Design and Process Evolution for Enabling Lead Technologies

Perry Kramer

AVP of Technology

AGENDA

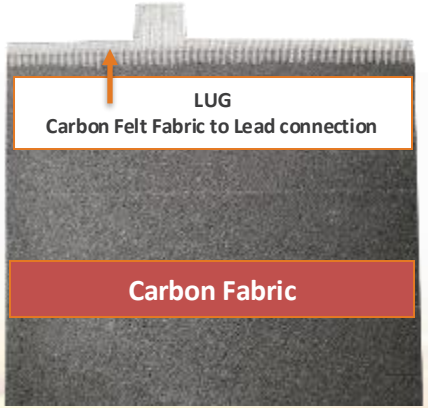
- **ArcActive**
  - 3 Design, Process and Test Phases
  - Prototype Results
  - Current Status
- **Bi-Polar Technology**
  - 3 Design, Process and Test Phases
  - Prototype Results
  - Current Status
- **Conclusion**

THE INVENTION

CARBON FIBER-BASED ELECTRODE

ARCACTIVE

Concast Negative Grid



ArcActive Negative Current Collector

- Durable Dynamic Charge Acceptance "DCA"
- Low Waterloss
- Reduced Mass
- Increased Electrolyte

PHASE 1 OF 3

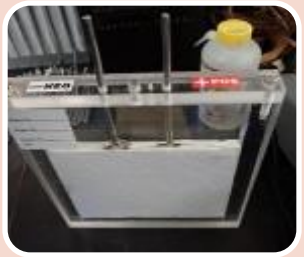
ARCACTIVE

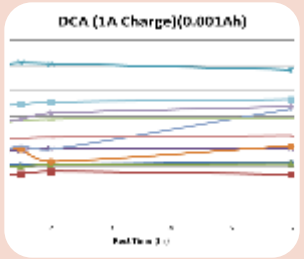
TRL 2*

MRL 2*

*TRL = Technology Readiness Level

*MRL = Manufacturing Readiness Level





Design

Minimal complexity

Quick Turnaround

Process

Manual

Low Volumes

Testing

Inexpensive circuits

Many variables

# of Samples

High

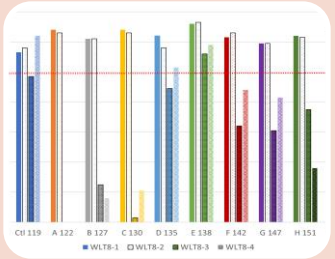
Low

PHASE 2 OF 3

ARCACTIVE

TRL 3

MRL 4



Design

Full Single Cells

Built in lab

Process

Continuous

Medium volumes

Testing

Application specific

Many variables

# of Samples

High

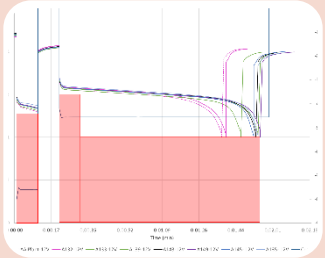
Low

PHASE 3 OF 3

ARCACTIVE

TRL 4

MRL 6



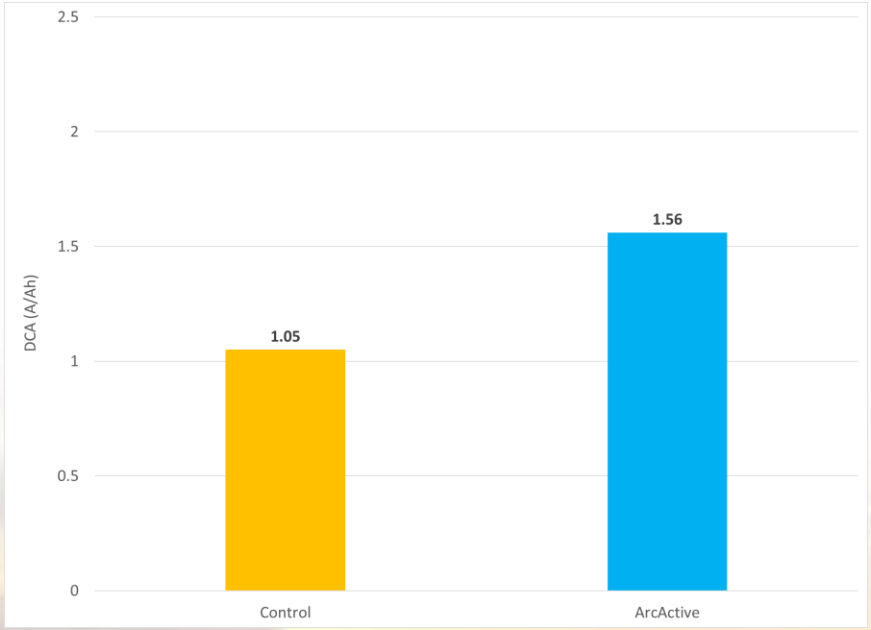
Design	Process	Testing
12V batteries Plant built	High speed continuous pasting Large volumes	Customer specific Many samples

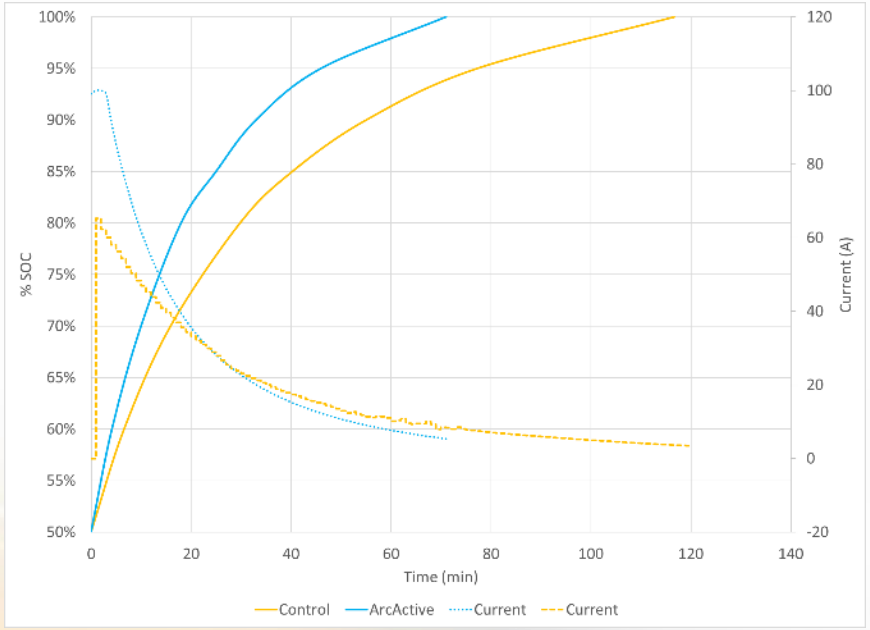
# of Samples

High

Low

CHARGE ACCEPTANCE

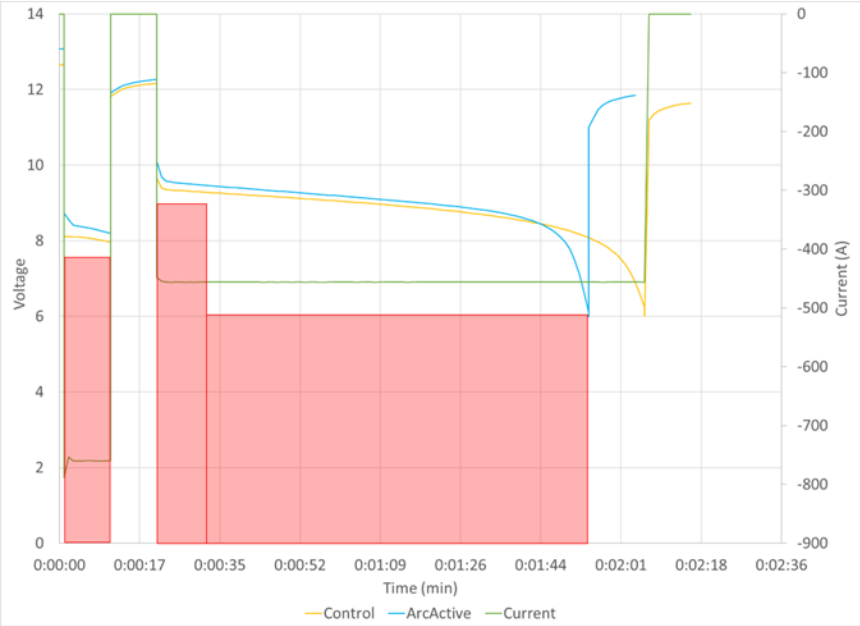




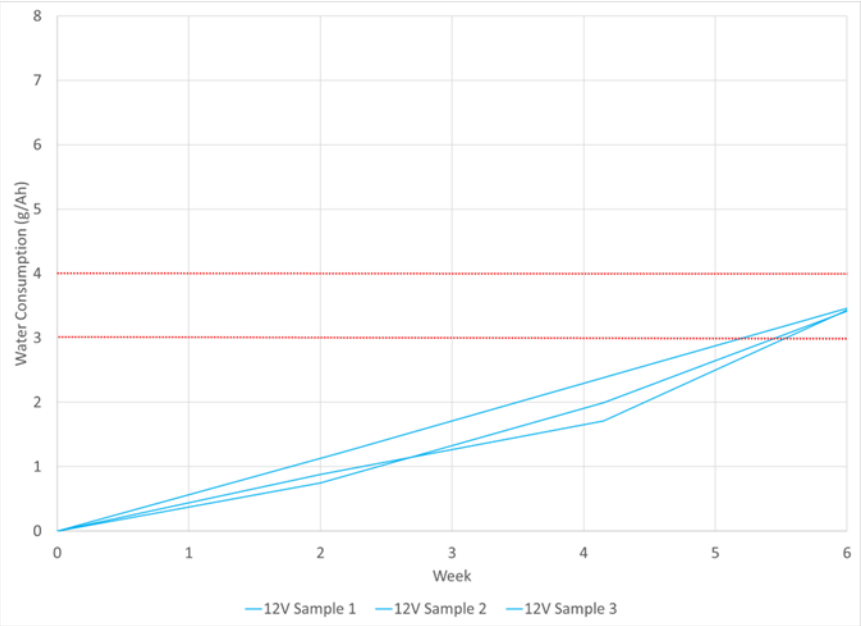
Dynamic Charge Acceptance:
Run-in WLTC Performance

Charge Recovery:
Recharge V/I from 50%SOC @ 25ºC using 100A/14.3V limits

COLD CRANK AND WATER CONSUMPTION



EN Cold Crank
760A/456A @ -18ºC

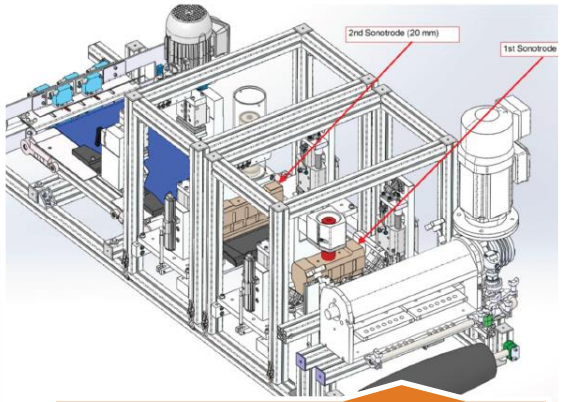


EN Water Consumption

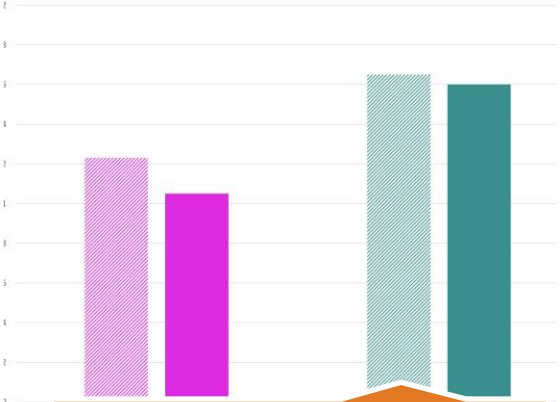
STATUS

ARCACTIVE

Developed EFB and AGM Technology



Improved pasting line capability

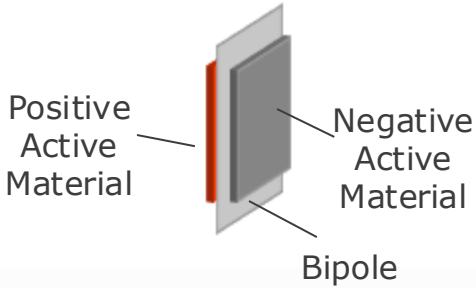


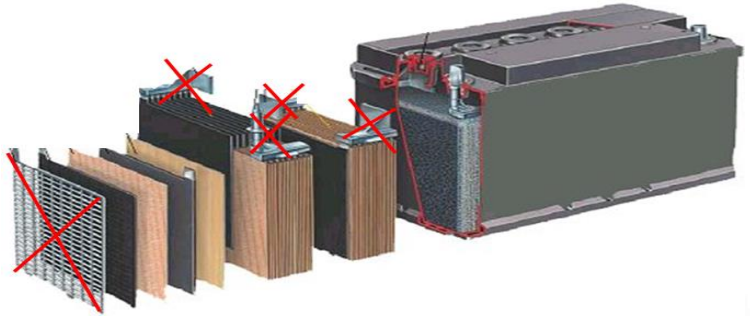
Increased charge acceptance in both hybrid and EV charging tests

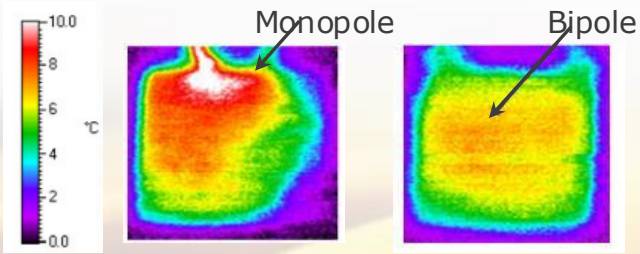
Manufacturing Readiness Level	MRL – 6
Technology Readiness Level	TRL – 4

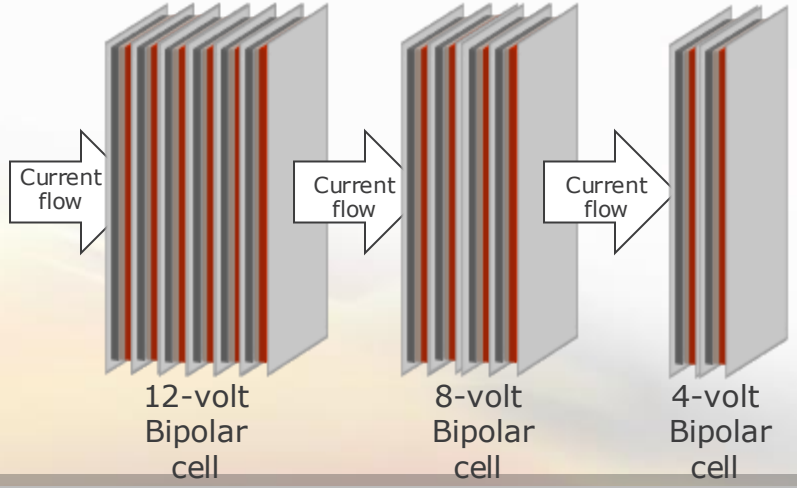
Bi-Polar Technology

TECHNOLOGY OVERVIEW









PHASE 1 OF 3

TRL 2

MRL 2

Design

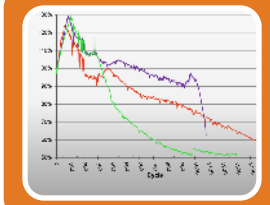
12V Battery

Epoxy

Process

Epoxy seal

Machined plastic



Testing

2HR 100% DoD

# of Samples

High

Low

PHASE 2 OF 3

TRL 3

MRL 3

Design

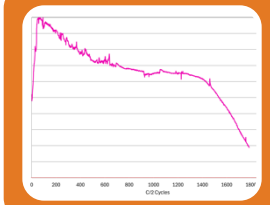
24V Battery

Machined and injection molded parts

Process

Vibrasonic welding

Single cell sealing



Testing

2HR 100% DoD

# of Samples

High

Low

PHASE 3 OF 3

TRL 4

MRL 4

Design

24V Battery

Machined and injection molded parts

Process

Laser/hot plate welding

Pilot Line

Testing

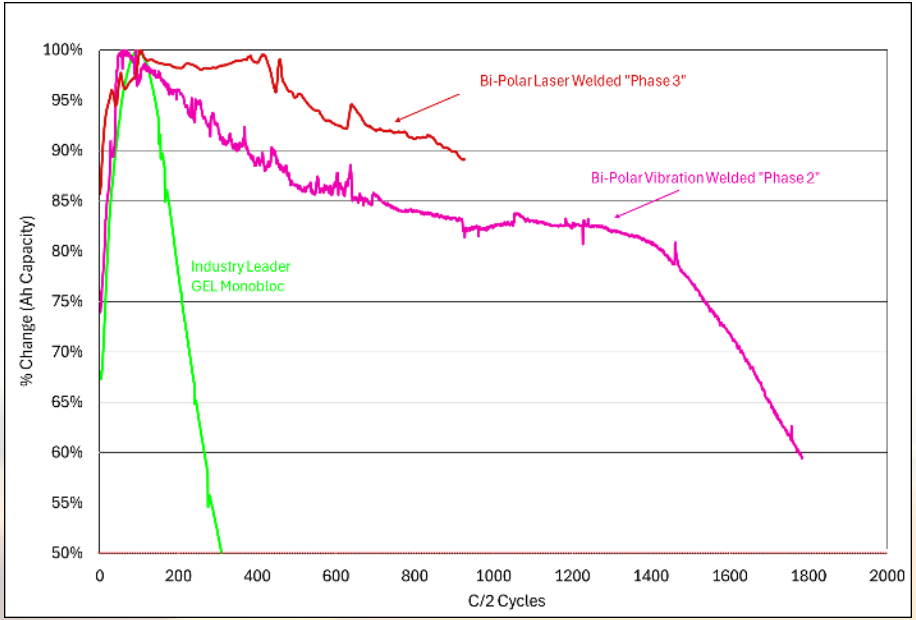
2HR 100% DoD

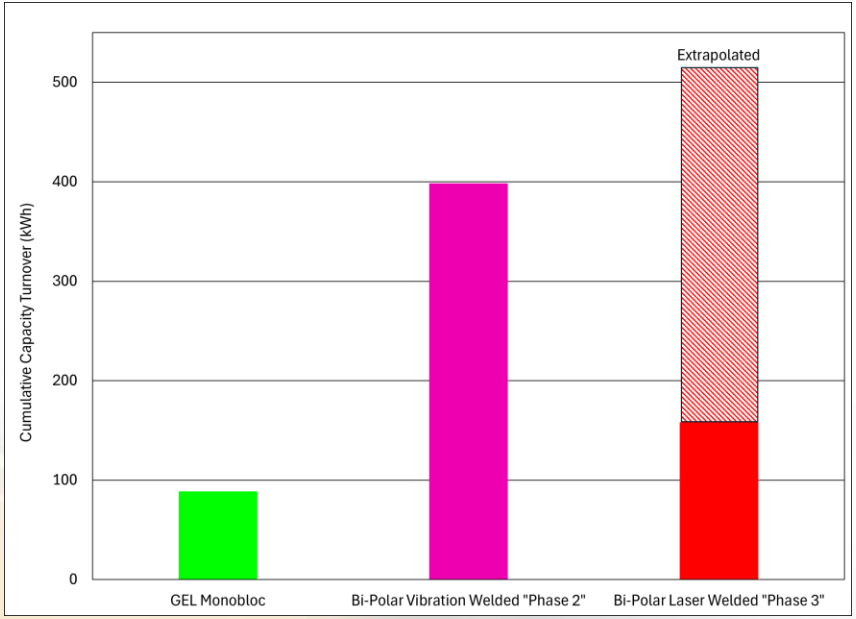
# of Samples

High

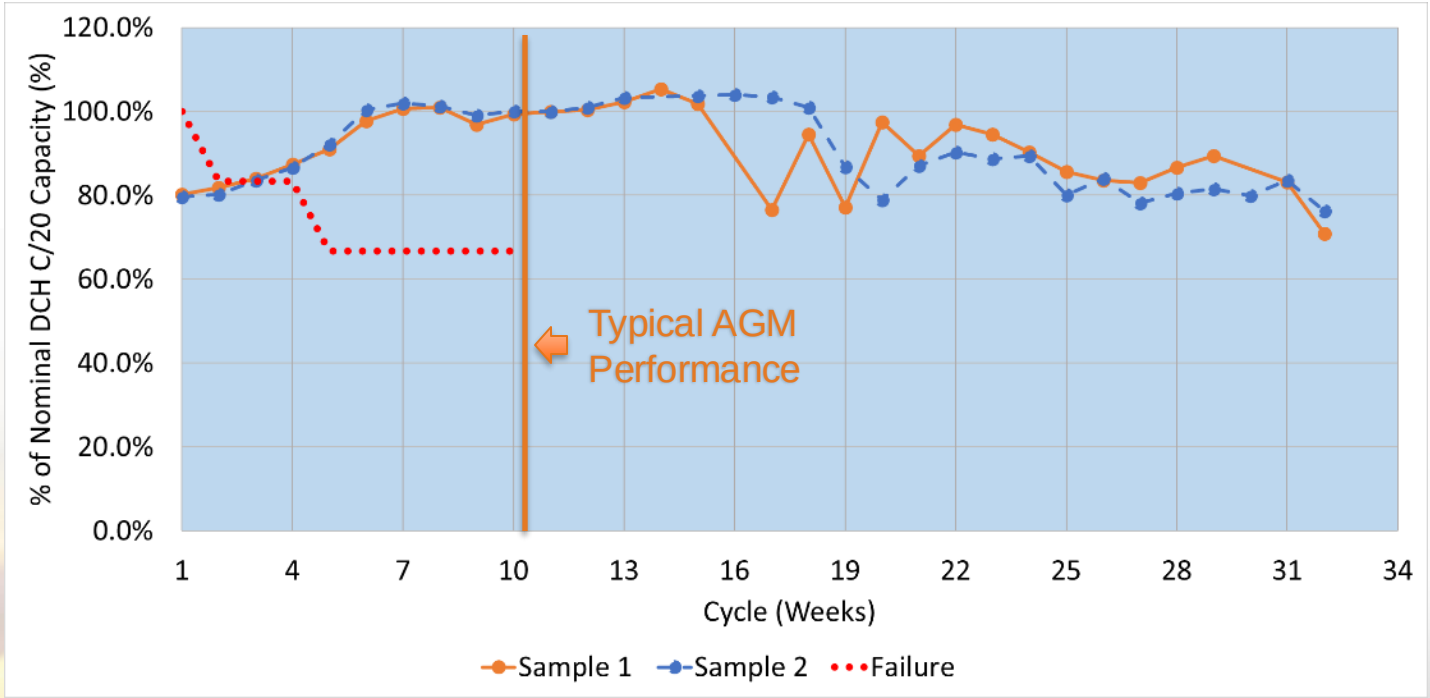
Low

100% DOD 2HR CYCLE LIFE



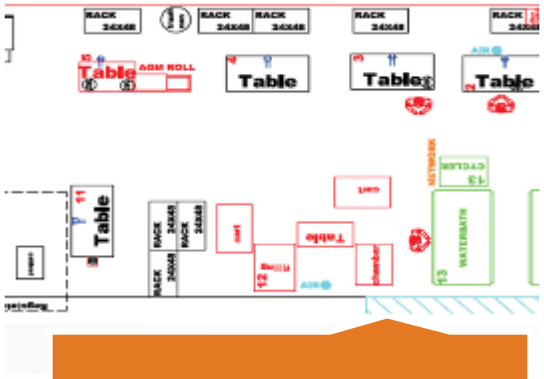


REPETITIVE OVER DISCHARGE TEST (ROD)



STATUS

24V Energy Prototypes



Efficient Pilot Line

Exceptional Cycle Life and Endurance

Manufacturing Readiness Level	MRL – 4
Technology Readiness Level	TRL – 4

CONCLUSION

ARCACTIVE

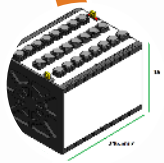
EFB

AGM

AUX

Bi-Polar

24V



48V

Form Factor

Next Step: Customer Samples

THANK YOU

Perry Kramer, Assistant VP of Technology
Email: pkramer@dekabatteries.com
http://dekabatteries.com