

BLACK DIAMOND  
STRUCTURES™



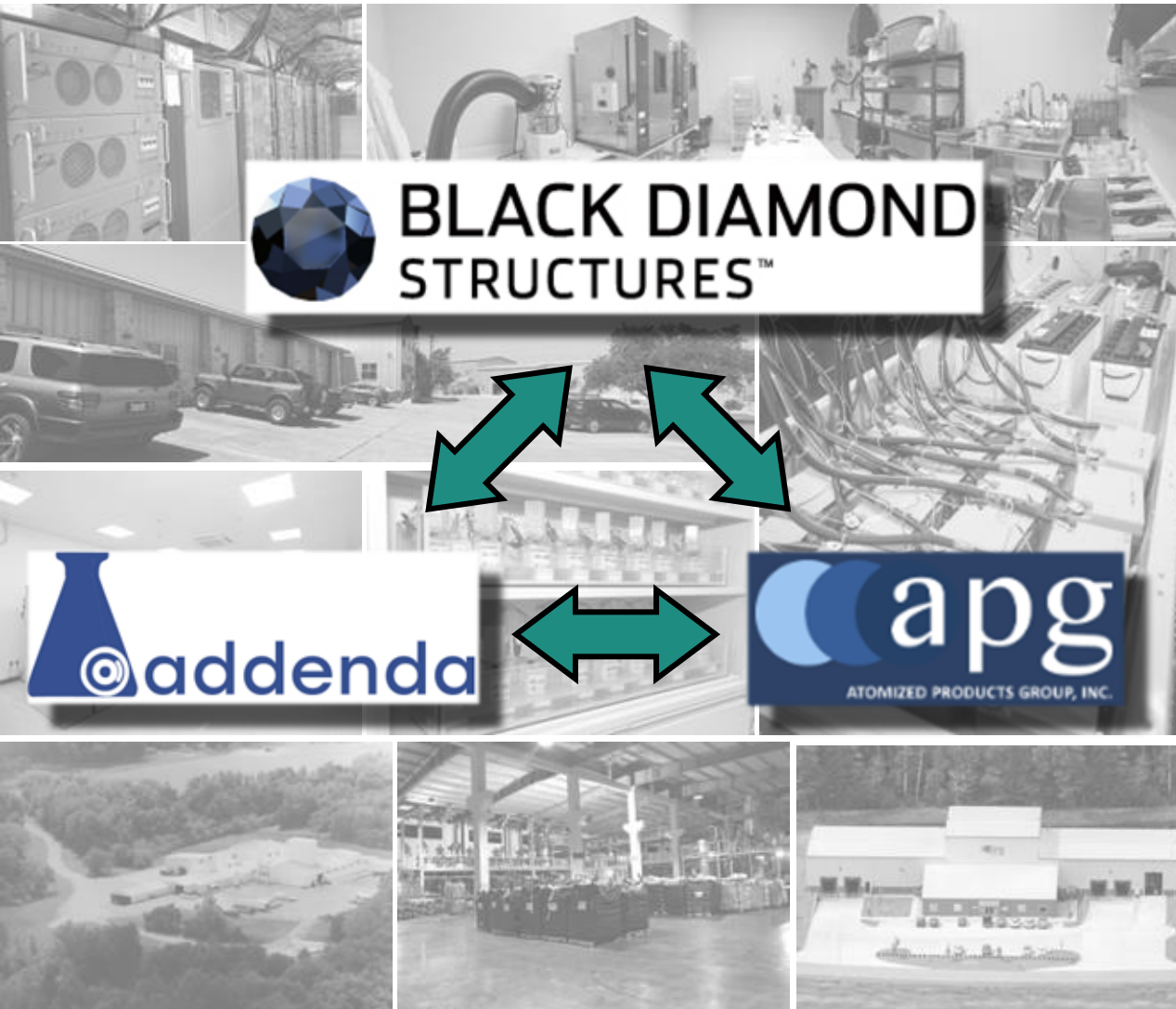
# Introduction to Expanders and Crystal Control Agents for the LATAM Market

An Advanced Additive Alliance: Part One



**ATOMIC**  
Solutions

# An Advanced Additive Alliance



## Black Diamond Structures, Atomized Products Group (APG), and Addenda announce an Alliance

- Formed to better serve our customers
  - Improves customer access to bespoke products
  - Bolsters customer technical support network
  - Aims to decrease customer development time
- Integrates
  - Product portfolios
  - Commercial teams
  - Research facilities (2 V, 12 V, Materials Testing)
  - Global manufacturing capability
  - Decades of application knowledge

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# Benefits of the Alliance

**Allows us to develop and offer a portfolio of solutions for both the positive and negative plates that are finely tuned and customized based on customer preference, need or requirement, such as:**

- Achieve higher benchmarks for critical battery performance characteristics/targets
- Improve paste consistency/symmetry
- Reduce cost and formation time

**Integrates global sales and technical teams for better support to battery manufacturers worldwide**

**Gives our customers access to a network of materials, 2 V cell, and 12 V battery testing capabilities**

- 129 available 12V circuits in the United States
- Advanced materials laboratories to quantify structure/function relationships and identify failure modes

## Products:

- Consistent high-quality supply of expander for any application from two USA-based manufacturing locations
- CX® line of advanced graphite-based expanders seeing worldwide commercial adoption for EFB and AGM
- Long term supply agreements with all approved expander raw material suppliers
- High quality alternative product suppliers for risk mitigation and cost benefits

## Capabilities / Scale / Certifications:

- IATF 16949:2016 certified at Chesapeake facility, ISO 9001:2015 certified at Garland facility
- Certified Woman-Owned Business by the WBENC to boost customers' diverse spending profile
- Capacity for significantly higher volumes (currently at 60% of capacity at both locations combined)



# Atomized Product Group (APG)



**APG production facility dedicated solely to negative expander production in Chesapeake, VA, USA.**

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## MOLECULAR REBAR® Materials

- Largest carbon nanotube formulation facility in the US
- ISO 9001:2015 and REACH certified
- Tuned for maximum compatibility with expanders from APG, Addenda, and more
- Minimal loading levels, often cost neutral or cost negative
- Dozens of customers around the world (ex. Eastman, Eternity, Rolls-Surrette, AutoX)



## Electrical and Material Characterization Labs

- 2 V subscale and 12 V full-scale facilities capable of running the world's tests
- Leverageable by our customers and development partners
- Speeds development
- Supports structure/function relationship understanding of products

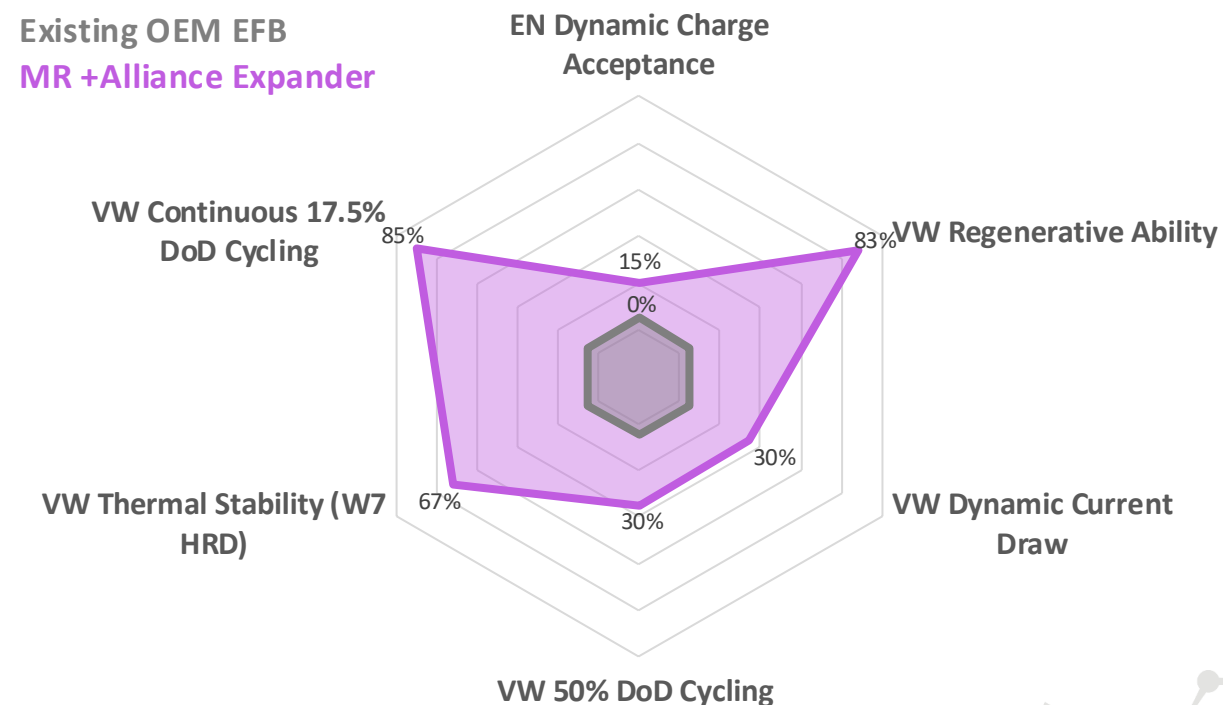


## Performance Grades

- Improve charge recovery, deep discharge, and PSoC capability
- Enable new products, material reduction, and SSoF reliability

## Process Grades

- Increase plates count per batch, product consistency, cpk values
- Reduce waste, recycling costs, paste jams
- Saves a manufacturer ~\$150-300/batch



Metric	PbLite® Effect
Extra Plates Per Batch (#)	50-200 (Auto)
Extra Plates Per Batch (%)	0.2 - 3.0
Waste Reduction	Up to 25%
CPK (Process Stability)	Up to 2X Improved
Paste Life Extension	10-15 mins
Safety Profile	Improved
Battery Performance	No Negative Effect

## Positive Additives:

- Micronized Tetrabasic Lead Sulfate (4BS) seed
- Nanoscale  $\alpha/\beta$ -seed on various lead sulfate phases
- Various grades of doped, mixed-metal oxide for use in positive active mass
- Red Lead
- Lead Oxides
- All products extensively tested and approved by the global battery industry

## Negative Additives:

- Produces negative expander strictly for the Chinese market at the Addenda China facility
- Organic crystal modification agents incorporating US-sourced kraft lignin and synthetic compounds
- Advanced nanoscale barium sulfate



## Case Study: addiBatt Tetra L2 4BS Seed

### 4BS Cure without Tetra L2:

- Large particles with broad size distribution
- Lack of consistency throughout the paste

No Tetra L2



### 4BS Cure with Tetra L2:

- Small, uniform particles
- High consistency from plate to plate
- Better structural integrity
- Faster formation
- Longer cycle life

1% Tetra L2



# Thank You For Your Attention!

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