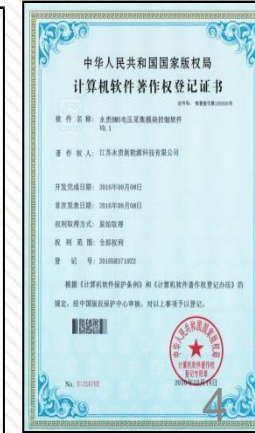
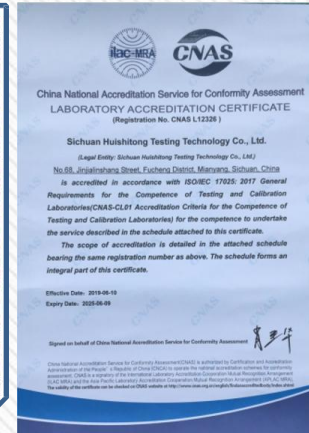
- 18 years of Battery management system (BMS) development and application experience
- 10 years of experience in battery systems and charging products
- Over 100,000 sets of in-service products

### Certifications

ISO/TS 22163  
ISO 9001  
CNAS

### Intellectual property

More than 300 patents



## research and development (R&D) :

Battery system design experts, including 3 doctors

Products: High-power energy storage system, auxiliary battery/emergency traction battery/main traction battery/emergency starting power supply Fuxing EMU, unmanned subway, maglev train, locomotive, track engineering vehicle, etc

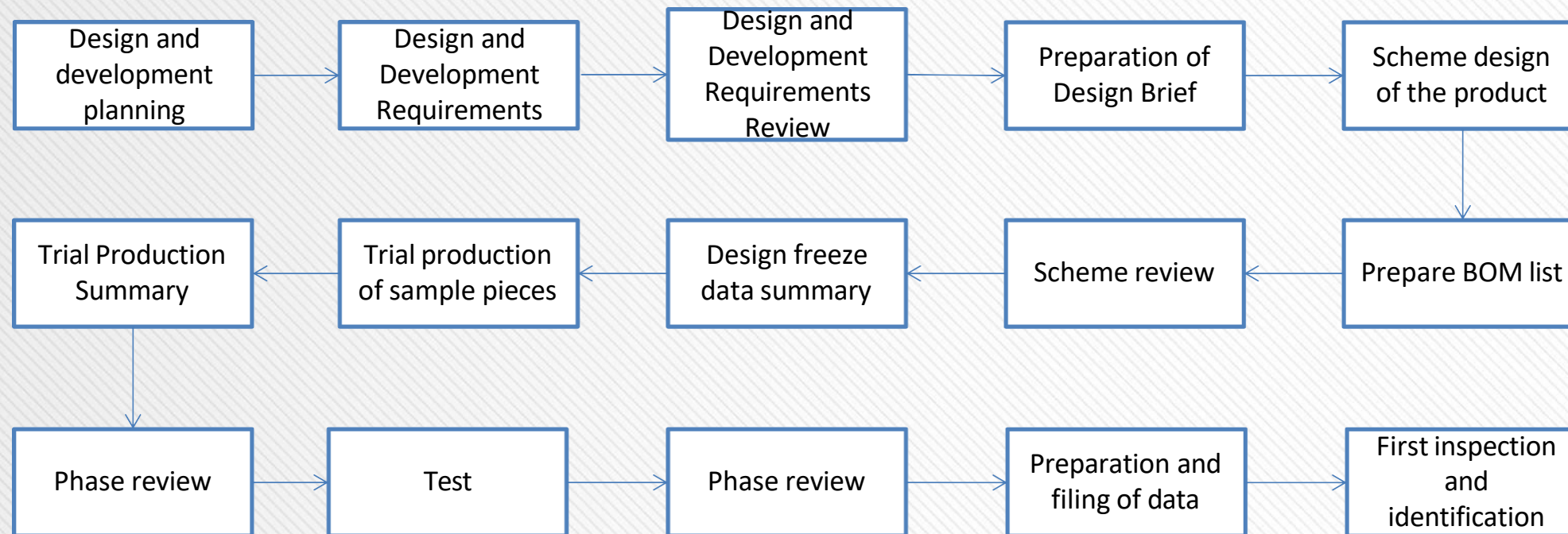


**Detection:** 1600m<sup>2</sup> Battery Test Center, 16 professional battery testers

**Manufacturing:** 53000m<sup>2</sup> plant, >50 sets of advanced production equipment



The battery system development process is managed according to ISO/TS2263/TS16949 project management process





# Development History of Yonggui Energy Storage

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Batch loading of the first batch of lithium titanate battery system of Fuxing EMU - 2017

The first batch to participate in the loading of lithium titanate battery system for metro engineering vehicle-2019

The first low-speed maglev train to realize the loading of lithium titanate battery system - 2019

The first medium-speed maglev train to realize loading of lithium titanate battery system - 2020

The first subway auxiliary power supply+self-traction lithium titanate battery system - 2020

The first batch to participate in bulk loading of lithium titanate battery system for motor vehicles in the city - 2021

The world's first ultra-high power peak shaving and frequency regulation energy storage 5MW/364KWH - 2022

The first batch to participate in 600km high-speed maglev lithium titanate battery system loading - 2023

The first batch to participate in the loading of hydrogen fuel+lithium titanate battery hybrid energy storage system - 2023

The first batch to participate in the loading of super capacitor+lithium titanate battery hybrid energy storage system - 2023



# Advantages of Lithium-titanate battery



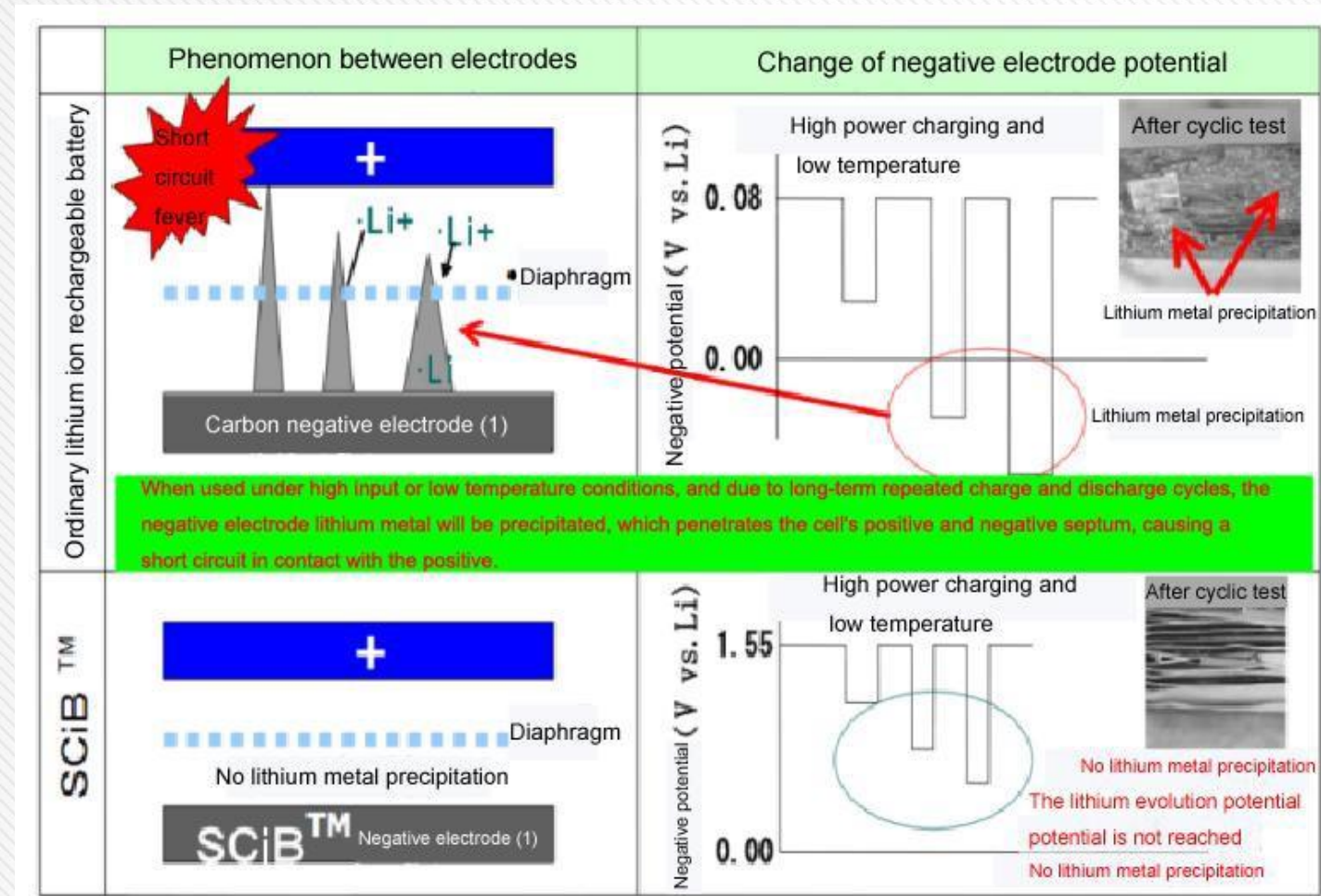


# Advantages of lithium titanate battery

## Safety of lithium titanate battery

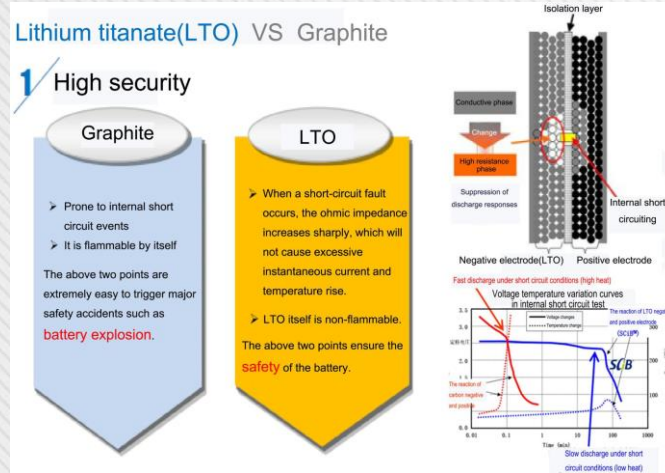
Lithium titanate has the following advantages:

Compared with graphite cathode material, lithium titanate material has higher lithium embedding potential (1.55V). Even under low temperature and high charging rate, the cathode battery is difficult to reach the reduction potential (0V) of lithium, fundamentally eliminating the possibility of metal lithium dendrite and reducing the risk of internal short circuit of the battery.



# Advantages of lithium titanate battery

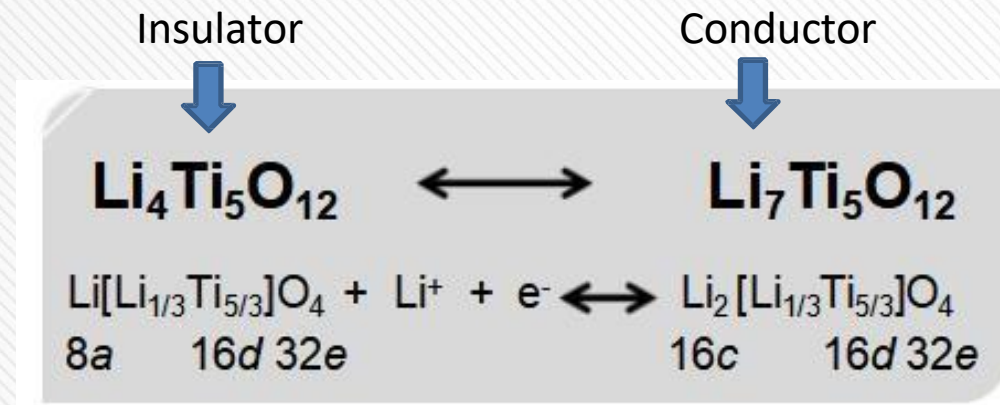
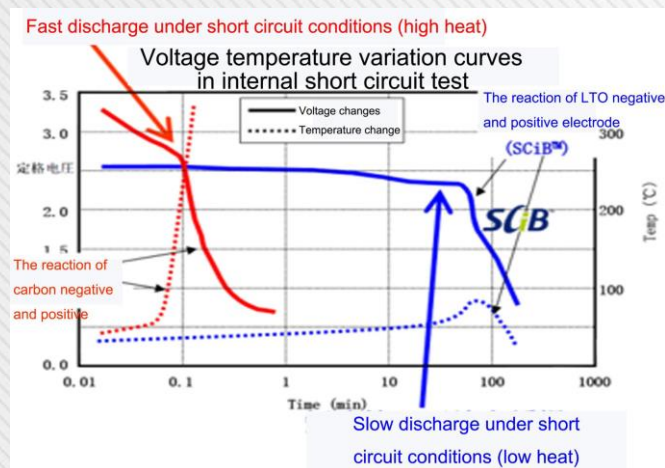
## Safety of lithium titanate battery



The cathode of ordinary lithium battery is graphite, which is inflammable  
 The cathode of lithium titanate battery is lithium titanate, which has no flammability

The red curve in the figure shows the short circuit temperature rise and voltage change curve of carbon negative battery. The voltage of carbon negative battery drops rapidly and the temperature rises sharply after short circuit, so it is easy to generate fierce chemical reactions such as fire and explosion.

The blue curve in the figure shows the short-circuit temperature rise and voltage change curve of lithium titanate battery. In case of short circuit of lithium titanate battery, the voltage drops slowly and the temperature rises slowly, with the maximum temperature not exceeding 100 °C, so fire and explosion will not occur.



# Advantages of lithium titanate battery

## Safety of lithium titanate battery



Over discharge test

The cathode substrate of lithium titanate battery is made of aluminum material, and over-discharge of the battery will not produce metal crystal branches and short circuit

### 高安全性を担保するメカニズム (集電箔 アルミ vs 銅)

#### 過放電、長期保管等で(負極集電)銅箔の溶出&短絡



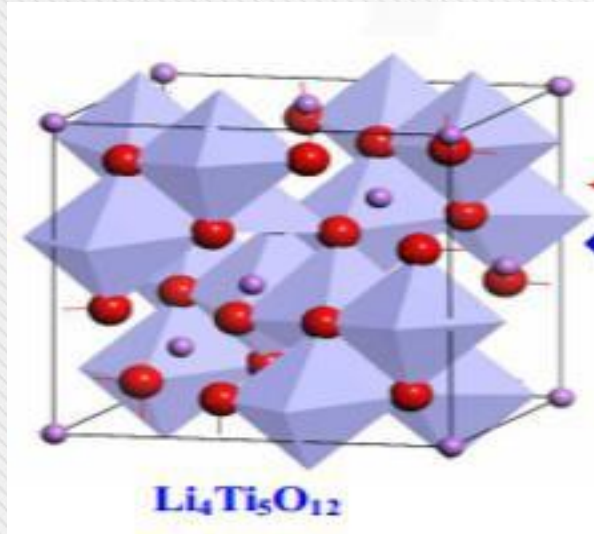
過放電(0V近傍)時にCuが溶解  
⇒ Li金属析出同様、電池内部短絡をおこす可能性がある。

充電実施で発熱~発煙・破裂・発火の可能性あり

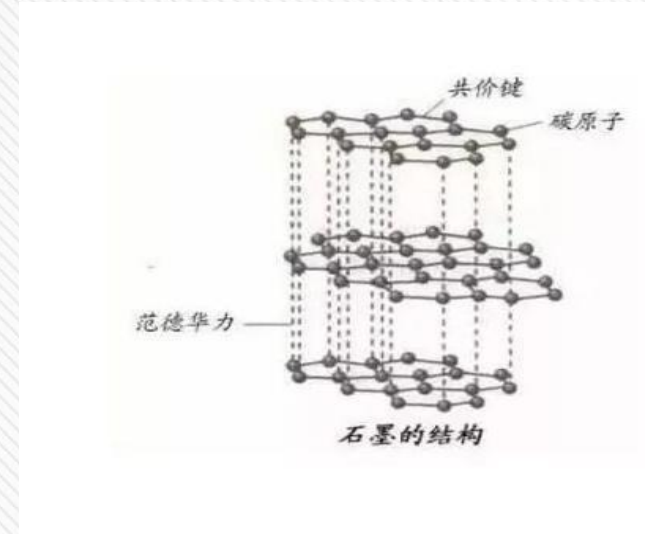
The metal foil used for carbon negative electrode of ordinary lithium battery must be copper foil. After over-discharge, the battery will produce copper crystal branches to puncture the diaphragm and cause short circuit

# Advantages of Lithium titanate battery

## High power advantage of Lithium-titanate battery



The Spinel Stereo Molecular Structure of Lithium titanate



The Planar Molecular Structure of Lithium iron phosphate Anode

Compared with the layered structure of graphite anode, the three-dimensional structure of Lithium titanate anode is more suitable for the insertion and removal of lithium ions, and is suitable for **high rate charging and discharging**;

Compared with graphite negative electrode battery, Lithium-titanate battery has no **SEI film**, smaller internal resistance and smaller temperature rise during high rate charge and discharge.

# Advantages of Lithium-titanate battery

## Safety of Lithium-titanate battery

### safety

Compliant with: GB/T31485-2015, GB38031-2020, TJ/JW126-2020, IEC62928;

Passed 10 safety tests;

No fire or explosion during the experiment.



Overdischarge



Forced Temperature cycling overcharging



External short circuit



Seawater immersion



Temperature cycling



External short circuit



Crimp



Heat additive



Fall



Flow pressure

# Advantages of Lithium-titanate battery

## Safety of Lithium-titanate battery

### safety

Compliant with: IEC61373 2010, TJ /JW127 2020, GB/T24338.4 2018 and other railway standards

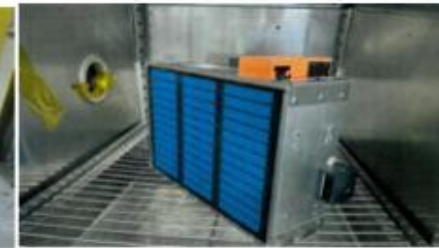
No fire or explosion during the experiment.



Vibration and impact test



Squeeze test



Temperature shock test



Damp heat cycle test



Fire test



Salt spray test



High altitude test



Protection performance test



Short circuit test



Thermal runaway test



# Yonggui's core technological advantages





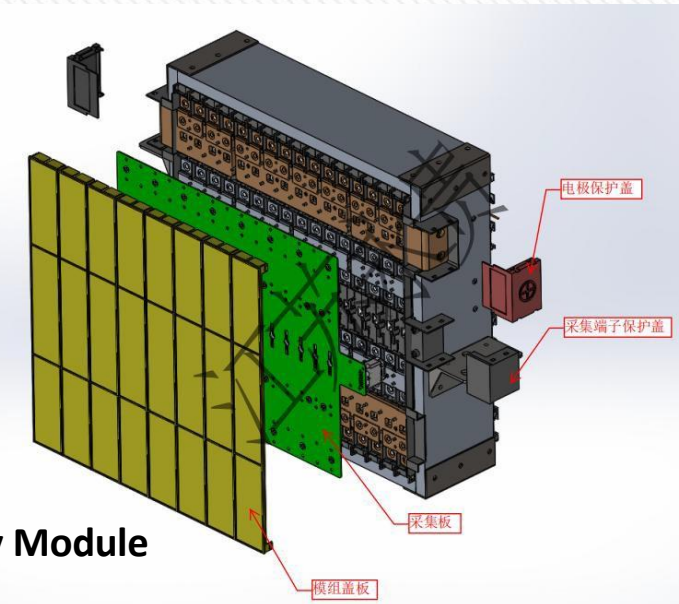
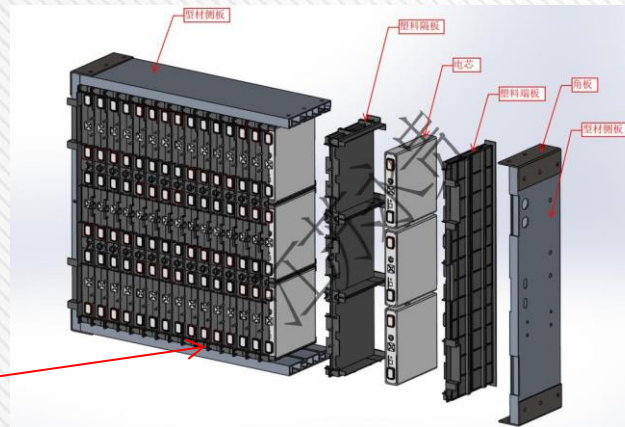
# Yonggui Design and Development Advantages

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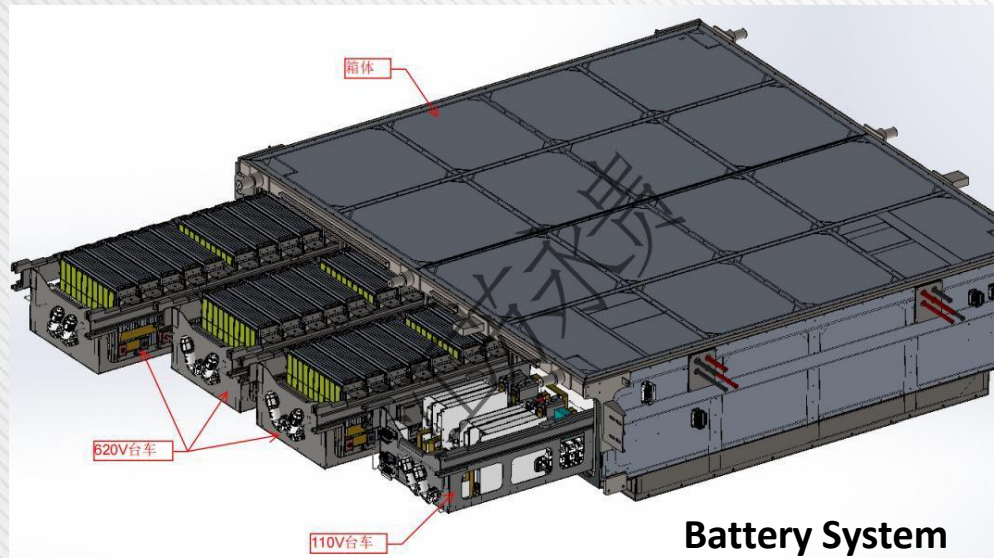
Toshiba battery cell:



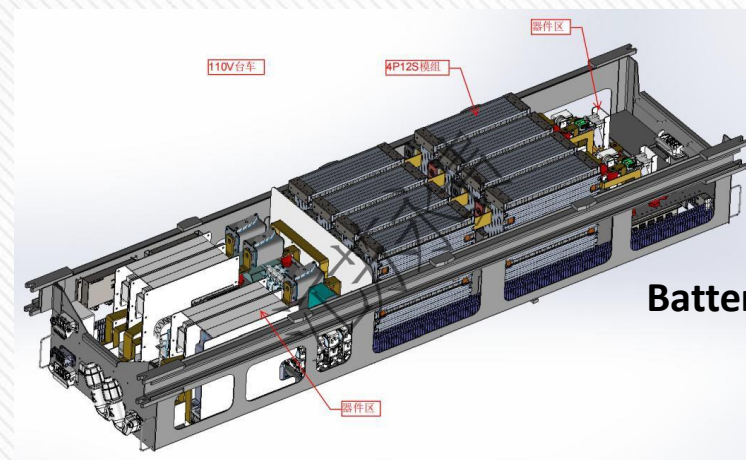
Yonggui Lithium-titanate battery system



Battery Module



Battery System



Battery trolley



# Experimental Center

Experimental Center: 1600m<sup>2</sup>

Instrument and equipment: over 100 sets

Equipment assets: 10 million yuan

Electrical performance test  
 environmental test  
 Mechanical performance test  
 Physical and chemical  
 performance test  
 Protective performance test  
 Mechanical life test  
 Simulation Experiment  
 Center



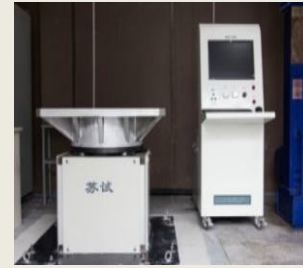
防尘试验箱



拉力试验机



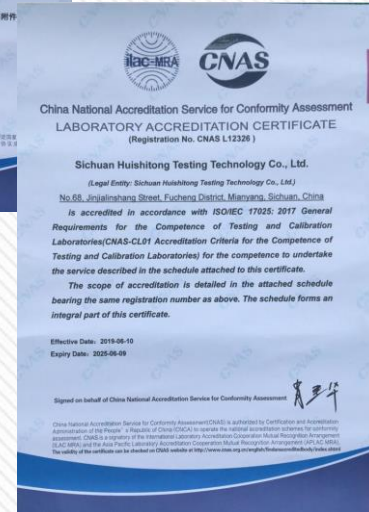
振动冲击试验机



碰撞试验台



减振器疲劳试验台



材料成分分析仪



盐雾试验箱



镀层测厚仪



三坐标测量机

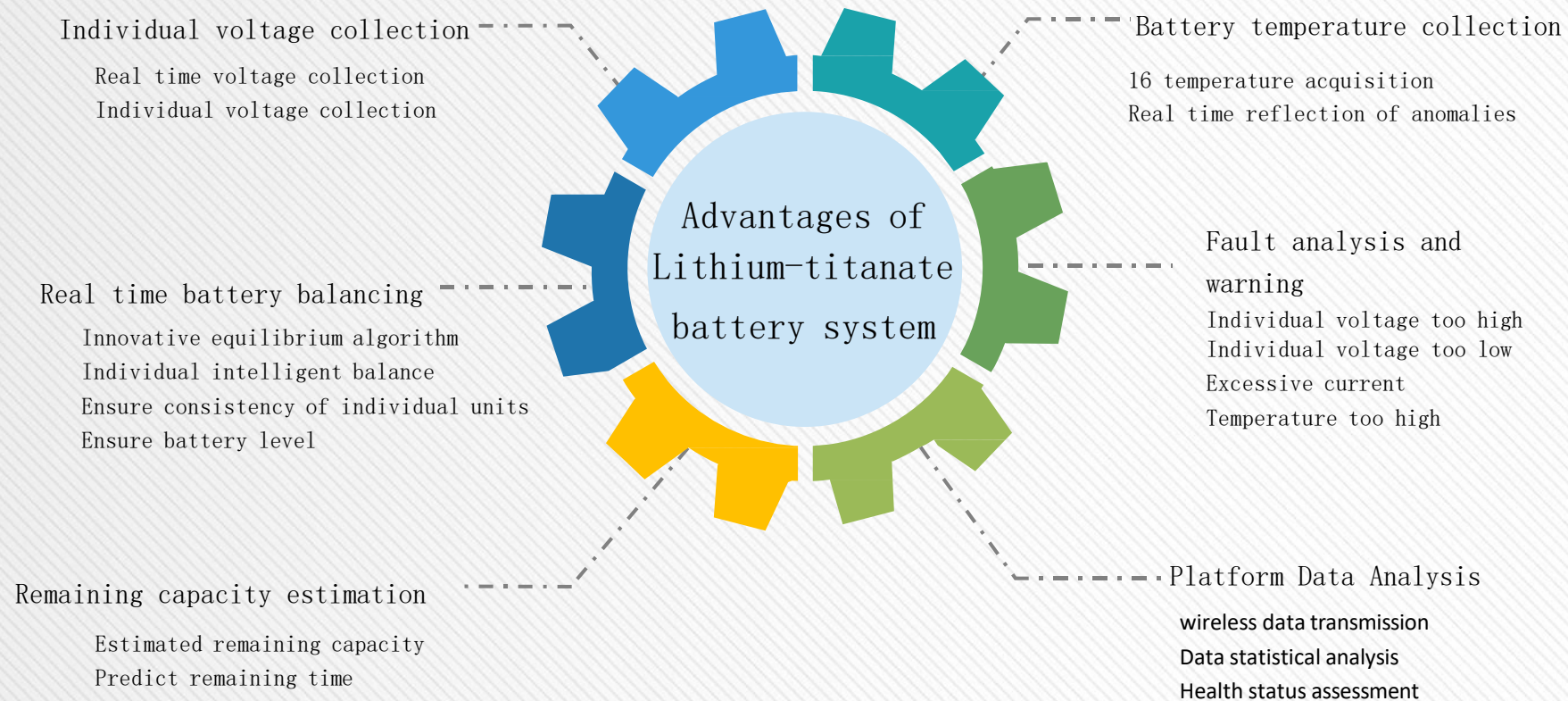


高低温试验箱



# Advantages of Lithium-titanate battery system

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# Core advantages of Yonggui Lithium-titanate battery system

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Real time equalization algorithm

Fix capacity deviation

Extend service life

Reduce the probability of failure



## Multiple security protection

### **Multiple safety protection mechanisms effectively prevent severe overcharging of batteries and ensure system safety:**

- The Lithium-titanate battery system communicates with the charger in real time, and controls the charging voltage and current according to the voltage of the single battery
- If the total voltage or individual voltage exceeds the threshold, cut off the internal contactor to prevent overcharging and isolate the battery
- The system adopts a dual contactor design to prevent the contactor from sticking and cannot be cut off
- If the double contactors are stuck, send a stop command to the charger through communication and hardware nodes to stop charging
- If communication fails or the charger loses control, the redundant detection system in the system will cut off the contactor and isolate the battery

# Application performance



# Application performance

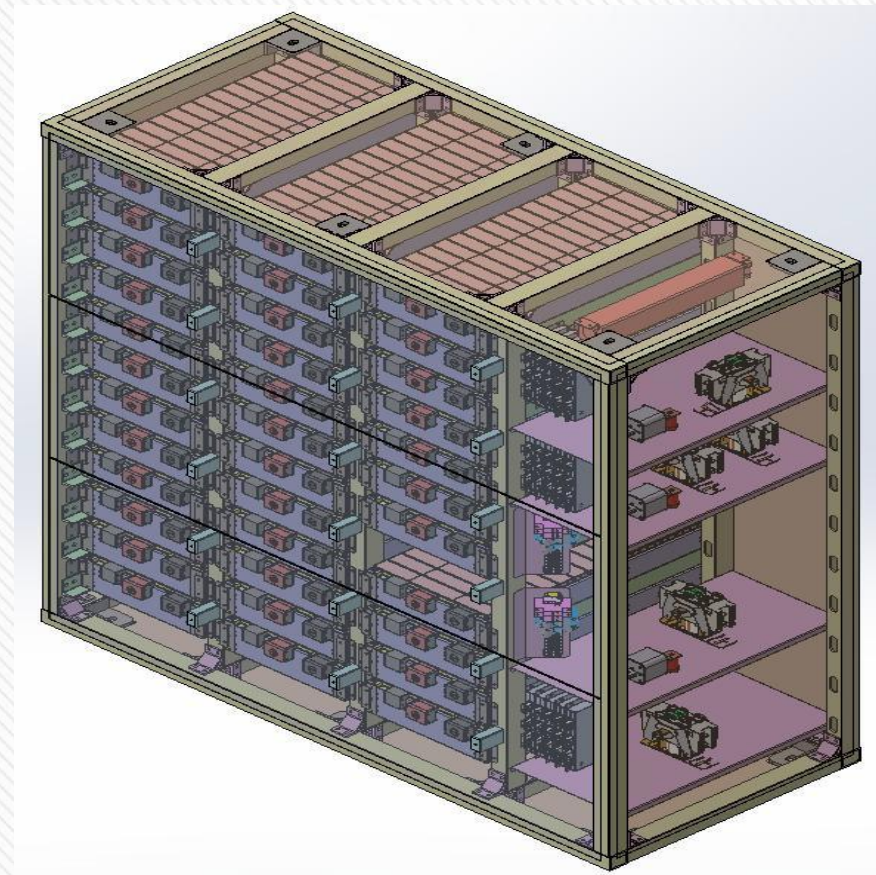
## Typical performance of rail transit

Serial Number	Custom	Project	Function	Quantity (set)
1	CRRC Sifang	600km high-speed maglev	Auxiliary power supply+suspension	2
2	CRRC Changke&Tangshan	The Fuxing EMU	Auxiliary power supply	104
3	China Energy Investment	Railway energy storage (13C charge and discharge)	Ultra high power peak shaving	1
4	CRRC Changke	400 km EMU (High cold)	Auxiliary power supply	2
5	CRRC Sifang&Changke	Urban high-speed trains	Auxiliary power supply	24
6	CRRC Tangshan	Standard freight high-speed train/high-speed inspection vehicle	Auxiliary power supply	4
7	CRRC Dalian	Low speed maglev	Auxiliary power supply+suspension	2
8	CRRC Zhuzhou Machinery Co., Ltd	Medium speed maglev	Auxiliary power supply+suspension	20
9	CRRC Puzhen	Shenzhen Line 6 branch line	Auxiliary power supply+self traction	4
10	CRRC Puzhen	Shaoxing Line 2	Auxiliary power supply	4
11	CRRC Dalian	Taiyuan Line 2	Auxiliary power supply+self traction	2
12	Tianjin metro	No. 6/10 (Battery Module)	Auxiliary power supply+self traction	74
13	CRRC Zhuzhou Machinery Co., Ltd	Turpan tram	Power traction	48
14	CRRC	Tramcar	Power traction	30
15	Shanghai Railway Bureau	Industrial and mining vehicle	Main power traction	2
16	Harbin	Industrial and mining vehicle	Main power traction	4

## Group form

The battery system consists of two sets of battery cabinets, which are divided into three clusters for parallel use. Each cluster has 5P414S, totaling 15P414S. When one cluster of batteries fails, the other two clusters can continue to supply power to the entire vehicle. The front panel is a detachable transparent acrylic board, with module pull-out installation for easy maintenance and repair

Battery configuration parameters	
Battery pack voltage range	DC621V~1055.7V
Battery capacity	390Ah
Battery pack energy	371.358kWh
Output current	431A
Rated output power	400kW
Battery life	10 Years
Standard single column configuration	3 clusters/column
Heat dissipation method	Natural cooling
Communication method	MVB&Ethernet
Temperature range	-25℃~45℃
Size	1800mm×800mm×1800mm
Weight	4500kg





# Hydrogen energy intelligent intercity Multiple unit Lithium titanate battery system

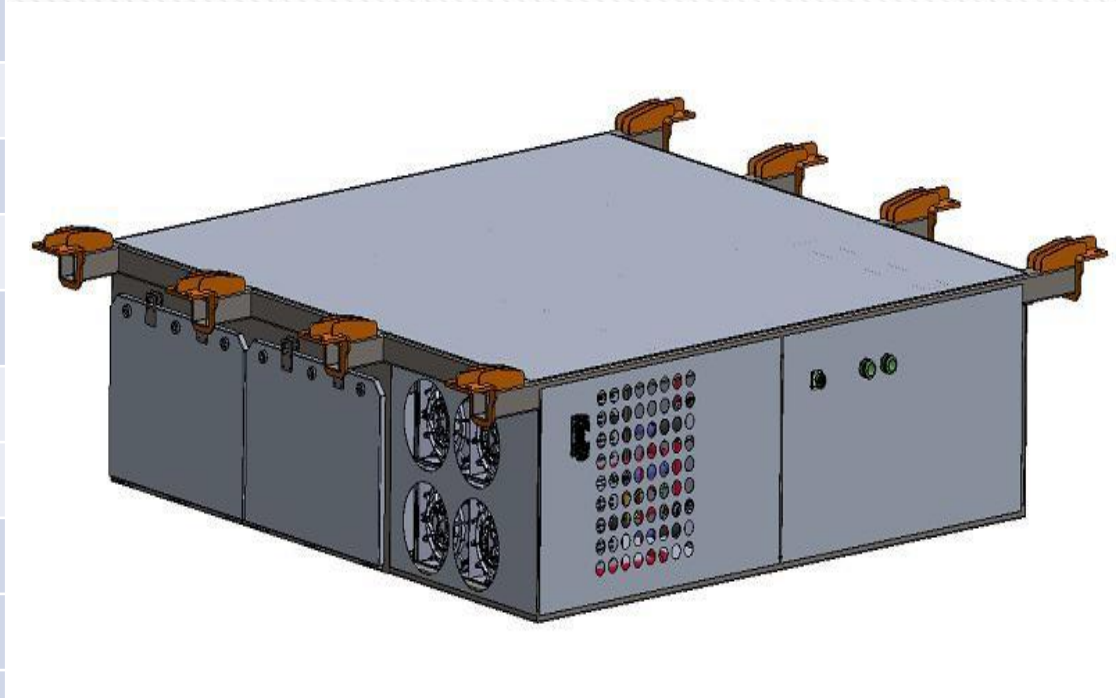
Stock name: Yonggui

Electric equipment

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**Project Overview:** The power battery has good voltage balance and heat balance design. The combination of power cells and fuel cells can simultaneously provide traction and auxiliary power. In addition, when the fuel cell system malfunctions, the power cell system can serve as an emergency traction power source to ensure reliable train operation. The power battery can supplement the insufficient output power of the fuel cell and meet the power requirements of the traction system in the form of energy mixing, while also absorbing 100% braking energy.

Battery configuration parameters	
Battery pack voltage range	DC990V~1729V
Battery capacity	60Ah
Battery pack energy	91.08kWh
Output current	530A
Rated output power	320kW
Battery life	10 Years
Standard single column configuration	4 groups
Temperature range	-25℃~55℃
Cooling method	Water-cooling
Size	2400mm*2400mm*700mm
Weight	2400kg

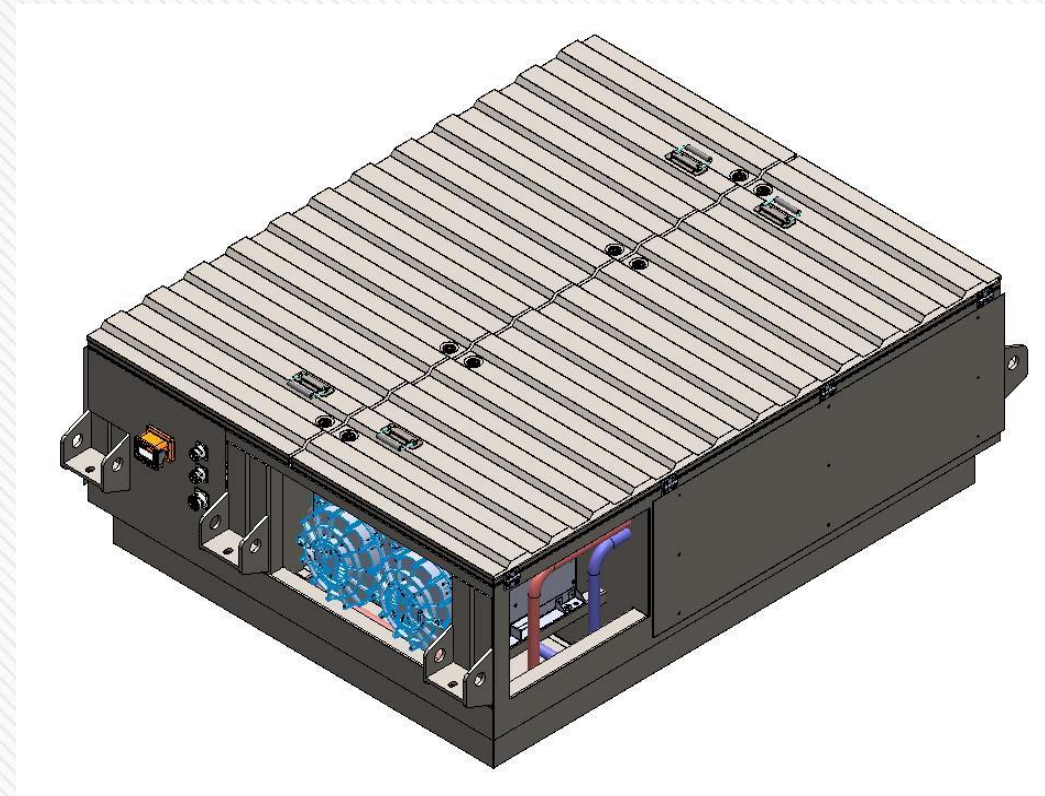




**Project Overview:** The system of Turpan Tourism Modern Tram (Phase I) Project adopts the hybrid power of "super capacitor+Lithium-titanate battery". In interval stations with low energy consumption, supercapacitors provide power to vehicles separately; In the section station with large energy consumption, the super capacitor and Lithium-titanate battery energy storage power supply jointly provide power for the vehicle.

## Battery configuration parameters

Battery pack voltage range	DC280V~480V
Battery capacity	100Ah
Battery pack energy	43.24kWh
Output current	350A
Rated output power	200kW
Battery life	>8 years
Standard single column configuration	1 set
Heat dissipation method	water-cooling
Communication method	MVB
Temperature range	-40℃~55℃
Size	1900mm*1550mm*670mm
Weight	1400kg





# 深圳地铁6号线支线钛酸锂电池 辅助+应急牵引

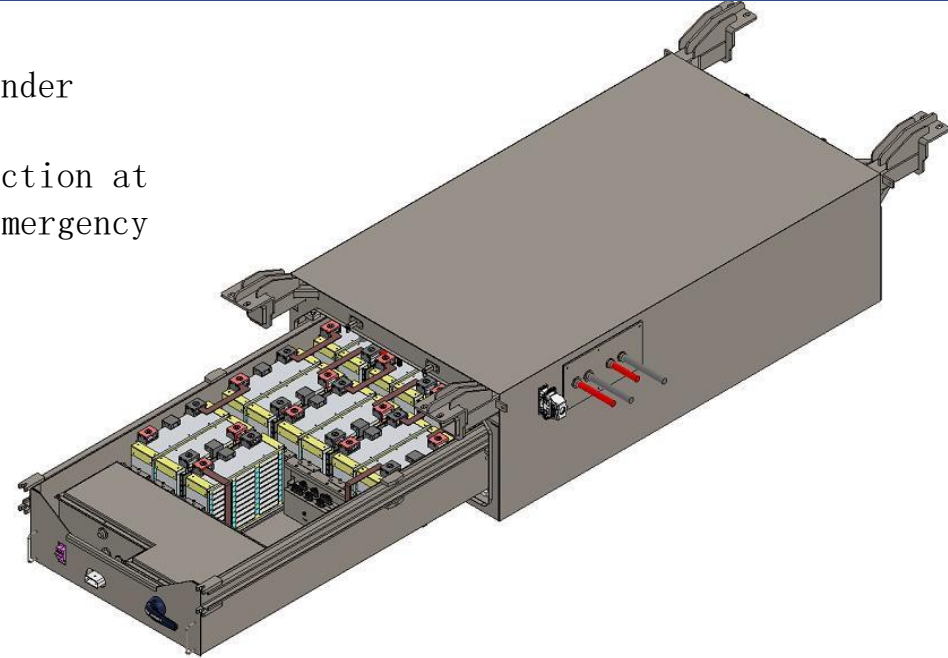
Stock name: Yonggui  
Electric equipment  
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## Project requirements:

Satisfy emergency load for 45min power supply under emergency conditions;  
When there is no network voltage, emergency traction at 5km/h for 1000m or traction at 5km/h for 100m+emergency load power supply for 45min.

## Battery configuration parameters

Battery pack voltage range	67.5V~121.5V
Battery capacity	230Ah
Battery pack energy	23.8kWh/box
Output current	386A
Rated output power	40kW
Battery life	23.8kWh/box
Single column configuration	2 boxes
Communication method	Ethernet
Temperature range	-25℃~55℃
Size	2600mm*1137mm*660mm
Weight	830kg





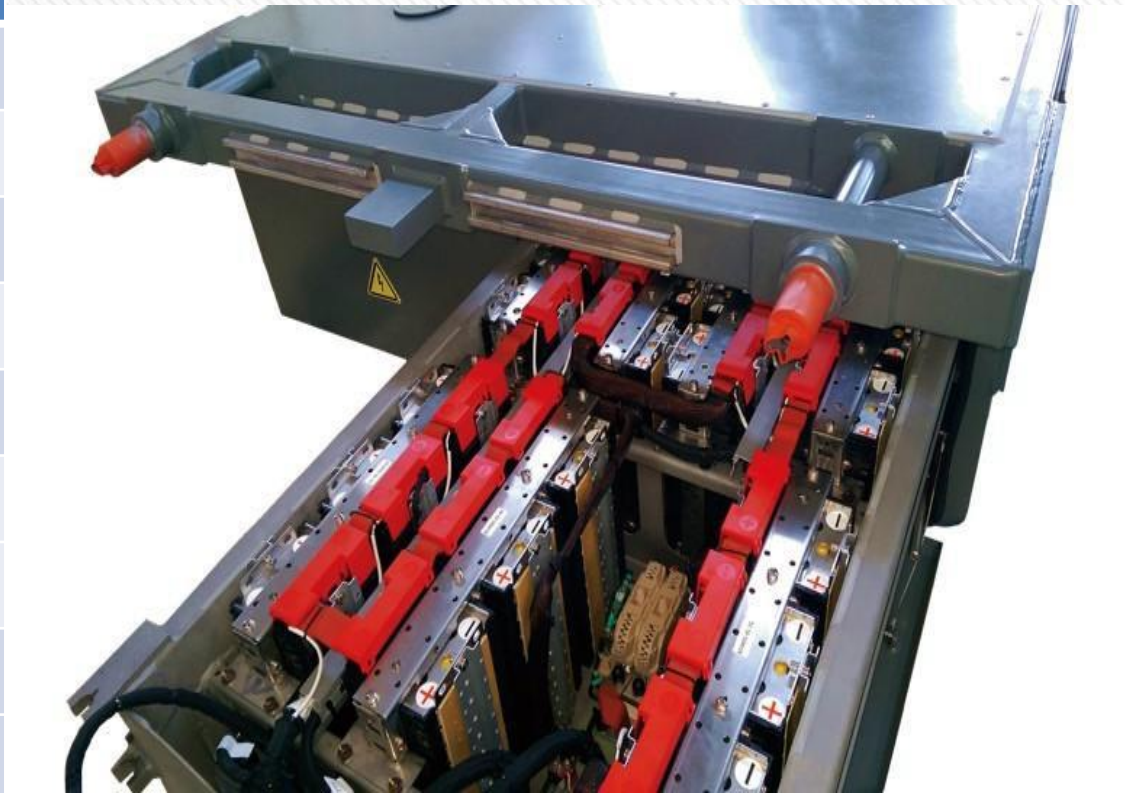
# High speed Multiple unit CR400BF Lithium titanate battery system

Stock name: Yonggui  
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Since 2017, more than 300 trains have been loaded on Fuxing Multiple unit, which has been operated safely and reliably for 6 years. China Railway Group has highly recognized the maintenance free and low maintenance costs of Lithium titanate battery system.

## Battery configuration parameters

Battery pack voltage range	78V~120V
Battery capacity	200Ah
Battery pack energy	22kWh
Output current	200A
Rated output power	22kW
Battery life	>10 years
Single column configuration	4 groups
Communication method	-40°C~55°C
Temperature range	3072mm×1711mm×574mm
Size	1550kg





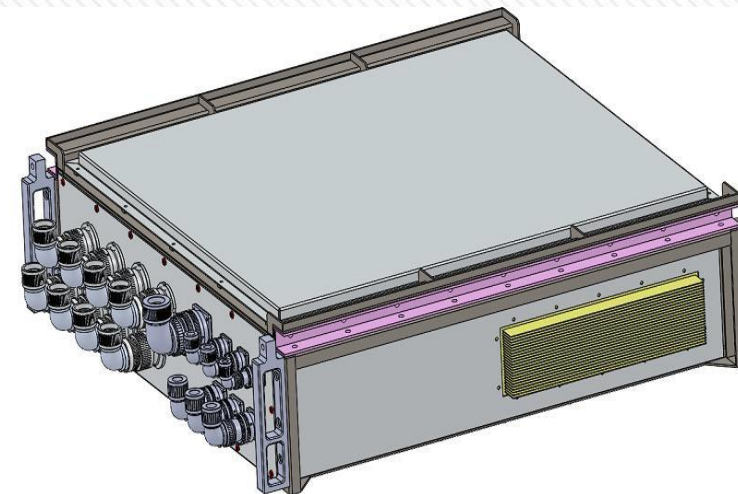
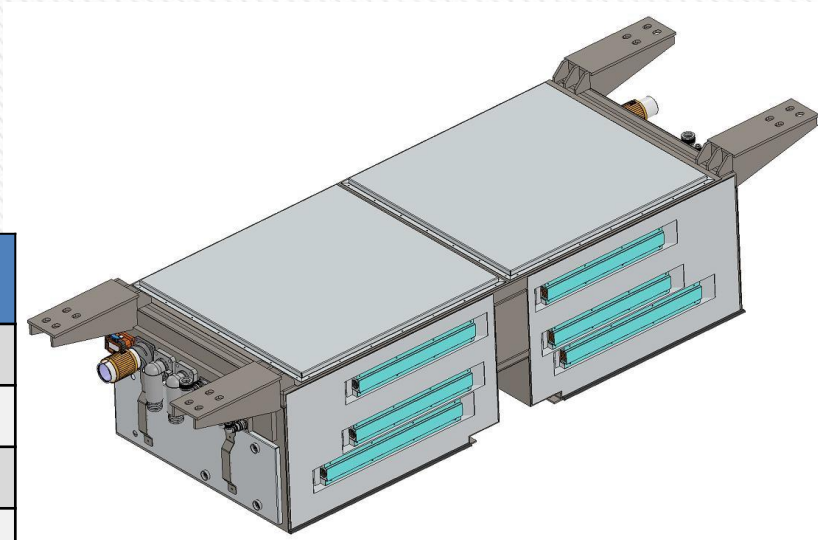
# 600km high-speed magnetic levitation Lithium titanate battery Auxiliary+emergency suspension

Stock name: Yonggui  
Electric equipment  
Stock code: 3 0 0 3 5 1

## Project requirements:

Maintain emergency ventilation of the suspended train for 90 minutes under emergency conditions, and use emergency lighting.

Project	B440 battery	B24 battery
Quantity	2 sets/box	2 sets/box
Rated capacity	46Ah	69Ah
Rated voltage	DC455. 4V	DC25. 3V
Voltage range	297V~534. 6V	16. 5V~29. 7V
Quantity of electricity	20. 948kWh	1. 745kWh
Peak discharge current	250A	-
Continuous discharge current	150A	100A
Cooling method	Air cooling+heating film	Self cooling+heating film
Size	2796×884×554mm	862mm×838mm×259. 5mm
Weight	≤1050kg	≤150kg



**Project requirements:** When the power supply of Head-end power is cut off, the storage battery will supply power for emergency lighting, emergency ventilation, broadcasting and control. When the emergency power consumption meets the continuous operation of emergency lighting and broadcasting for 120 minutes, and the ventilation volume is not less than 10m<sup>3</sup>/(h · person), emergency ventilation is required for 30 minutes.

Battery configuration parameters	
Battery pack voltage range	78V~120V
Battery capacity	100Ah × 2 sets/box
Battery pack energy	10.35kWh×2 sets/box
Output current	136A
Rated output power	15kW
Battery life	>10 years
Single column configuration	2 boxes
Communication method	RS485
Temperature range	-25°C~55°C



# Port application performance

## Port performance—AGV

Toshiba SCiB Battery Application Port AGV Project

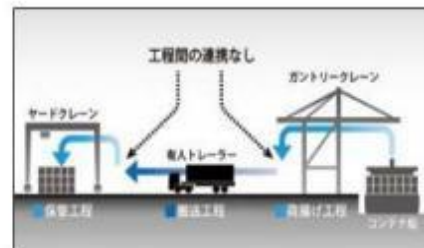
Qingdao Port: the first fully automated wharf in Asia

Qingdao Port Phase I: 38 sets

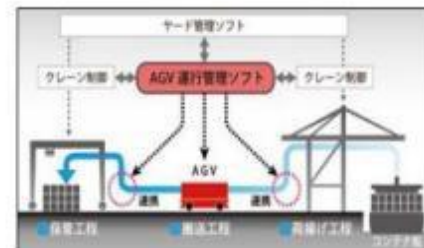
Qingdao Port Phase II: 45 sets

86.9kwh(12m):7P270S(1890 batteries)

	Qingdao Port
Charging method	Fast charging method for 60 seconds of charging
Battery pack composition	270S 7P=1890 batteries
Battery weight	0.97t
Battery exchange equipment	Not required



Schematic diagram of traditional container handling



Schematic diagram of container handling at automated terminals

# Port application performance

## Port performance - tire mounted cranes

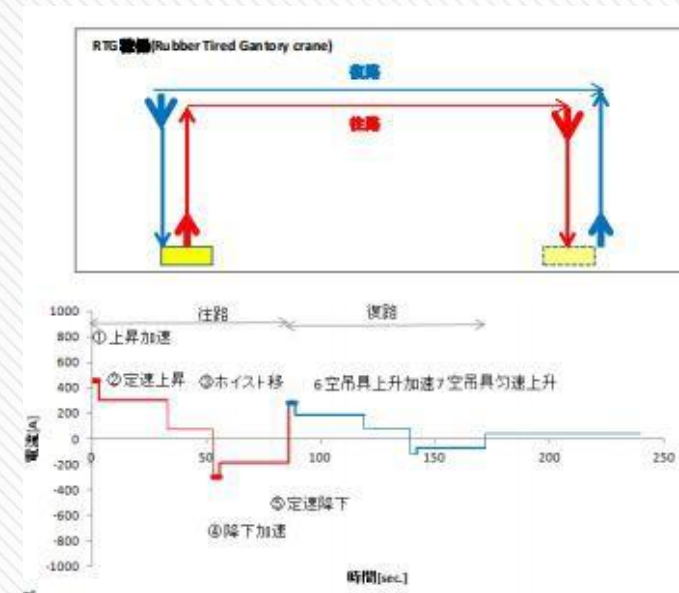
Toshiba SCiB Battery Application Port RTG Project



港口RTG: 62.7kWh (19S3P@2P12S)



As of December 2019,  
performance announcement:  
Ningbo Port: 22 sets  
Port of Xiamen: 4 sets  
Jakarta Port: 4 sets  
Taicang Port: 8 sets  
Qatar: 12 sets  
Saudi Arabia: 10 sets  
Thailand: 2 sets  
and so on



Total installed capacity: More than 110 sets worldwide, distributed across major ports in China and Southeast Asia. Becoming a standard application product for oil electric hybrid tire cranes.

# Energy storage application performance

## Peak shaving in railway Electrical substation (13C charging and discharging)

### Lithium titanate energy storage advantages:

High safety: currently the safest lithium battery

Ultra high power: supports continuous 15C and short-term 40C charging and discharging

Ultra long life: cycle life of 30000 to 100000 times

Ultra low temperature: supports -40 °C discharge, with a discharge capacity greater than 70%

Ultra high power density: It can significantly reduce the capacity and installation space of energy storage systems in peak shaving and frequency modulation applications. (5MW/364kwh)

It has the advantages of small land occupation, cost reduction and efficiency increase, and high flexibility



NO.	Project	Parameter
Electrical parameters	Energy storage capacity	364kWh
	Cell type	Power type Lithium-titanate battery
	Rated output voltage	DC910V
	Output voltage range	DC585~DC1010V
	SOC Scope of Work	5%~95%
	Maximum continuous output current	5500A
	Maximum continuous input current	5500A
	Dielectric Strength	Leakage current ≤ 20mA
Electrical interface	High voltage output interface	1000V/1100A (5-way)
	Power supply interface	Input power supply three-phase 380V25A
	Communication interface with bidirectional DC/DC	CAN2.0B
	Interface with system monitoring	Ethernet
	Video interface	Ethernet
Mechanical parameters	Maximum external dimensions	12m standard container
	Weight	15t
	Protection grade	Not less than IP54
	Cabinet color	7035
	Container color	7035



# Foreign performance

## Typical performance of Lithium-titanate battery abroad

Tokyo Metro 2000: 120 trains

Shinkansen N700/N700S: 875 trains

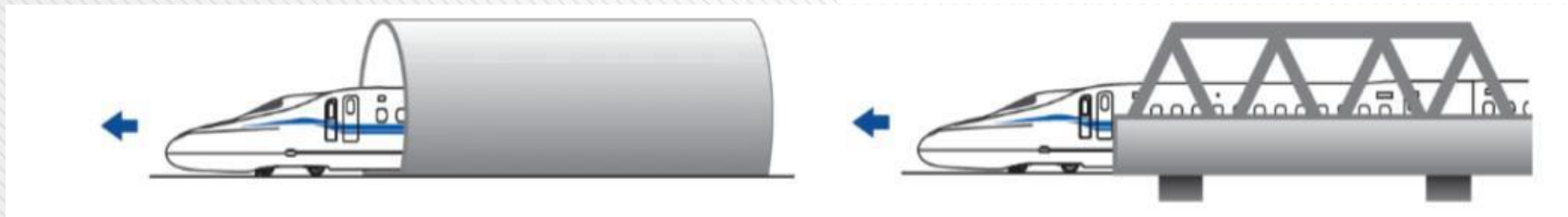
Japanese passenger car light hybrid system: 2 million vehicles

European low-floor buses: over 500 vehicles

Shuangyuan Trolleybus project: more than 40 trains



非常走行用電源装置



When natural disasters such as earthquakes occur, a self-propelled mode is used to detach from tunnels or bridges



# Lithium titanate bus



# Lithium titanate bus

## Battery comparison

<b>Battery pack type Performance index</b>	<b>Lithium Iron Phosphate</b>	<b>LITHIUM TITANATE</b>
<b>Safety</b>	High	Extremely high
<b>Cycle life (100% DOD)</b>	3000 times	17000 times
<b>Charging rate</b>	0.25C~1C	Continuous 5C, peak 10C
<b>Discharge rate</b>	2C	Continuous 5C, peak 10C
<b>Charge Temperature</b>	0~55 °C	-50~55°C
<b>Discharge temperature</b>	-20~55 °C	-40~55°C
<b>Low temperature discharge capacity</b>	40%	80%
<b>Energy density (Wh/kg)</b>	160~190	80-110

# Lithium titanate bus

## Application advantages of Lithium titanate bus

Performance index	LITHIUM TITANATE	Lithium Iron Phosphate	Notes
Safety	Extremely high	High	Lithium-titanate battery does not separate lithium, and there is no internal short circuit risk
Charging time	12 minutes	4 hours	High charge discharge ratio of Lithium titanate
Charging station	No need (1-2 charging positions)	Need (Charging station for 10-20 vehicles)	Some lines can save charging stations for office or commercial use
Low temperature	-40~55°C	-20~55°C	
Gradeability	Strength	Weakness	High discharge rate of Lithium titanate

similar to

be similar to

The initial procurement cost is close to



# Service Commitment

Stock name: Yonggui

Electric equipment

Stock code: 3 0 0 3 5 1



## Existing Office

- ◆ Northeast China (Harbin, Changchun)
- ◆ North China (Beijing, Qingdao, Tangshan)
- ◆ South China (Shenzhen)
- ◆ East China (Nanjing, Shanghai, Hangzhou)
- ◆ Central China (Wuhan, Zhuzhou)
- ◆ Western region (Chengdu, Xi'an)



## Service idea

We promise to provide full service before, during, and after sales, with a 3-hour response and a 24-hour on-site service in China.



# 江苏永贵新能源科技有限公司

Jiang Su Yong Gui New Energy Technology Co., Ltd.



## 优秀的储能系统服务商

Excellent energy storage system service provider