Electroville: High-Amperage Storage Device
Energy Storage for the Neighborhood

Liquid Metal Battery

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Purpose:

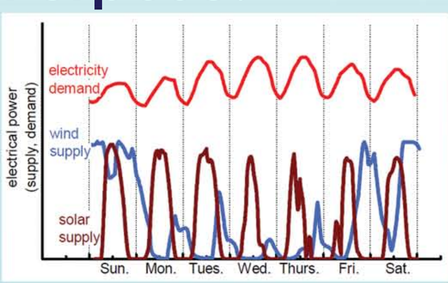

Figure 1. Intermetiency of renewables limits market penetration

Grid Scale Energy Storage
Storage is a key enabler for wind and solar renewable energy sources

Key Requirements
1. Cost (< $300/kWh)
2. Lifespan (> 10 years)
3. Enery efficiency (> 80%)

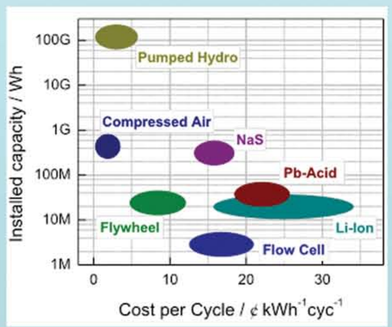

Figure 2. Storgae must be <10 cents per kWh to be competitive

Figure 3. Aluminum potline

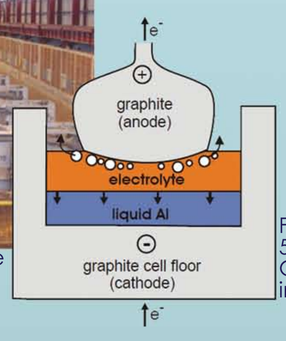

Figure 4. Aluminum Smelter 500,000A, 4V, MW per cell Gas produced at anode, irreversible process

New Approach
Begin with an energy intensive process

Technology:

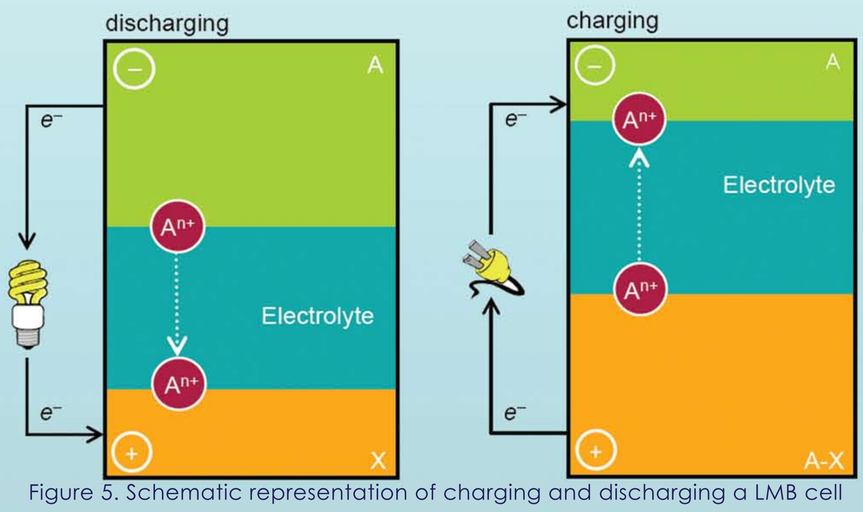

Figure 5. Schematic representation of charging and discharging a LMB cell

Liquid Metal Battery
Electropositive Metal A
Molten Salt Electrolyte
Electronegative Metal X

An energy intensive, but ***reversible*** process

Liquid-liquid interfaces are kinetically the fastest in all of electrochemistry
low activation overvoltage

All-liquid construction eliminates any reliance on solid-state diffusion
long service life

All-liquid configuration is self-assembling
scalable at low cost

Results:

Typical Cell Performace
99% current efficiency
70% energy efficiency
$100/kWh active material cost
4hr discharge time

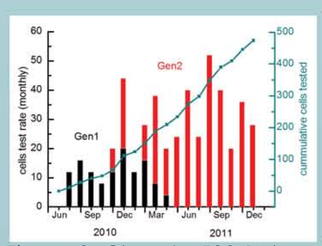

Figure 9. Close to 500 1Ah cells have been tested to date.

Figure 10. 130 20Ah cells have been tested to date.

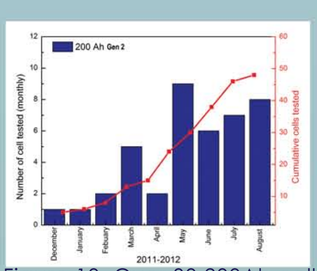

Figure 10. Over 30 200Ah cells have been tested to date.

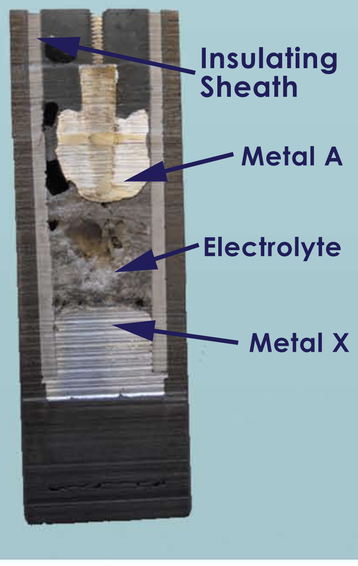

Figure 7. Cross section of prototype 1Ah cell.

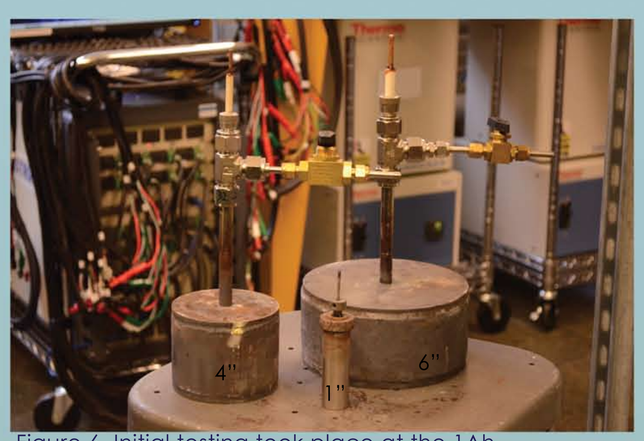

Figure 6. Initial testing took place at the 1Ah scale (center). Cells have now been scaled to 20Ah and 200Ah (left & right).

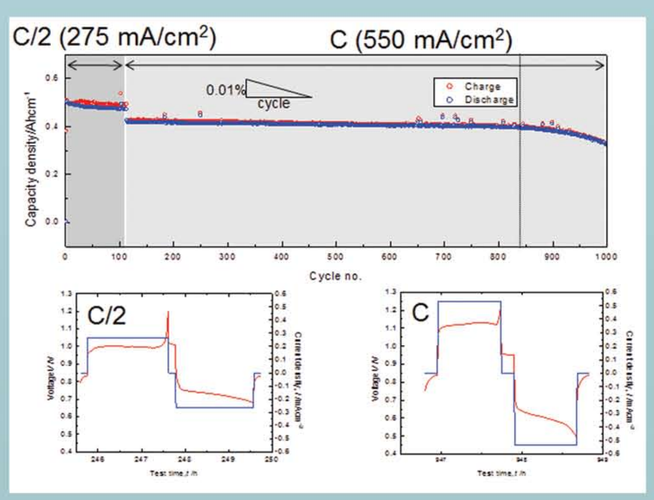

Figure 8. 1Ah cells have demonstarted long cycle life at high rate. Discharge capacity over 1000 cycles (top) and typical charge / discharge curves for rates of C/2 (left) and C (right).

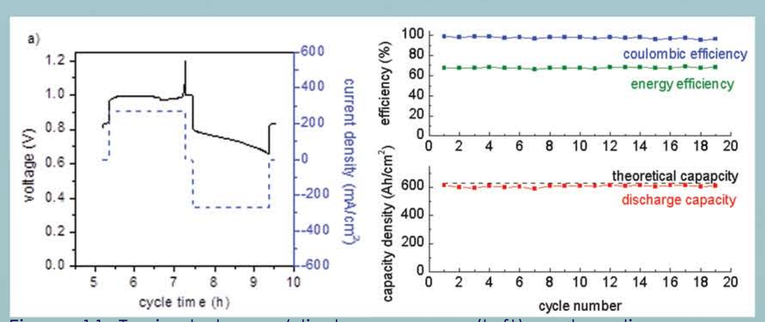

Figure 11. Typical charge/discharge curve (left) and cycling performance (right)of a 1Ah cell.

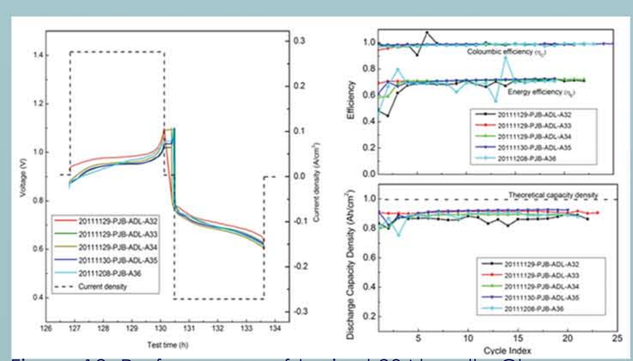

Figure 12. Performance of typical 20Ah cells. Charge discharge curves (left) and cycling data (right)