UWM RESEARCH FOUNDATION **Technology Overview**

Lithium-ion battery self-healing anode with excellent cycle life and low temperature performance

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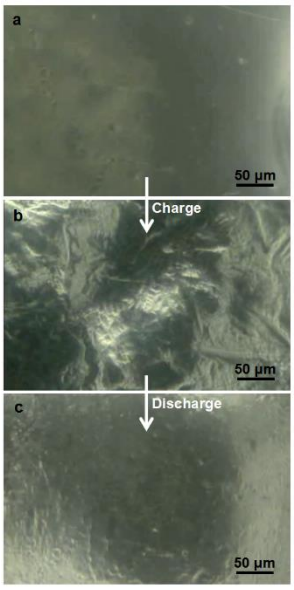
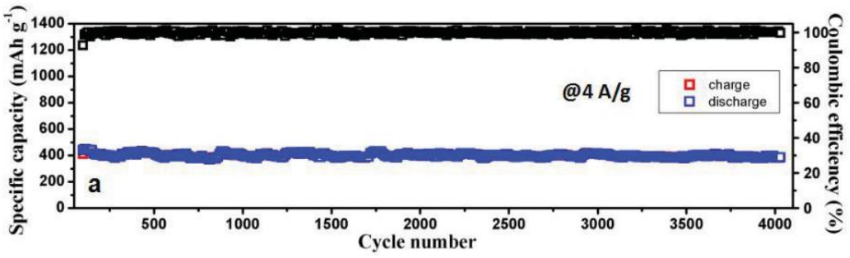


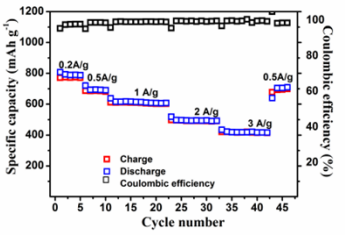
TECHNOLOGY

UWM researchers in the Department of Mechanical Engineering have developed a self-healing liquid metal anode solution with negligible capacity fade and good low temperature performance for lithium-ion battery applications. Utilizing metal alloys to store lithium during battery cycling, this technology can operate at approximately room temperature or below. Specific capacities of 775 mAh/g and nearly 100% capacity retention over >4,000 cycles have been demonstrated.

They key to cycle performance of this technology is the scaffold used in conjunction with the metal alloy nanoparticles that allow cracks from the charge-discharge cycle to be self-healed. Target industries for this technology cover two general industry needs:

1) Applications where a device must operate long term, but the battery cannot be easily replaced.
2) Applications where cold start or cold operation are required. Operating temperatures of approximately -50-30°C are contemplated with this technology.





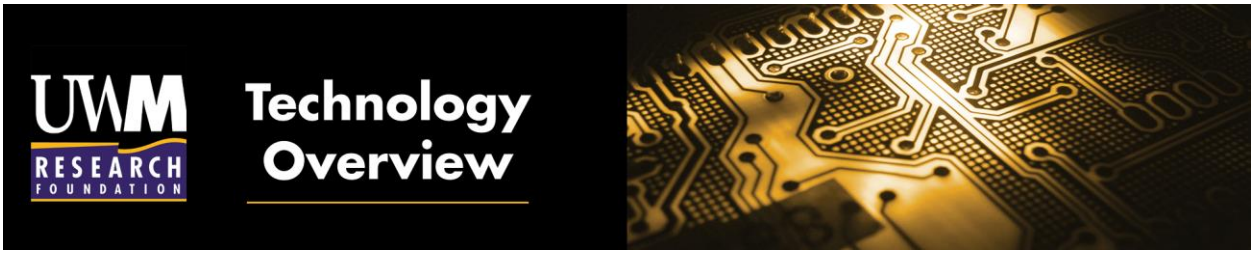
FEATURES/BENEFITS

Self-Healing Anode
Alloy-scaffold combination self heals cracks formed during lithiation

Low Temperature Operation
Suitable metal alloys could operate at temperatures as low as -50°C

Excellent Cycle Life
Negligible capacity fade over at least 4,000 cycles - avoids battery replacement

Greater Capacity Storage
Specific capacities of alloy are 2-3 times greater than commercial graphite anode



INTELLECTUAL PROPERTY

US Utility Patent Pending.

We seek your feedback on this technology. We would welcome the opportunity to further discuss the technology and partnering options that would suit your business needs.

MARKET

Global Market Insights predicts an increase in use of portable electronic devices and electric/hybrid vehicles will drive the lithium-ion battery market from 2016 to 2024. The awareness of carbon-footprint reduction by consumers and regulatory agencies will also help drive battery use growth in the market.

The prognosticators at IDTechEx predict that new battery technology will be needed for the above mentioned portable electronic devices, vehicles, as well as the many other consumer electronics in the marketplace.

These market forces create a favorable environment for this technology to capture a share of the lithium-ion battery market with its advantages over current technology.

PAPER(S):

Wu et al. “A room-temperature liquid metal-based self-healing anode for lithium-ion batteries with an ultra-long cycle life”, Energy Environ. Sci. 10 (2017), 1854–1861.

INVENTORS

Junhong Chen, PhD

Dr. Junhong Chen is a Distinguished Professor of Mechanical Engineering and Materials Science and Engineering at UW-Milwaukee. His research focuses on nanomaterials for sustainable energy and environmental applications. The materials developed in Dr. Chen’s lab are characterized and have been applied to applications including nano-structure-based gas sensors, biosensors, lithium-ion batteries, supercapacitors, solar cells, liquid sensors, and water treatment. Dr. Chen is the director of both the NSF I/UCRC on Water Equipment and Policy and the Laboratory of Nanotechnology for Sustainable Energy and Environment.

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