YONGGUI

Stock name: Yonggui Electric equipment

Stock code: 300351

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

YONGGUI

Company profile

Introduction to Yonggui

Stock name: Yonggui Electric equipment
Stock code: 300351

- 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 Electric equipment
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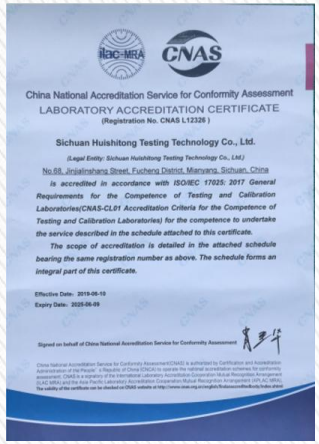
- Jiangsu Yonggui focuses on the application and development of lithium-ion battery systems
  - 18 years of Battery management system (BMS) development and application experience
  - 10 years of experience in battery systems and charging products
  - Over 100,000 sets of in-service products
- Certifications
  - ISO/TS 22163
  - ISO 9001
  - CNAS
- Intellectual property
  - More than 300 patents



Introduction to Yonggui

Stock name: Yonggui Electric equipment
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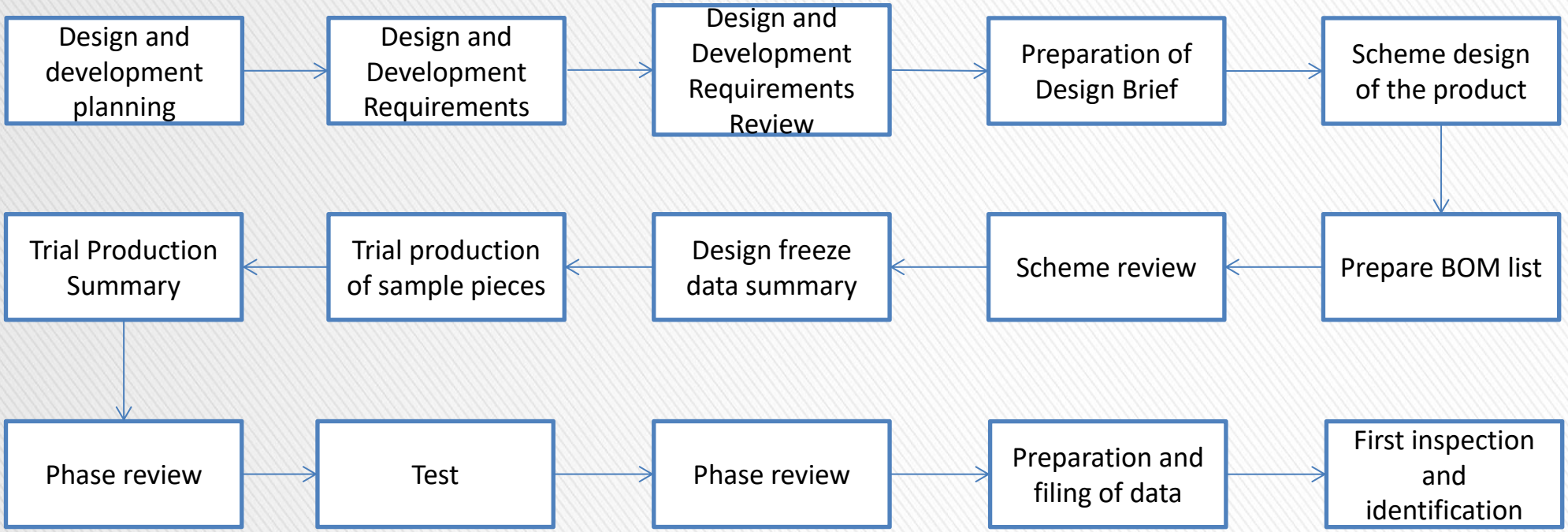
- **research and development (R&D) :**
  - Battery system design experts, including 3 doctors
  - Products: High-power energy storage system, auxiliary battery/emergency traction battery/main traction battery/emergency starting power supply Fuxing EMU, unmanned subway, maglev train, locomotive, track engineering vehicle, etc

- **Detection:** 1600m ² Battery Test Center, 16 professional battery testers
- **Manufacturing:** 53000m2 plant,>50 sets of advanced production equipment

Development process of battery system

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



Development History of Yonggui Energy Storage

Stock name: Yonggui Electric equipment
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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

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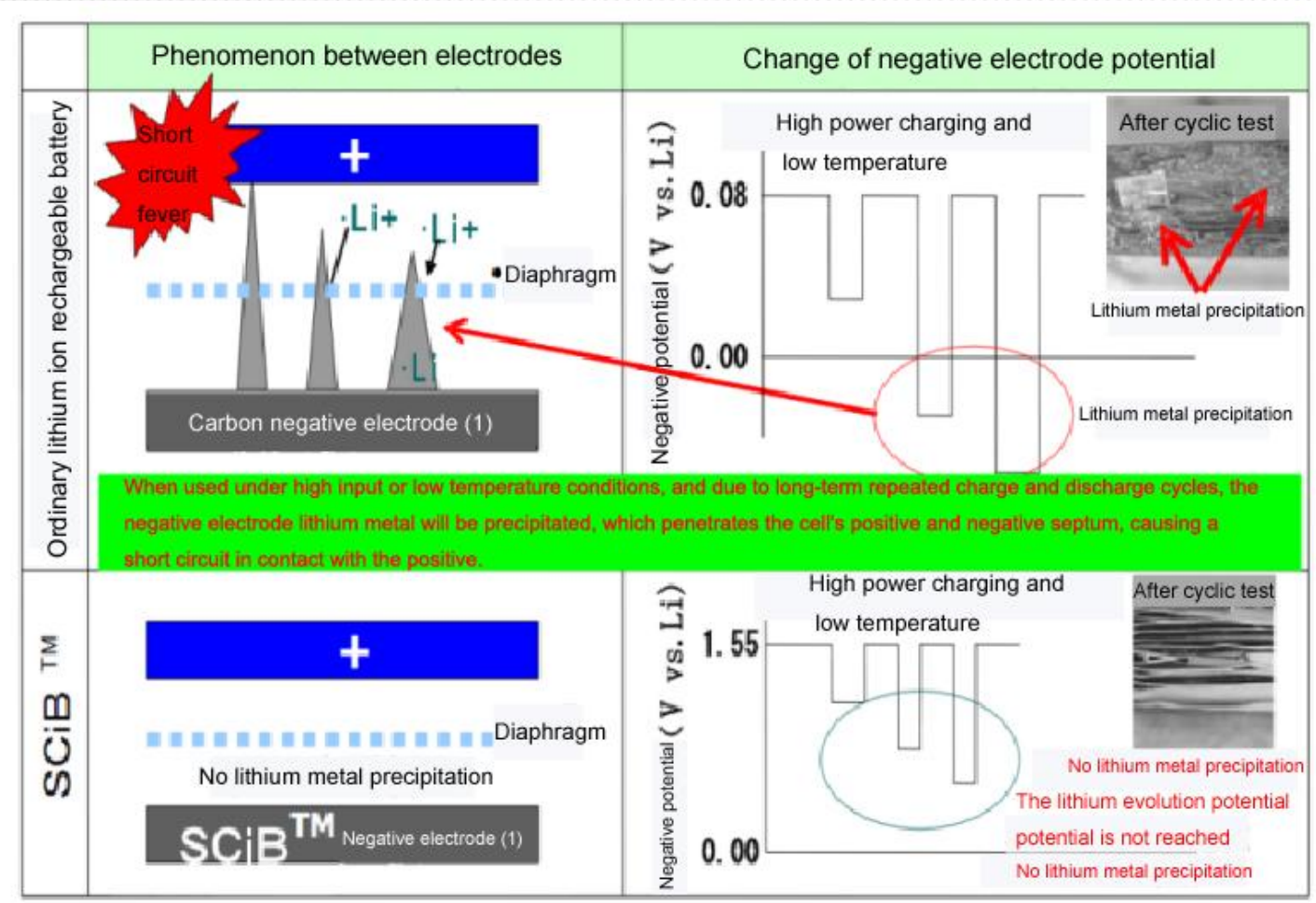
Advantages of Lithium-titanate battery

Advantages of lithium titanate battery

Safety of lithium titanate battery

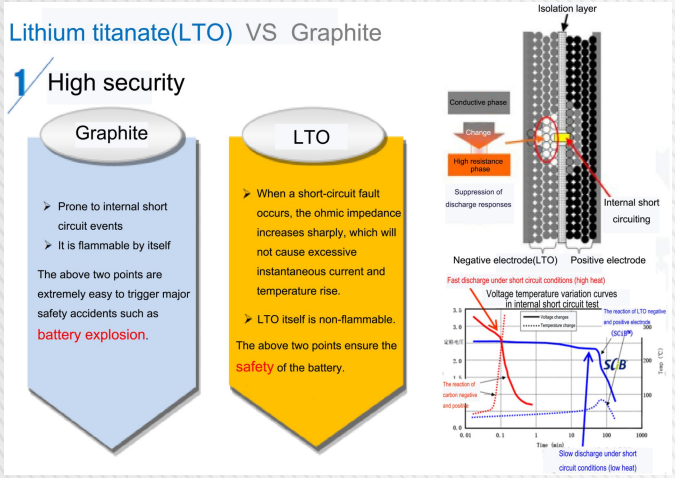
Lithium titanate has the following advantages:

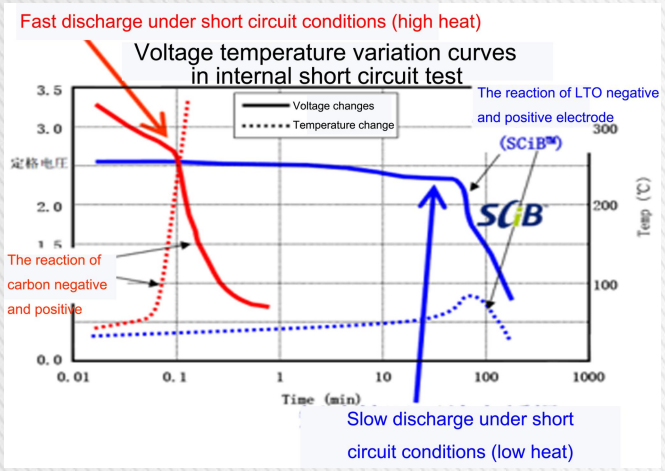
Compared with graphite cathode material, lithium titanate material has higher lithium embedding potential (1.55V). Even under low temperature and high charging rate, the cathode battery is difficult to reach the reduction potential (0V) of lithium, fundamentally eliminating the possibility of metal lithium 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 ℃, so fire and explosion will not occur.

Insulator Conductor

$$Li_4Ti_5O_{12} \longleftrightarrow Li_7Ti_5O_{12}$$

$$Li[Li_{1/3}Ti_{5/3}]O_4 + Li^+ + e^- \longleftrightarrow Li_2[Li_{1/3}Ti_{5/3}]O_4$$

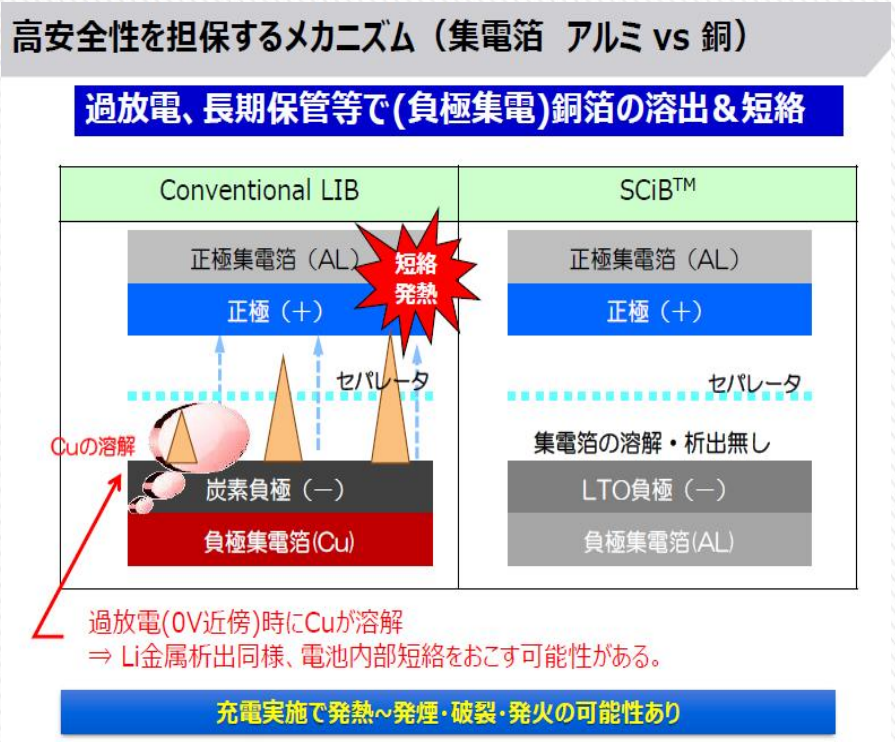
8a 16d 32e 16c 16d 32e

Advantages of lithium titanate battery

Safety of lithium titanate battery

Over discharge test

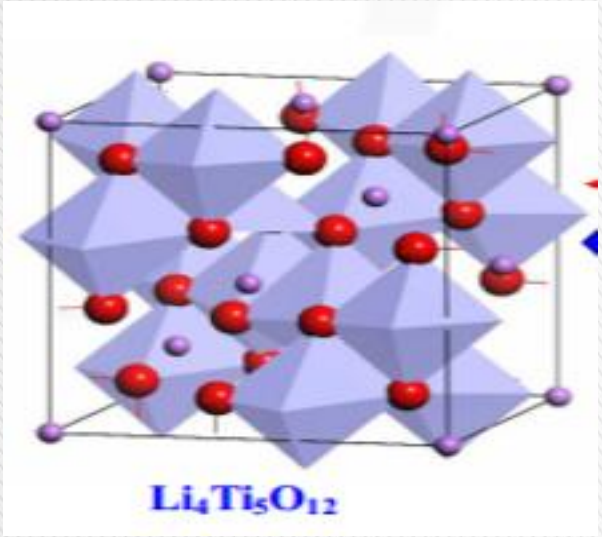
The cathode substrate of lithium titanate battery is made of aluminum material, and over-discharge of the battery will not produce metal crystal branches and short circuit



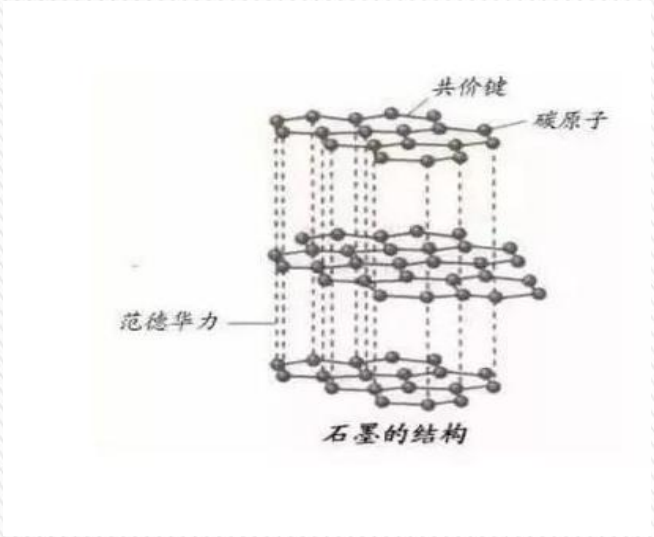
The metal foil used for carbon negative electrode of ordinary lithium battery must be copper foil. After over-discharge, the battery will produce copper crystal branches to puncture the diaphragm and cause short circuit

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

ForcedTemperature cycling overcharging

External short circuit

Seawater immersion

Temperature cycling

External short circuit

Crimp

Heat additive

Fall

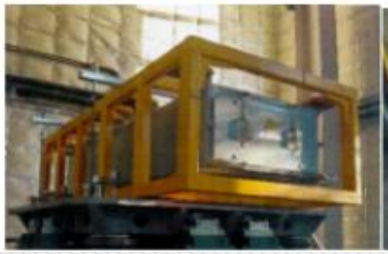
Flow pressure

Advantages of Lithium-titanate battery

Safety of Lithium-titanate battery

- **safety**

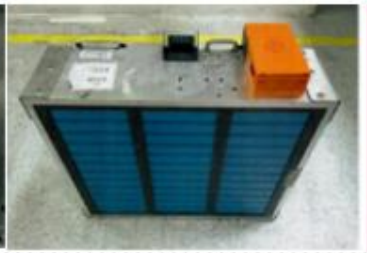
- Compliant with: IEC61373 2010,TJ /JW127 2020,GB/T24338.4 2018 and other railway standards
- No fire or explosion during the experiment.



Vibration and impact test

Squeeze test

Temperature shock test



Damp heat cycle test

Fire test

Salt spray test

High altitude test

Protection performance tes

Short circuit test

Thermal runaway test

Yonggui's core technological advantages

Yonggui Design and Development Advantages

Stock name: Yonggui Electric equipment
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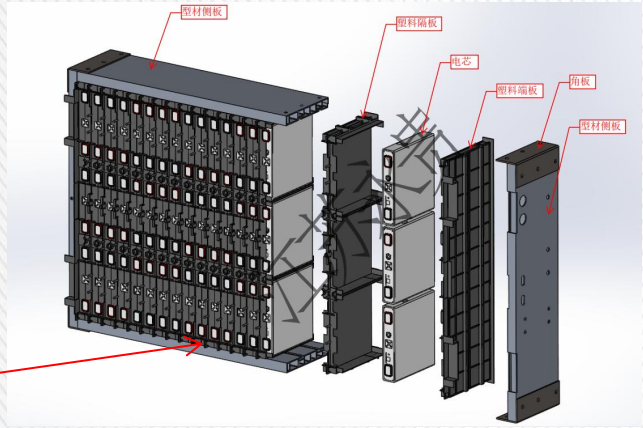
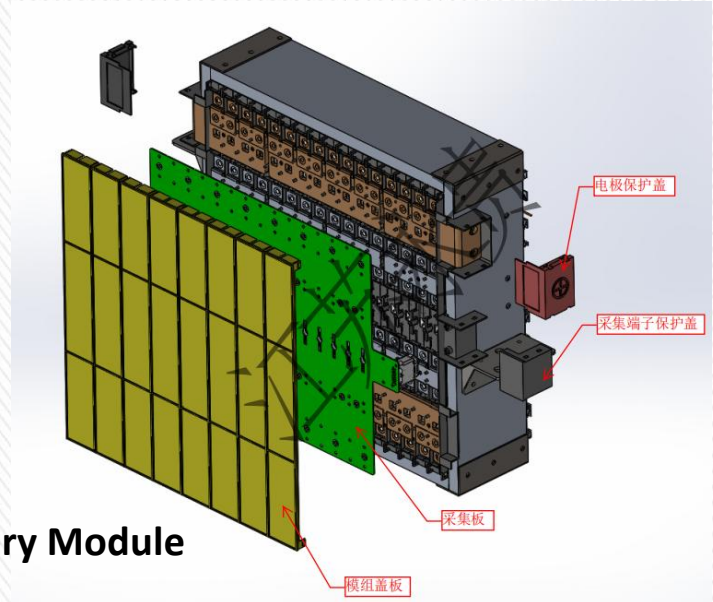
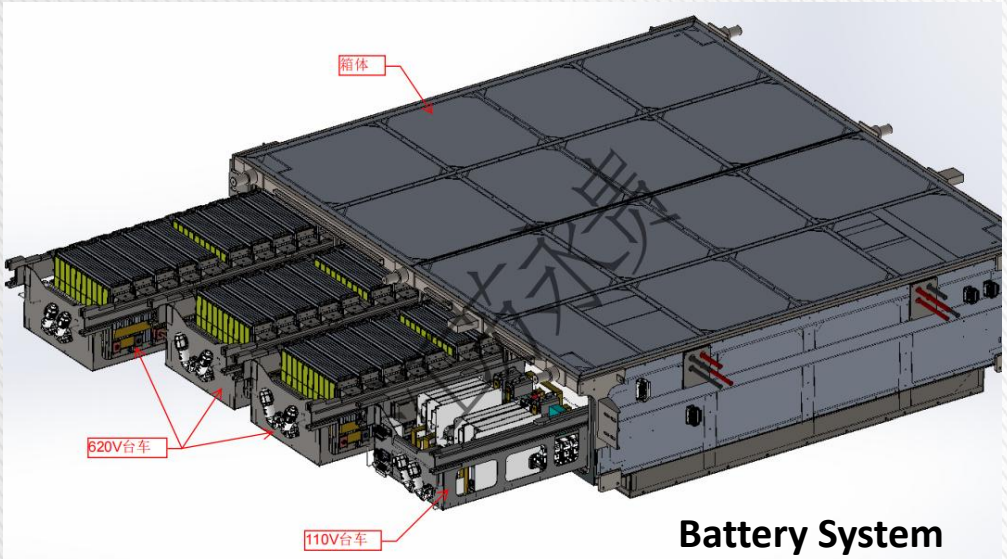
Toshiba battery cell:

Yonggui Lithium-titanate battery system

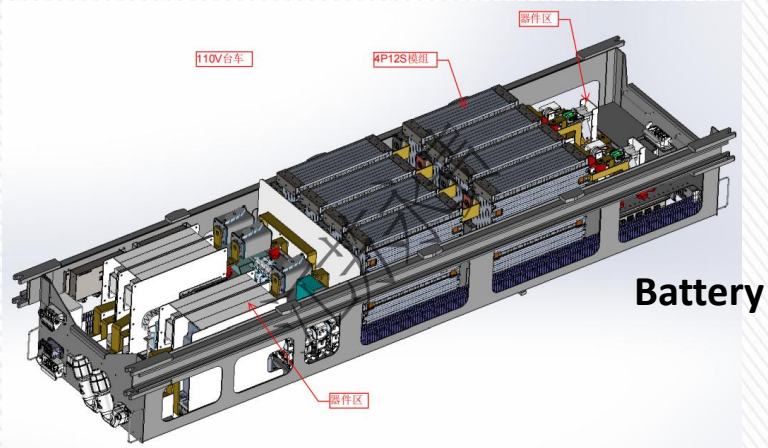




Battery Module



Battery System



Battery trolley

Experimental Center

Experimental Center：1600m²

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

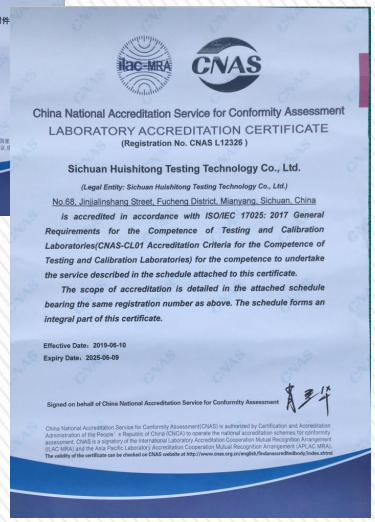
防尘试验箱

拉力试验机

振动冲击试验台

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

Stock name: Yonggui Electric equipment
Stock code: 300351

Individual voltage collection

Real time voltage collection
Individual voltage collection

Battery temperature collection

16 temperature acquisition
Real time reflection of anomalies

Real time battery balancing

Innovative equilibrium algorithm
Individual intelligent balance
Ensure consistency of individual units
Ensure battery level

Fault analysis and warning

Individual voltage too high
Individual voltage too low
Excessive current
Temperature too high

Remaining capacity estimation

Estimated remaining capacity
Predict remaining time

Platform Data Analysis

wireless data transmission
Data statistical analysis
Health status assessment

Core advantages of Yonggui Lithium-titanate battery system

self-healing

- Real time equalization algorithm
- Fix capacity deviation
- Extend service life
- Reduce the probability of failure

Core advantages of Yonggui Lithium-titanate battery system

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

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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

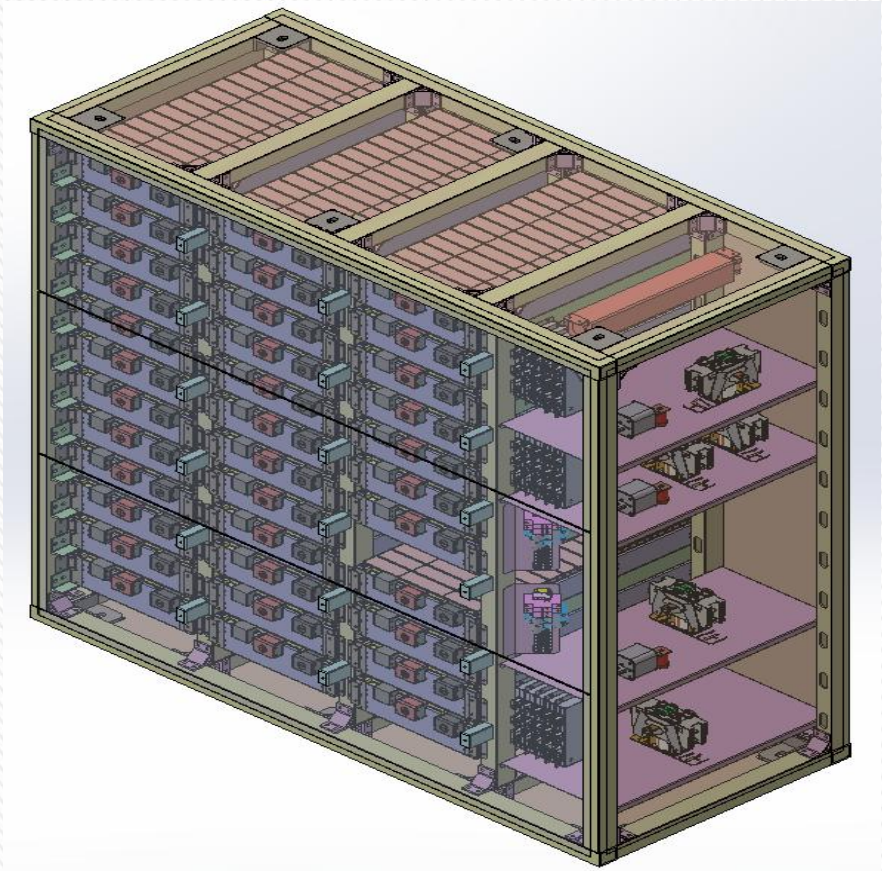
Lithium titanate Battery System of Dusi Line Engineering Vehicle

Stock name: Yonggui Electric equipment
Stock code: 300351

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

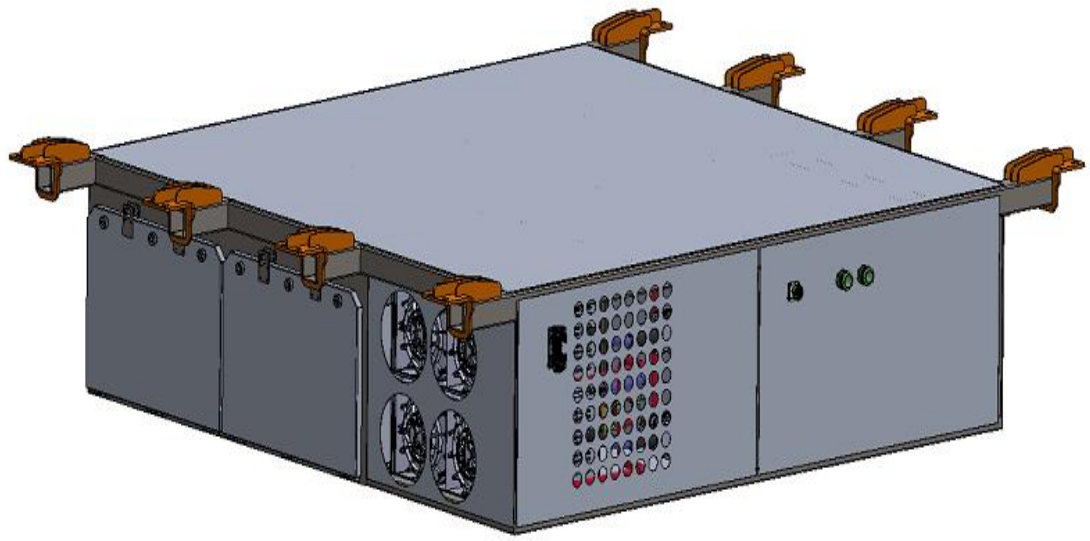


Hydrogen energy intelligent intercity Multiple unit Lithium titanate battery system

Stock name: Yonggui Electric equipment
Stock code: 300351

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

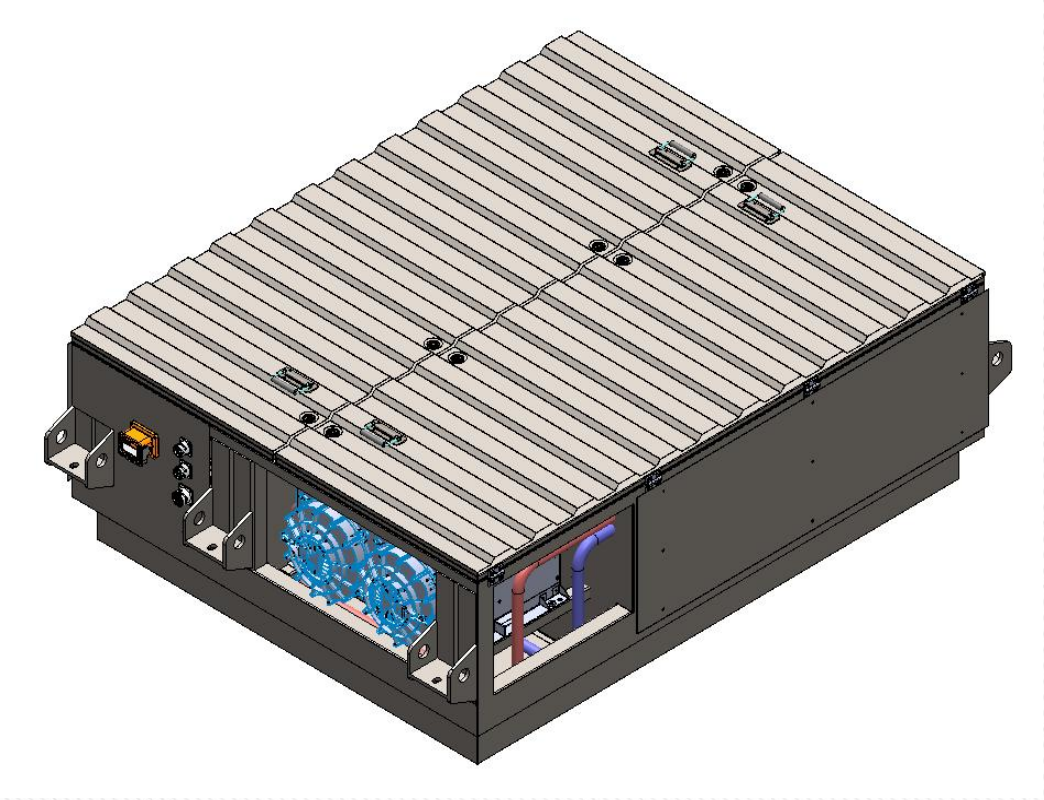


Turpan Tram
Lithium titanate battery system

Stock name: Yonggui Electric equipment
Stock code: 300351

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



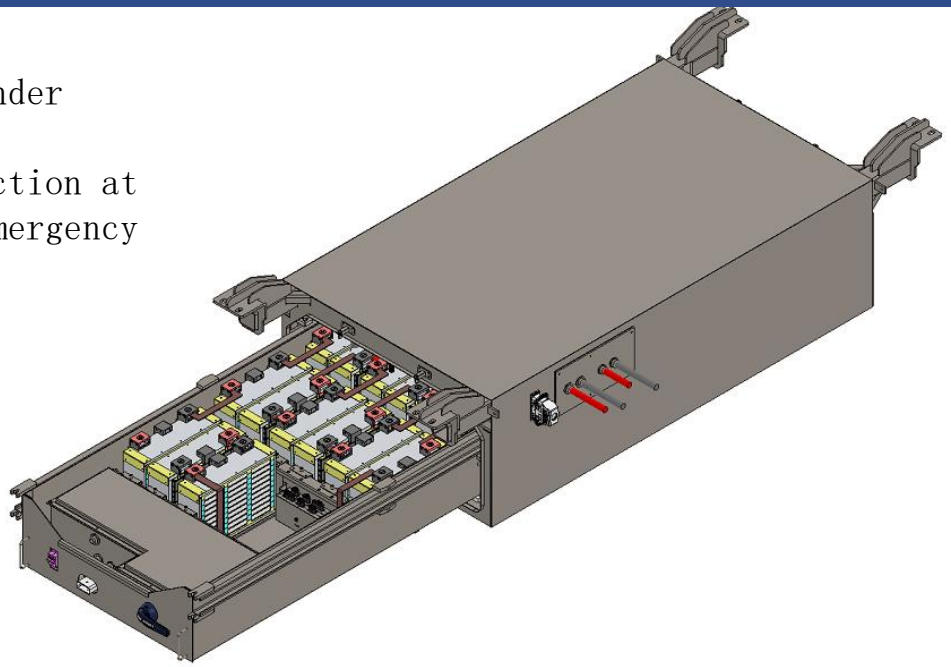
深圳地铁6号线支线钛酸锂电池辅助+应急牵引

Stock name: Yonggui Electric equipment
Stock code: 300351

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

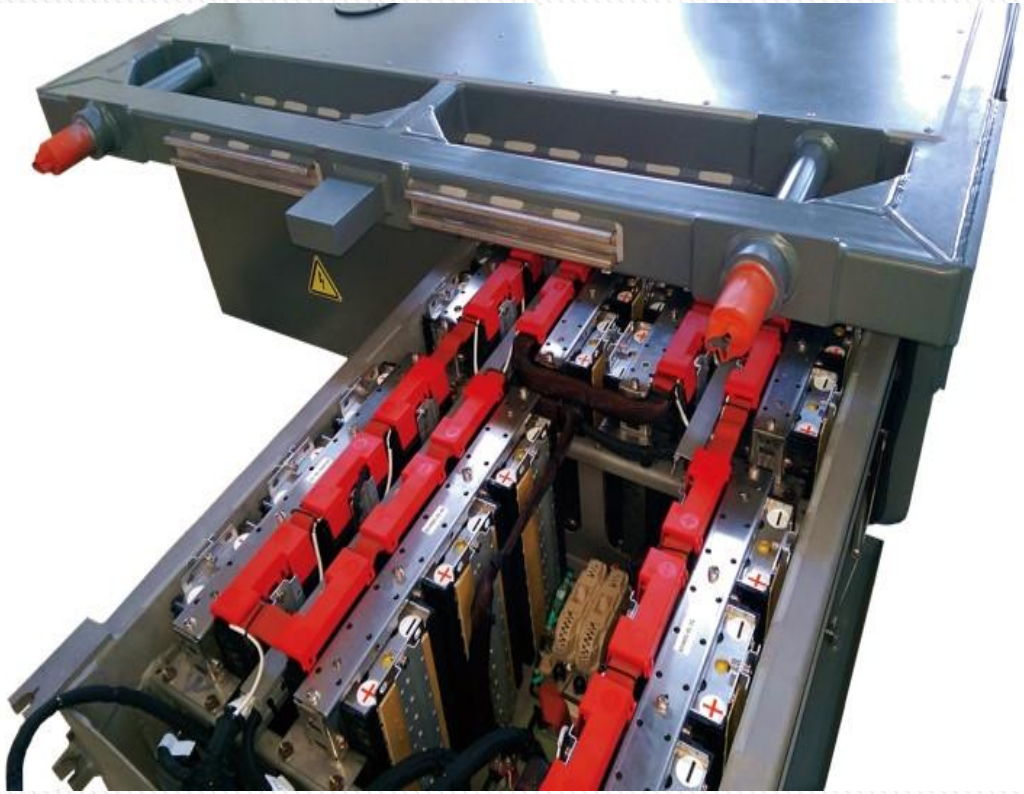


High speed Multiple unit CR400BF Lithium titanate battery system

Stock name: Yonggui Electric equipment
Stock code: 300351

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℃～55℃
Temperature range	3072mm×1711mm×574mm
Size	1550kg



江苏永贵新能源科技有限公司
Jiangsu Yonggui New Energy Technology Co., Ltd.

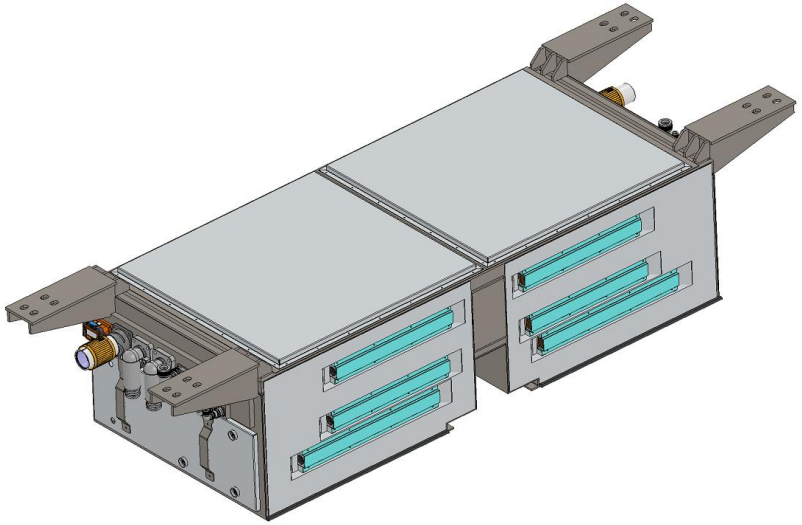
600km high-speed magnetic levitation Lithium titanate battery Auxiliary+emergency suspension

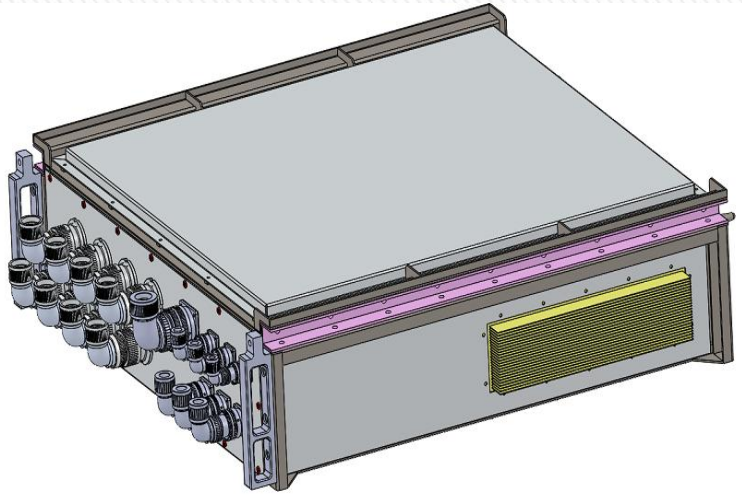
Stock name: Yonggui Electric equipment
Stock code: 300351

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



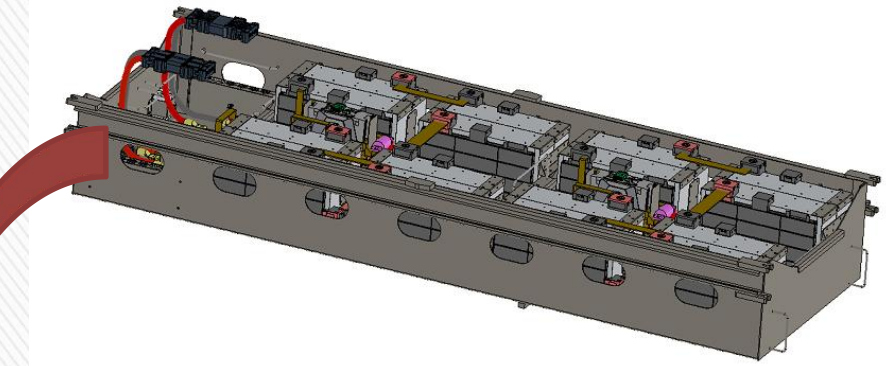


Smart intercity Multiple unit CRH3A Lithium titanate battery system

Stock name: Yonggui Electric equipment
Stock code: 300351

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 10m3/(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℃～55℃



Port application performance

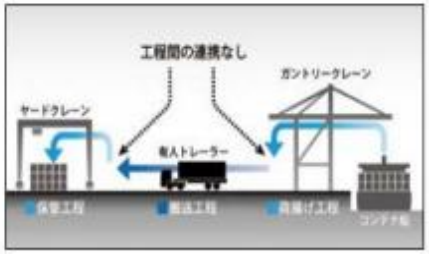
Port performance—AGV

Toshiba SCiB Battery Application Port AGV Project

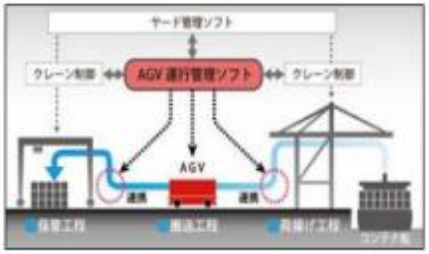
Qingdao Port: the first fully automated wharf in Asia
Qingdao Port Phase I: 38 sets
Qingdao Port Phase II: 45 sets

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



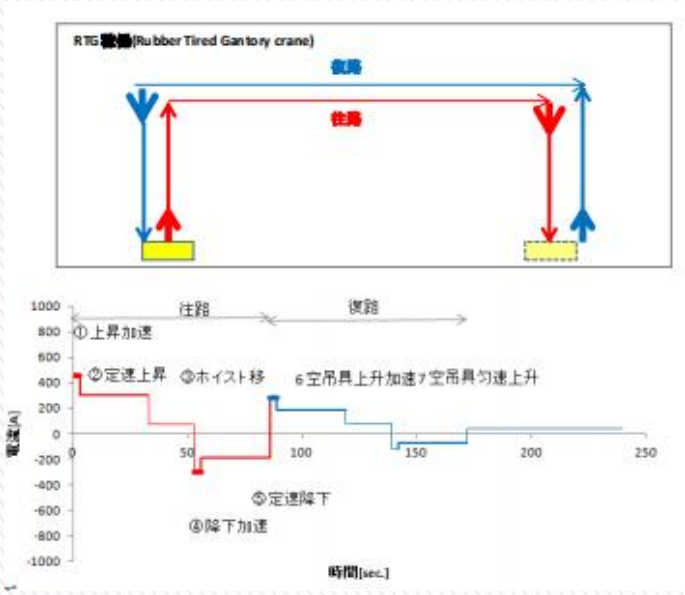
Schematic diagram of container handling at automated terminals

Port application performance

Port performance - tire mounted cranes

Toshiba SCiB Battery Application Port RTG Project

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:

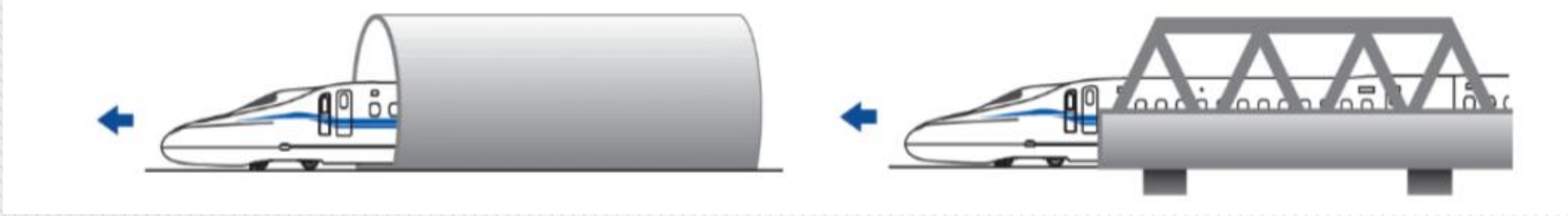
- High safety: currently the safest lithium battery
- Ultra high power: supports continuous 15C and short-term 40C charging and discharging
- Ultra long life: cycle life of 30000 to 100000 times
- Ultra low temperature: supports -40 ℃ discharge, with a discharge capacity greater than 70%
- Ultra high 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



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

YONGGUI

Lithium titanate bus

Lithium titanate bus

Battery comparison

Battery pack type / Performance index	Lithium Iron Phosphate	LITHIUM TITANATE
Safety	High	Extremely high
Cycle life (100% DOD)	3000 times	17000 times
Charging rate	0.25C~1C	Continuous 5C, peak 10C
Discharge rate	2C	Continuous 5C, peak 10C
Charge Temperature	0~55 ℃	-50~55℃
Discharge temperature	-20~55 ℃	-40~55℃
Low temperature discharge capacity	40%	80%
Energy density (Wh/kg)	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℃	-20~55℃	
Gradeability	Strength	Weakness	High discharge rate of Lithium titanate
Life cycle cost	be similar to	be similar to	The initial procurement cost is close to

Service Commitment

Stock name: Yonggui Electric equipment
Stock code: 300351

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.

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






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