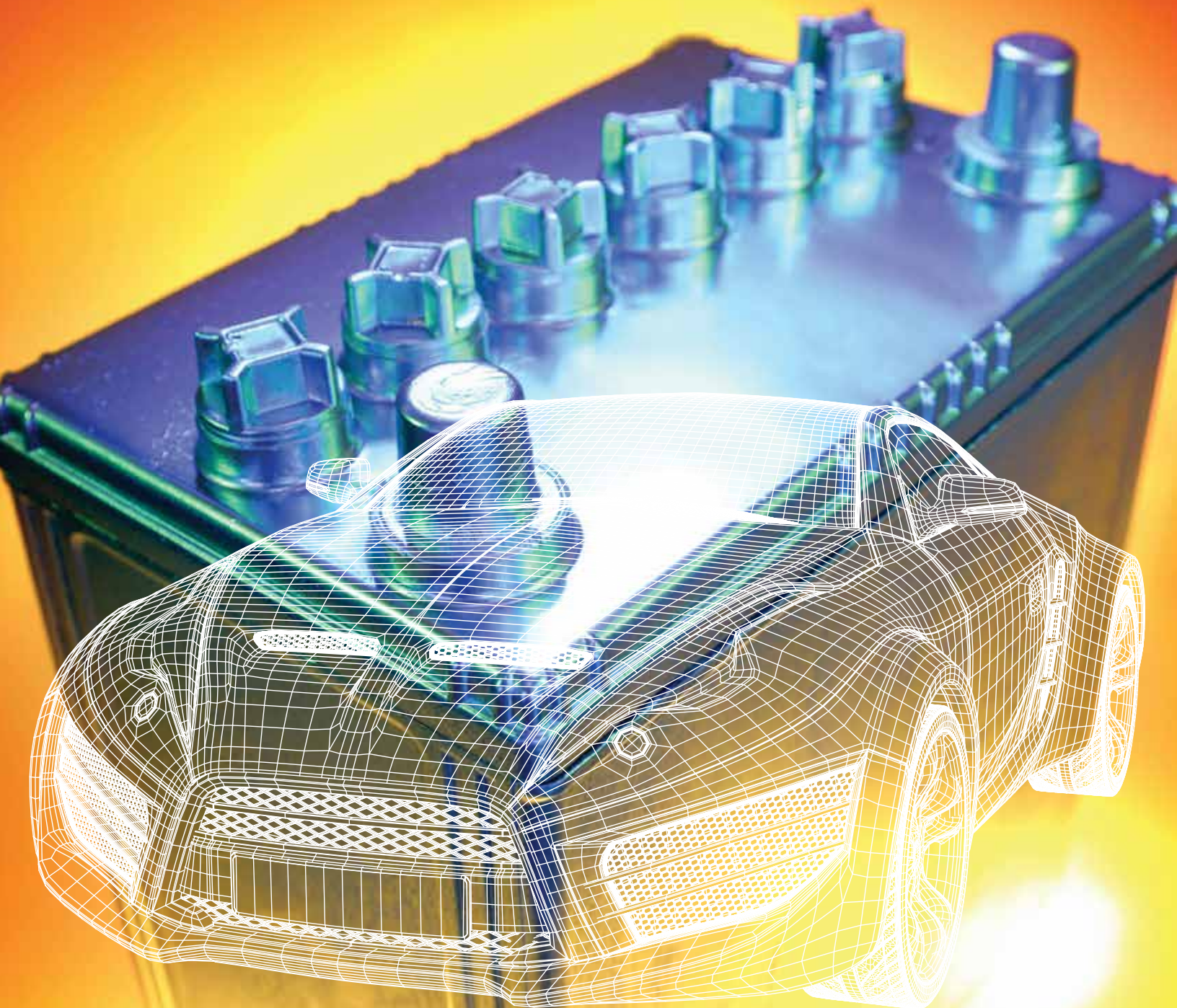


SUPERIOR  GRAPHITE

INNOVATING SINCE 1917

*Formula* **BT**<sup>®</sup>







## FormulaBT®: Superior Performance Graphite/Carbon for Energy Applications

**Graphite/Carbon additives in Lead-acid battery electrodes for use in highly demanding operations such as High-Rate Partial State-of-Charge (HRPSoC)**

**FormulaBT® (Battery Technology)** are carbon and graphitic powders, developed and manufactured by Superior Graphite, primarily for use in the energy marketplace.

**FormulaBT®** takes advantage of the unique continuous electro-thermal purification treatment patented by Superior Graphite. This continuous high-temperature process exposes the raw materials, e.g. natural graphite, synthetic graphite and other carbonaceous products to temperature up to 2700 °C, so that impurities including inorganic contaminants are evaporated. Combined with a variety of milling and classification techniques and processes, **FormulaBT®** provides the market with superior performance and high purity products.

### FormulaBT® Advantages:

#### Significant Cycle Life Improvement

Significant reduction of irreversible sulfation due to hindrance of lead sulfate crystal growth and uniform formation of lead sulfate across the negative plate under high-rate partial state-of-charge (HRPSoC) working conditions.

#### Capacity Improvement

Improving high-rate capability and the charge efficiency of the negative plates through providing excellent electrical conductivity.

#### Chemical Stability

No chemical interference with the electrode components.

### FormulaBT® Characteristics:

#### High Purity

High consistent carbon content (>99.9%) with low moisture content, and ultra low metallic and non-metallic impurities.

#### High Crystallinity

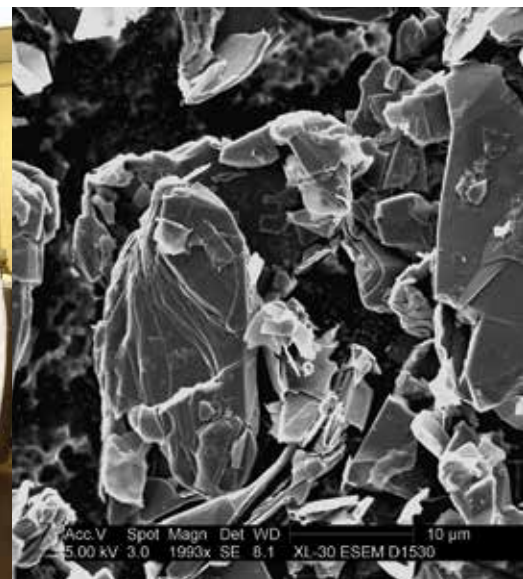
Excellent electrical and thermal conductivity.

#### Defined Texture

Well-defined particle shape, surface area, as well as bulk density to maximize the nucleating effect for uniform formation of lead sulfate and hinder lead sulfate crystal growth.

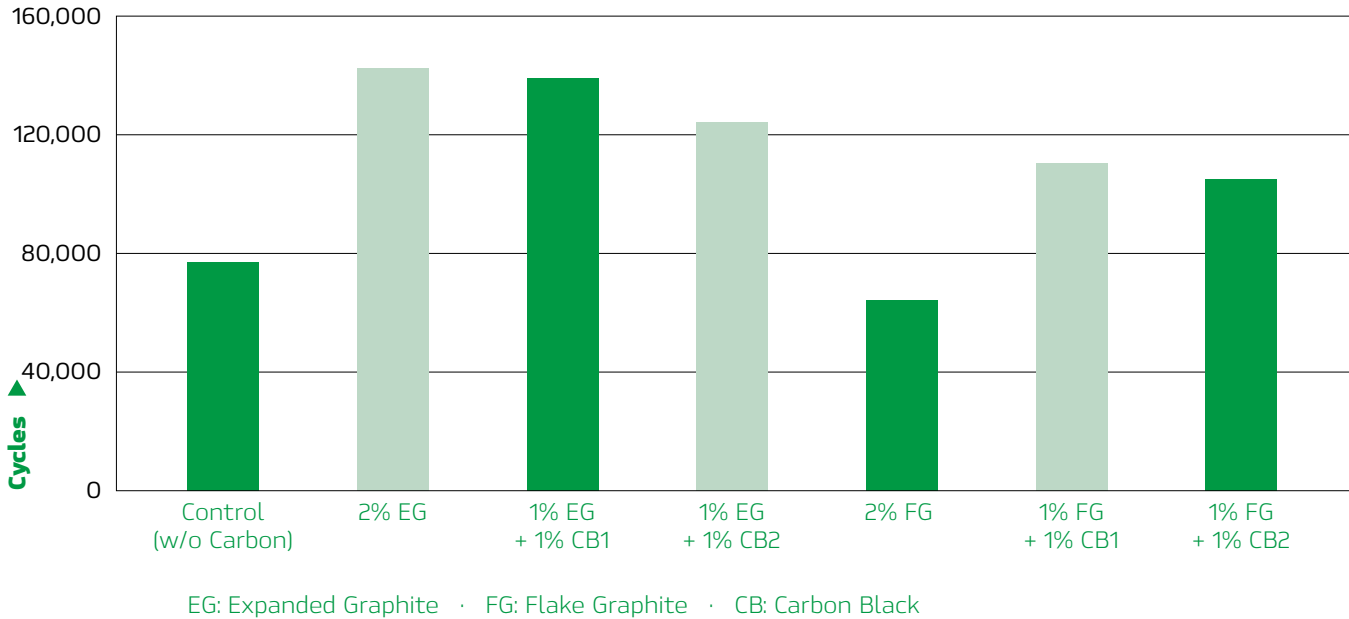
#### Well-Defined Particle Size Distribution

Predictability in performance and processability.



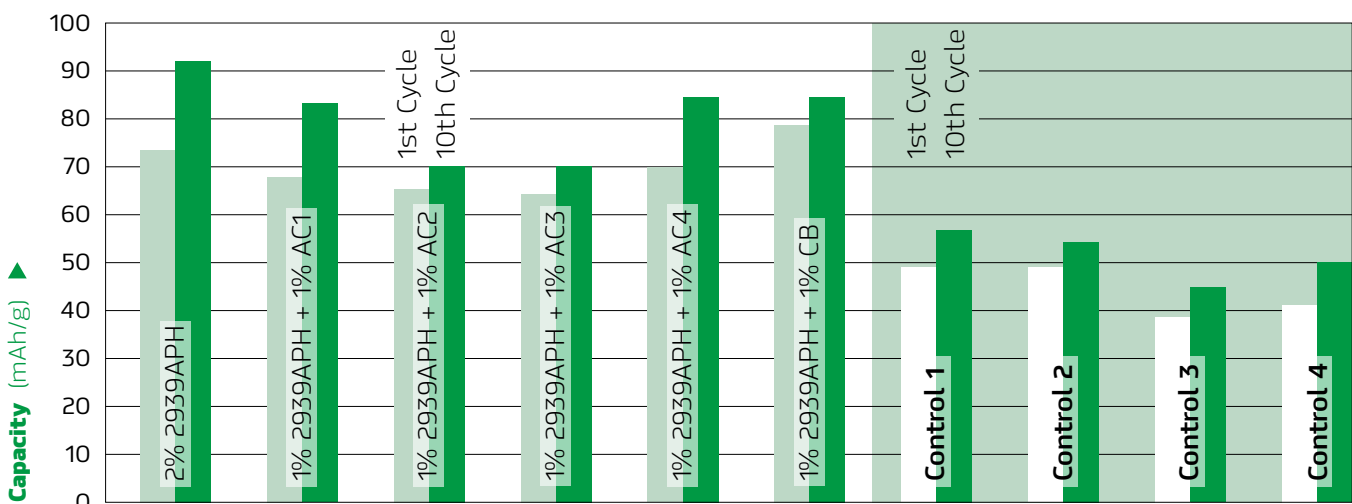
## Enhanced Levels of Carbon Black and Graphite Showed Significant Improvements in VRLA Cycle Life

Number of HRPSoC micro cycles completed to 80% nominal capacity or termination



## FormulaBT® Significantly Improves Initial Capacity under HRPSoC Cycling Conditions

Average 1st and 10th Cycle Capacity (normalized for dry unformed negative active material weight)



\*FormulaBT 2939APH; AC: activated carbon; CB: carbon black.

## FormulaBT® Products

### Graphite/Carbon additives in Lead-acid battery electrodes for use in highly demanding operations such as High-Rate Partial State-of-Charge (HRPSoC)

**FormulaBT® ABG series** · Expanded flake graphite powders with high purity. Outstanding thermal and electrical conductivity enhancer for various battery systems (large surface area is in the range of ~20 m<sup>2</sup>/g), various particle sizes, well-defined particle size distribution. Excellent compressibility and lubricating properties.

**FormulaBT® LBG series** · Natural flake graphite powders with high purity. Excellent electrical and thermal conductivity enhancer, various particle sizes down to 4 micron, well-defined particle size distribution. Especially developed for battery and fuel cell applications. Very high compressibility and lubricating properties.

**FormulaBT® 29xx series** · Thermally-purified, natural flake graphite powders from 10 micron up to 800 micron. Conductivity additive for batteries and fuel cells.

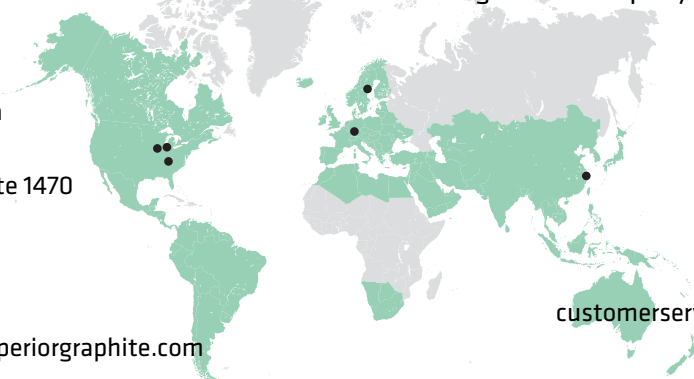
**FormulaBT®** is more than just a high performance energy material. **FormulaBT®** is a philosophy:

- Our innovative research and development team provides superior solutions with customized products.
- Our dedicated production staff, combined with ISO 9001 certified quality management systems ensure high quality products which meet agreed-upon specifications.
- Our extensive worldwide distribution network ensures supply chain efficiency.
- Our materials management experts secure the supply of high quality raw materials, and continuously evaluate new sources globally.

### OUR MISSION:

We create value for our customers by providing SUPERIOR SOLUTIONS – utilizing our unique technologies, processes and talents – while contributing to the company's long-term success.

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