microvast™

Thinking Forward Powering Now

Microvast LpTO™
Optimized Li-ion Battery Chemistry
For **Heavy Duty Long Cycle Life Application**

Not Only An Battery Company

Microvast Overview

A R&D Driven Advanced Chemical Company Group

Background

- Vertically Integrated Energy Storage Technology Innovator. Advanced Energy Storage Solution Provider for Grid-Scale Stationary and E-mobility Applications.
- Founded 2006 at Houston, Texas
- 700+ Employees Worldwide

Technology

- Nano Level Material Re-engineering
- Core Patents & Technologies: Ultrafast Responsive & Extended life Advanced Li-ion Battery Solutions
- Dedicated R&D Center with 100+ Staff
- 230+ Patent Pending, 40% Granted

Production

- Full Production Started from 2009
- TS16949 / ISO9001 Certified
- Production History
  - 35 Million Cells Delivered
  - 1200+ EV System Deployed
  - 7 Grid-BESS System Deployed

Microvast Overview
Investor

IFC | World Bank

IFC is private sector investment arm of the World Bank Group and is the world's largest multilateral institution focused on private sector development.

- Industry's top line investor
- Headquartered in Washington, D.C. | offices in 86 countries
- US $18 billion in financing

Ashmore

Based in London, Ashmore is one of the world's leading investment managers dedicated to emerging markets with a history of consistently outperforming the market.

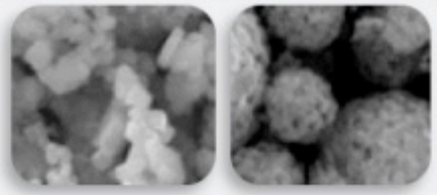
- Top rankings by major rating agencies including Lipper and Standard & Poor's.
- Ashmore manages US$68 billion (at 30 September 2012)

Microvast Overview
Major Milestones

2000
- Founder Started Omex – Nano UF Membrane Technology

2006
- Founder Established Microvast Inc. For Advanced Chemical R&D

2009
- Omex Sold to Dow Chemical, Backbone Of DOW's Water & Process Solutions Division



- Mass Production of LpTO™ Material & Cells

2011

- Delivery E-Car Pack to FAW-Volkswagen
- Delivery E-Bus Packs to China State Grid Fast Charge E-Bus project

- First fleet UltraFast charge E-bus
- Investment From IFC, Ashmore

2012

- HengTong E-bus Joint venture
- UltraFast charge fleet grow to 500
- LpTO™ got into U.S. grid market

- 900 buses and 60million km millstone
- 2nd generation products

2013

2014

- MW Complete BESS FRRS System
- Over 2,000 Packs milestone

Microvast Overview
History Of Technology Superiority – Story of Omex

Omex Environmental

OMEX™ | DOW

Established by same founder at 2000 at Texas. Sold to Dow Chemical at 2006 and became backbone solution for DOW Water & Process Solutions Division

Patented World Leading Technologies:
- Ultrafiltration Membrane (UF)
- Membrane Bioreactor (MBR)
- Electrodionisation (EDI)

Reference: "Dow China buy heralds battle of the giants"
Global Water Intelligence
Vol 7, Issue 7, 2006

Technology In Actions Worldwide

■ Ultrafiltration Water Treatment

Japan	Panasonic	Germany	Infineon
U.A.E	Jumeirah Beach Hotel		
China	Nuclear Station Ultra-pure Water		
	Beijing Olympics Water Treatment		

■ Sea Water Desalination

Israel	Tel Aviv and Ashkelon | World's largest	50% Of Israel's clean water supply
US	Florida, Tampa Bay | Largest in US	10% Of Region's drinking water supply
Australia	Perth | Largest Southern Hemisphere	15% Of Australia's clean water supply
US DOD	Iraq | Frontline Deployed DOD Contract	During Second Iraq war

Microvast Overview
Dedicated R&D, Strong IP Position

230+ Patent Applications

40% granted and growing

45% global applications

70% invention patents

R&D Staff: 100+

Core Patents In:

- Special LTO/NCM/Graphite
- High Performance Separator
- High/Low-Temp Electrolyte

Microvast Overview
Subsidiaries & In-House Vertical Integration

microvast MATERIALS

New Material

Modified LpTO™/Porous Carbon/Special NCM

High-performance electrolyte

High porosity separator

microvast POWER SYSTEMS

Cell to System Development

Battery Cells

Commodity Packs

Packs for Vehicle

HENGTONG A MICROVAST COMPANY

Vehicle Powertrain

E-bus power system

microvast POWER SYSTEMS

Energy Storage

Energy storage/solutions for grid

Microvast Overview
State-Of-The-Art Facilities

Production Facilities

microvast POWER SYSTEMS

microvast MATERIALS

HENGTONG
A MICROVAST COMPANY

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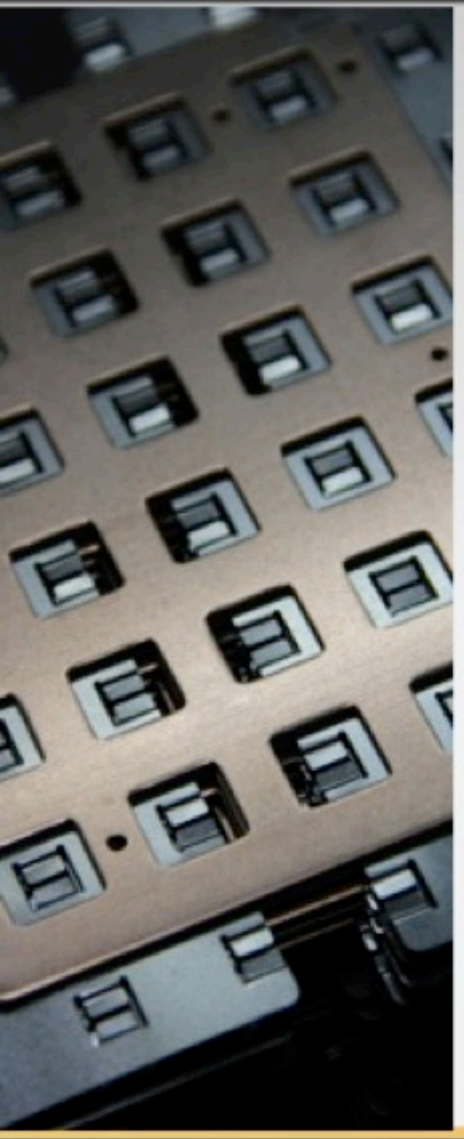
A MICROVAST COMPANY

Microvast LpTO™ Battery Technology
Why LpTO?



Key Characters of LpTO™ Battery

- Ability To Accept Up To 20C High Rate Charge
  - Complete 100% Electric Vehicle Battery Charge **In 5-10 Minutes**
- 20,000 Cycles At High Rate (6CC/6CD) 100% DOD Charge Cycles
  - **10x Longer Life Cycle** Of Any Other Li-ion Battery Choices
- Extra Safety Mechanism Within Chemistry
  - Known To Be The **Safest Chemistry Of Li-ion** Battery Family
- Excellent Capacity Retention At Extreme Temperature
  - Widest Operation Temperature Range **-30°C to +60°C**

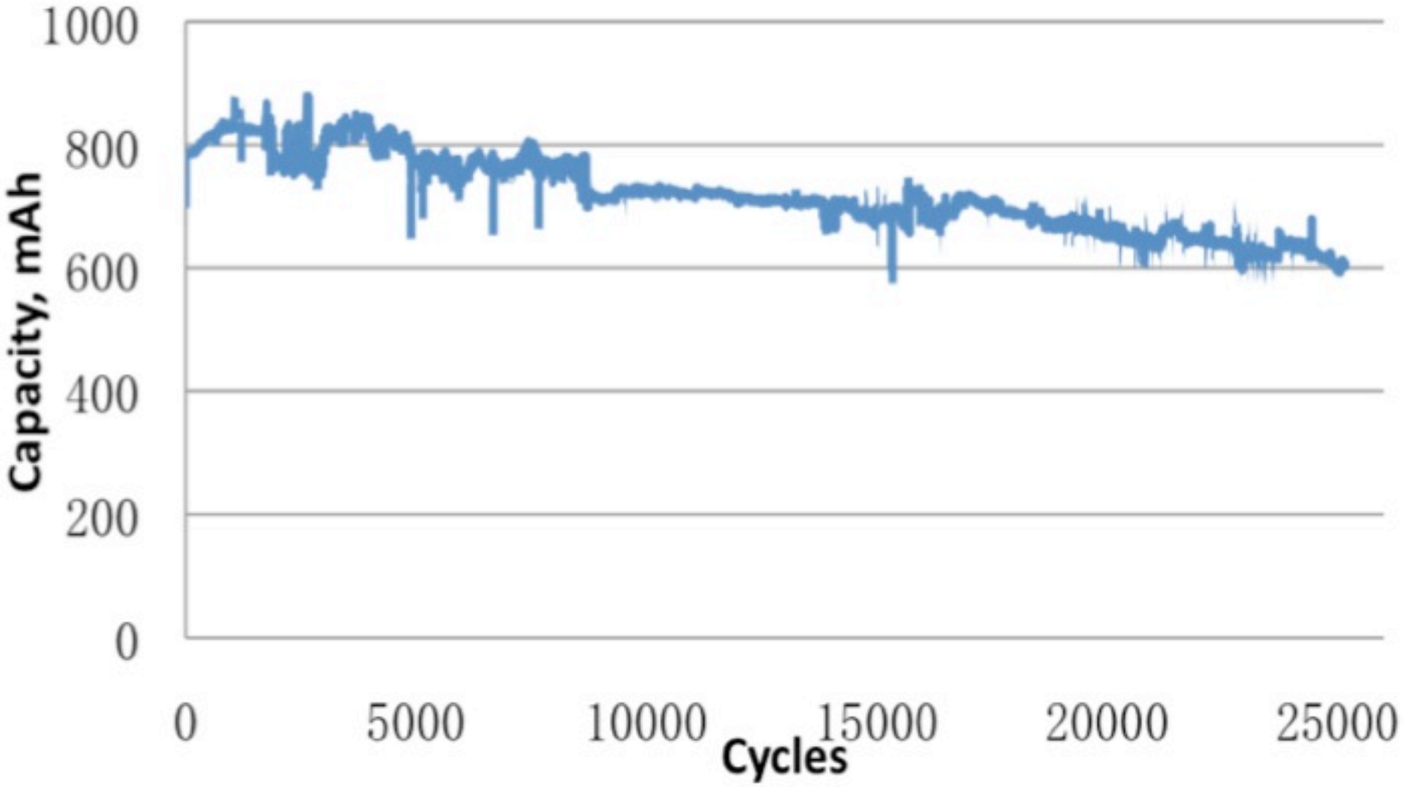
Microvast LpTO™ Battery Technology
Comparison With Other Battery Chemistries

Cell Level Data	LpTO™	LFP	NCM	Ni-Mh	UltraCap
Nominal Voltage	2.3	3.2	3.7	1.2	2.5
Max/Nominal Cell Charge Rate	+20C/+6C	+2C/+0.5C	+1C/+0.2-0.5C	+0.5C/+0.1C	+20C
Max Cell Discharge Rate	-20C	-10C	-3C	-2C	-20C
Max Operating SOC	95%	90%	90%	90%	99%
Min Operating SOC	15%	20%	20%	30%	0%
Typical Cell Energy Density (wh/Kg)	85	110	140	45	5
Typical Cycle Life @ 100% DOD	20,000 (At 6CC/6CD)	2,000	1,000	600	500,000
Temperature Tolerance	Excellent	Good	Fair	Poor	Good
Chemistry Safety Mechanism	Excellent	Poor	Poor	Fair	Mechanical

Microvast LpTO™ Performance

Cycle Life At High Rate Charge/Discharge

NCM/LpTO™ GEN I | 100% DOD, 6CC/6CD Cycle test at 25°C



- Resulted Minimum Gassing
- Cycle life: 25,153 to 78%

Microvast LpTO™ Performance
Superb Safety

- LTO is best-known in the industry to be the Safest Chemistry in Li-ion Battery family
- Excellent Thermal stability (Minimum heat at high rate Charge/Discharge)
- Minimum generation of Lithium Dendrite (Lowest risk of internal short circuits & thermal hazard)

Cell Penetration Tests

NCM

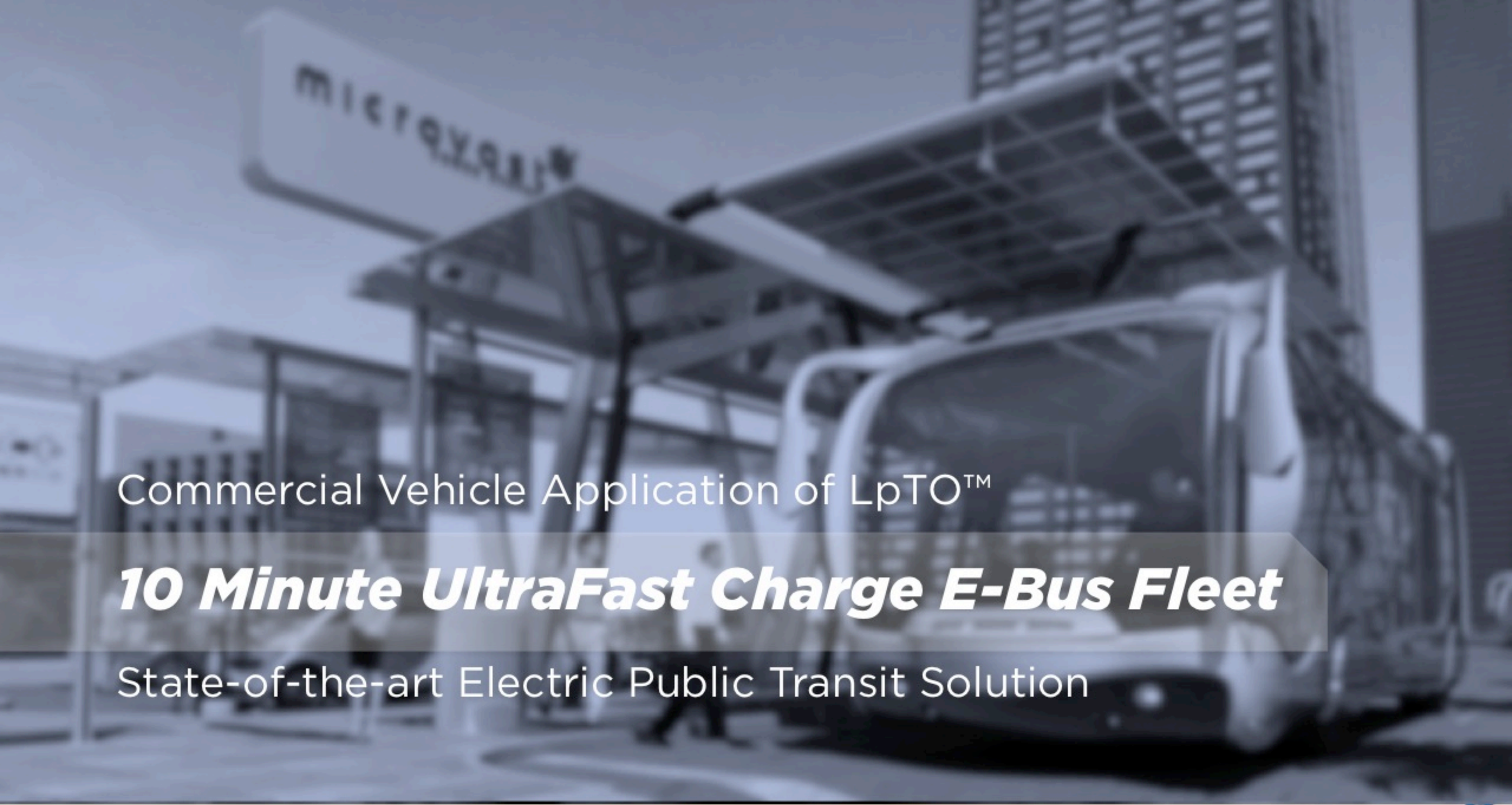
Instant fire & excessive oxygen release, extremely hard to extinguish.

LFP

Fire & toxic gases release.

LpTO™

Minor sparks, no smoke or fire.



Commercial Vehicle Application of LpTO™

10 Minute UltraFast Charge E-Bus Fleet

State-of-the-art Electric Public Transit Solution

LpTO™ Solution For Electric Public Transit

Bus Lifetime Battery Consumption Comparison

	Conventional Battery Electric Bus	Ultrafast Charge LpTO™ Electric Bus
Operation pattern	Operate Throughout Day One Complete Cycle Charge at night	5 Minutes Shallow Charge After Each Loop
Charging Time To Full Capacity	5-8 Hours	5-10 **Minutes**
Daily distance	150miles (15 Loops x 10 Miles Loop)	150miles (15 Loops x 10 Miles Loop)
Drive Battery Pack	411kWh Per Day (1.92kWh/mile 30%-95% SOC)	27.5kWh Per Loop(1.92kWh/mile 30%-95% SOC)
A/C Battery Pack	170kWh (Complete Day)	11.5kWh (One Loop)
Total Battery Pack Per Bus	581 kWh	39 kWh
Battery Pack Life Cycle	<1,500 100%DoD Cycles	>15,000 100%DoD Cycles
Replace	Every 2-3 years	Every 8-10 years
Total Battery Consumption In Vehicle Service Life (16 years)	Change 4 times: **2,324** kWh	Change once: **78** kWh

- Estimation based on study on Maui Bus KAHULUI LOOP ROUTE #5, Maui County, State of Hawaii, US
- Route Fleet: 35ft low floor A/C transit bus
- Route Length: 10Miles per Loop / 15 Loops per day per bus

LpTO™ Field Experience
10 Minutes UltraFast Charge Electric Bus

Microvast put LpTO™ into commercial operation since 2011

April 2011, the first 6 “10 minutes fast-charging electric buses” into operation in Chongqing, P.R.C

LpTO™ Field Experience – 10 Minutes Ultrafast Charge EV
Accumulated 60 million KMs in Commercial Operation

Proven Successes In Commercial Vehicle Sector

- To date, over 1,200 electric buses equipped with LpTO™ batteries are in operation in Asia, Europe and US
- 12 Ultrafast Charging Stations in use or under construction
- Over 2,000 E-Vehicles equipped with Microvast packs to be delivery by 2014 to multiple cities worldwide

Ultrafast Charge Pure Electric Buses powered by Microvast Battery

LpTO™ Field Experience – 10 Minutes Ultrafast Charge EV

Accumulated 60 million KMs in Commercial Operation

Hybrid Electric Buses powered by Microvast Battery Technology

LpTO™ Field Experience
Other Applications

Battery Powered
Tram Battery for CSR

High Speed Rail Braking
Energy Recovery Battery
for CNR

BESS for FRRS Market
in US

Application Case Study:

Chongqing UltraFast Charge Transit Fleet

Chongqing, China | Since April, 2011

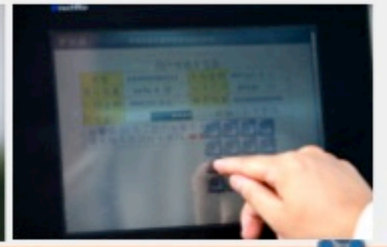
LpTO™ Field Experience – Chongqing, China
10 Minutes UltraFast Charge Electric Bus

The Fleet

- Routes between 20-30 km, 5-10mins ultrafast rapid charge battery back to 100% after each loop
- 70,000 km / per bus traveled | 4,000+ deep cycles charged | 60,000,000 km operational mileage & data accumulated

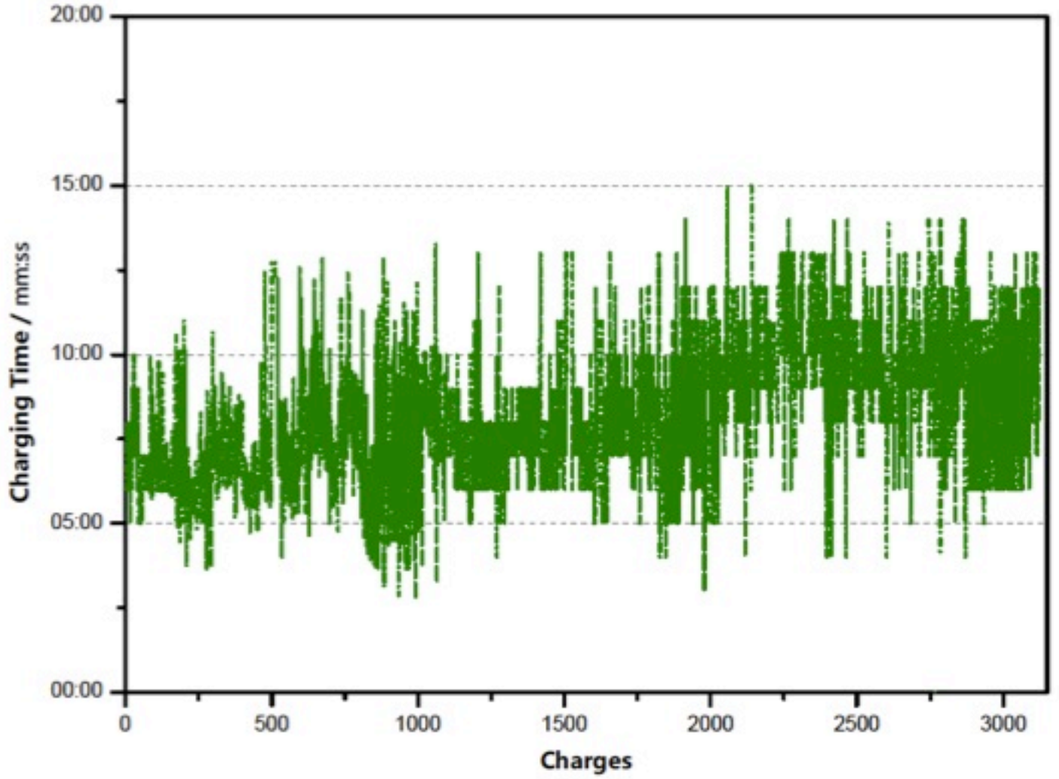
The Charge Station

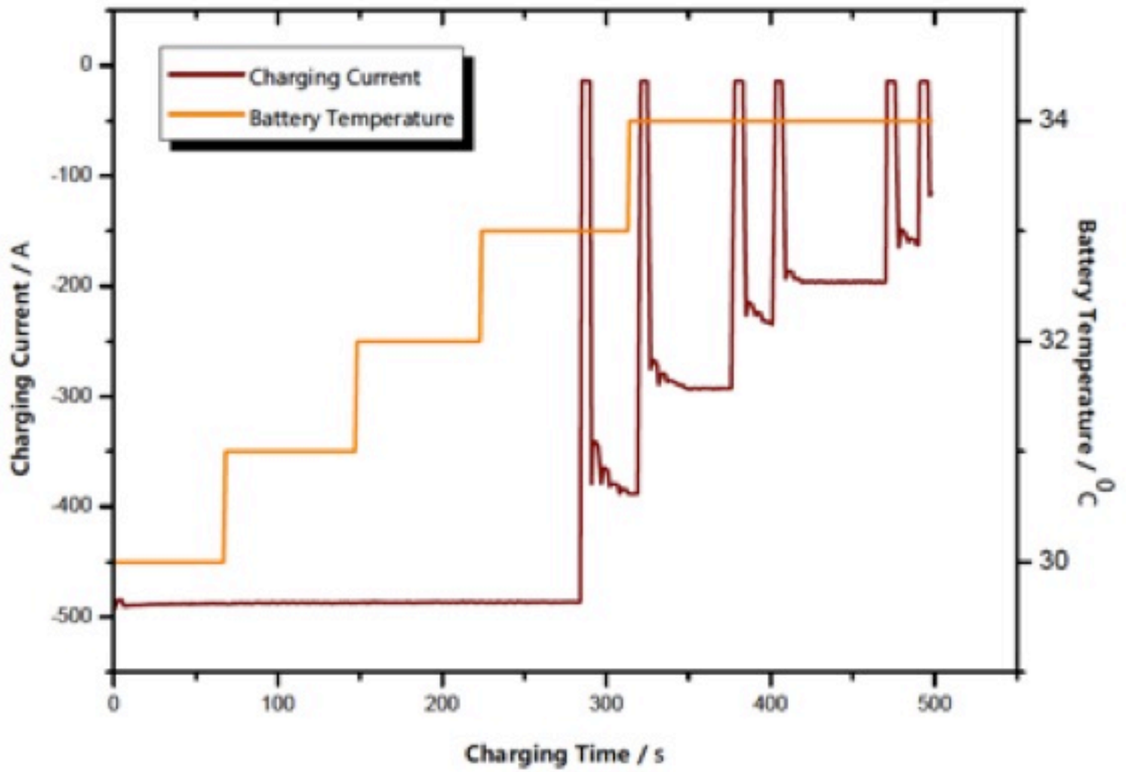
- Invested, Built & Managed by China State Grid
- Each Vehicle Only Take 5-10 Minutes to Charge, Flows Like A Gas Station
- Six 450kW Charge Points Serves 50+ Buses | 1/5 Cost Conventional Charge Station
- ZERO Maintenance Operation



LpTO™ Field Experience – Chongqing, China
Battery Performance & Data

I. Data Collected from bus 62051#, March 2011 - March, 2013 | Accumulated 40,000km and 3,000 deep charges
II. Charging takes approximately 8 minutes from 30% to 100% SOC each time. Temperature rises about 4℃





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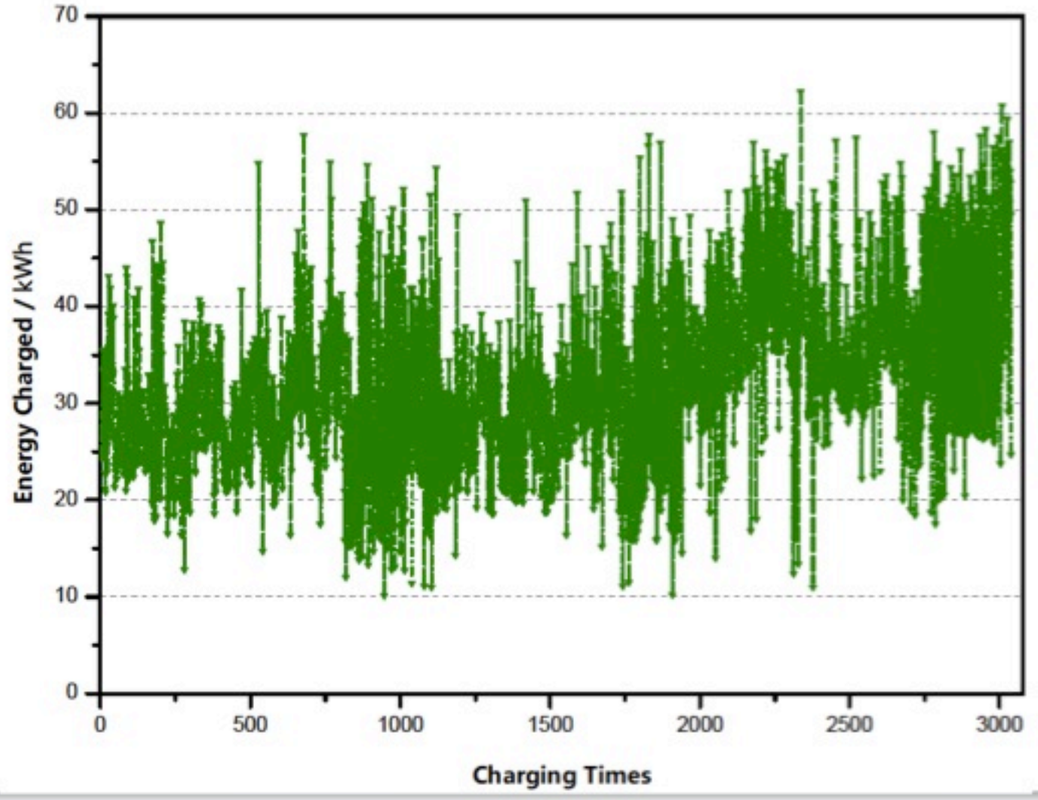
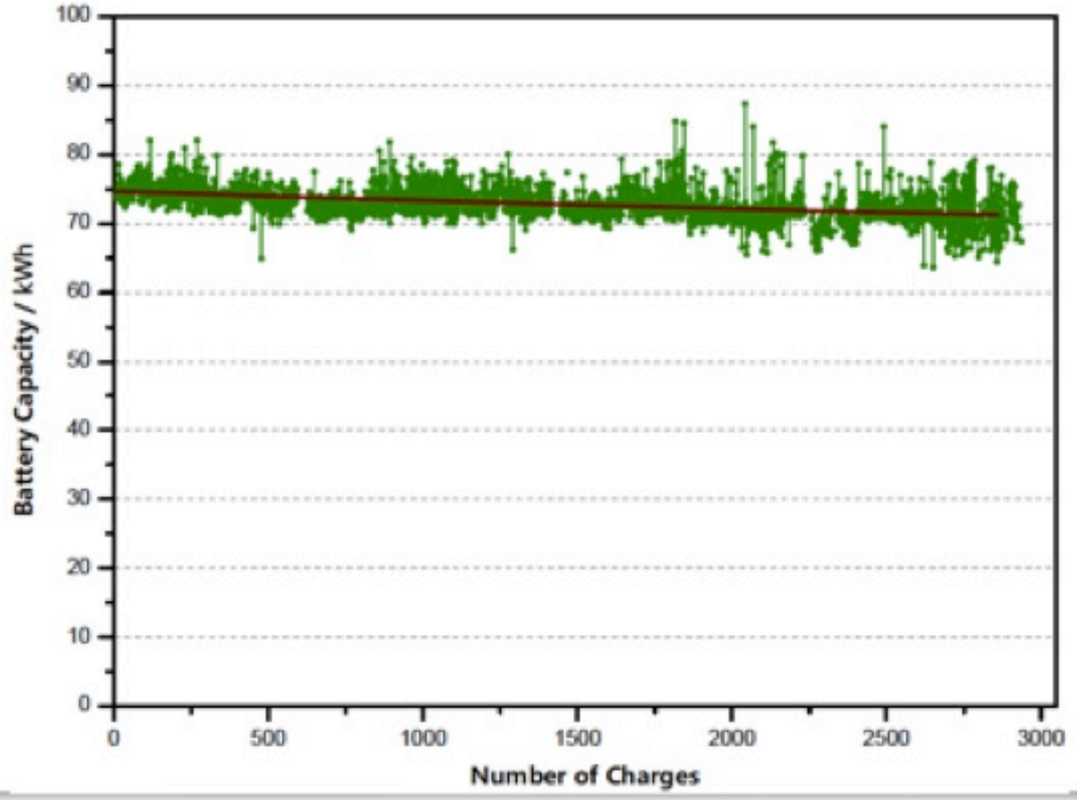
LpTO™ Field Experience – Chongqing, China
Battery Performance & Data

I. Average duration of each charge < 10 minutes, Charge power on average 400kW
II. Each charge between 20kWh to 45kWh
III. Battery Capacity Degradation: < 3% [Newer Fleet After 2012 Battery Capacity Degradation To Date: < 1%]





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Unlimited Potential of LpTO™
Powertrain Solution for Commercial Vehicles

LpTO™ battery solution is prefect for any route-operation based commercial vehicle fleet.

Microvast is capable of providing complete complete powertrain engineering solution for different applications.

Shuttle Bus
Port Truck
Utility Vehicles
School Bus
...

Thinking Forward | Powering Now

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