FLOW-ASSISTED ZINC ANODE BATTERIES FOR GRID-SCALE ELECTRICITY STORAGE

Prof. Sanjoy Banerjee, banerjee@che.ccny.cuny.edu
CUNY Energy Institute (NY) and Ultralife Battery Corp (NY)

MnO_2-ZN BATTERY COST ~$100KWH

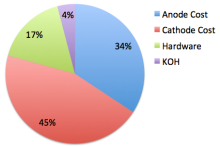
The CUNY EI is improving the cycle life of a proven chemistry through advanced materials characterization and novel control strategies

Rechargeable Alkaline Battery
Pasted Zn: control dendrites
Pasted MnO_2: make rechargeable

Advantages
Low-cost, Safe, non-toxic
Easy to fabricate and recycle
Modular

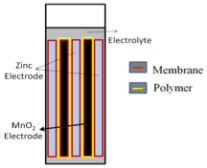
Innovations
Membrane
Polymer
Electrode composition
Operations

<$100/kWh



Battery

120 Wh/lt

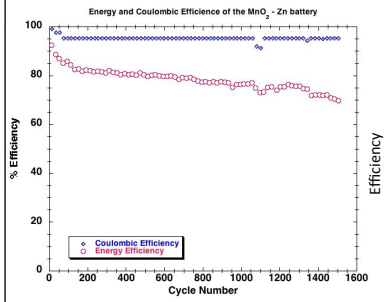


ZN-MNO_2 BATTERY PERFORMANCE

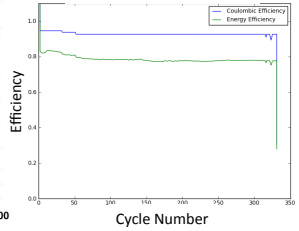
Performances
> 5 times the cycle life of a Pb-Acid battery
< 1/4 $/kWh cost of a Pb-Acid battery
< 1/16 $/kW cost of a Pb-Acid battery

Progress
Sept 2011: 700 cycles
Feb 2012: 950 cycles
August 2012: 1500 cycles

C-Rating Performances
C: 94% capacity 80% efficiency
2C: 94% capacity 75% efficiency



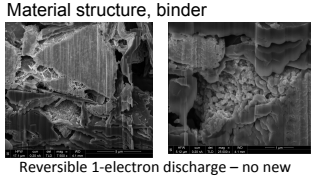
1C discharge rate



MNO_2-ZN CHARACTERIZATION

Operations and materials are improved through advanced in-situ characterization in collaboration with Brookhaven National Lab

Pasted MnO_2: Phase control, Material structure, binder

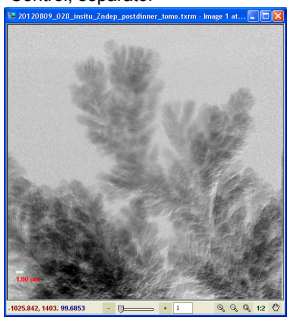


Reversible 1-electron discharge – no new phase formed

In-Situ

Full scale

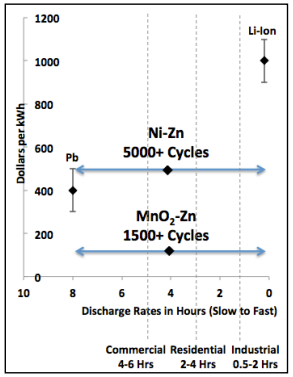
Pasted Zn: Dendrite Control, separator

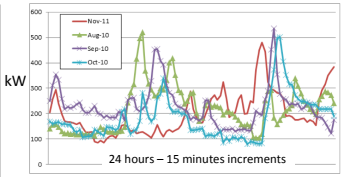


Zn-Metal deposition

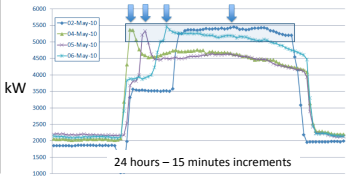
GRID APPLICATIONS (100KWH – 500MWH)

MnO_2-Zn technology meets the discharge requirements of grid-scale applications





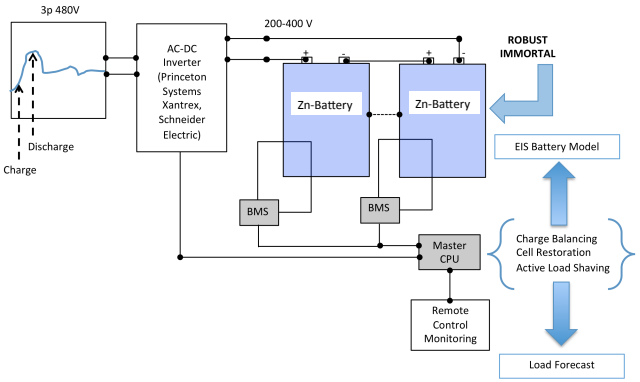
Industrial load (<1 hour)



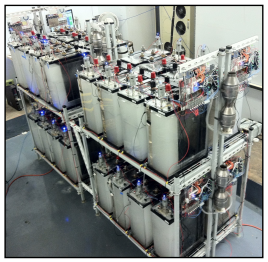
Commercial/T&D deferral (>4 hours)

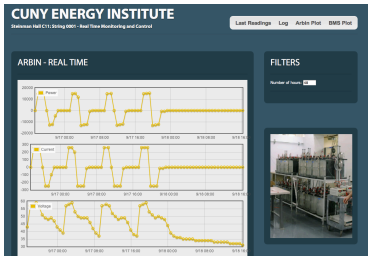
GRID-CONNECTED SYSTEM

The CUNY EI is developing and testing hardware/software systems for peak shaving applications in commercial and industrial buildings



30KWH DEMONSTRATION





30KWh Ni-Zn Battery System demonstrates urban demand charge reduction at a CUNY Energy Institute

Ni-Zn will be integrated with MnO_2-Zn in 2013

100+ Cycles
> 90% Columbic Efficiency
> 80% Energy Efficiency

Commercialized by Urban Electric Power
http://string0001.uepinc.com