Porocarb®
Ion Conductive Additive
Upgrade Your Battery

TUNEABLE PORE SIZE AND PORE VOLUME

Porocarb® is a product family of synthetic porous carbon powders tailored specifically for demanding electrochemical applications where the needs for a designed porosity and good kinetic accessibility intersect. Porocarb® porous carbon powders open the path to improved electrochemical systems which were not achievable in the past using standard carbon conductive additives off the shelf.

Proven and Powerful Benefits with Porocarb®:

- Higher energy density
- Increased electrode loading
- Savings in inactive material
- Increased capacity retention
- Improved ion transport
- Cut process cost
- Savings in NMP
- Faster electrode filling
- Ease of processing

Porocarb® Lead
- Improved endurance
- Increased cycle life for 17.5% DoD test
- Enhanced dynamic charge acceptance (DCA)
- More than doubled charge acceptance for DCA
- Higher deep-discharge capacity
- Long-lasting power supply

Porocarb® S-Cap
- Enhanced low temperature performance
- Maintained ion transport
- Higher power
- Low internal resistance
- Improved cycle-life performance
- Homogeneous mass transport

LiB 100%

More Cycle Life

Lead Acid Batteries 48%

Higher Deep-discharge Capacity

Lead-Acid Batteries 123%

More Charge Acceptance

Lead-Acid Batteries 30%

More Cycle Life

Ultra- & Supercaps 30%

Better Low Temperature Performance

Ultra- & Supercaps 15%

Increased Capacity Retention

Lithium-Ion Batteries 15%

Savings in NMP

Lithium-Ion Batteries 20%

Higher Energy Density

Lithium-Ion Batteries 15%

Savings in NMP
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TUNABLE PORE SIZE AND PORE VOLUME

Porocarb® – Your Benefits with Heraeus Battery Technology

Heraeus’ Porocarb® porous carbon functional additives are the innovative solution for the high end segment to extract greater performance from lithium ion batteries, lead-acid batteries and supercapacitors.

Proven and Powerful Benefits with Porocarb®:

**LiB** Porocarb® Lion
- Higher energy density
- Increased electrode loading
- Savings in inactive material
- Increased capacity retention
- Improved ion transport
- Cut process cost
- Savings in NMP
- Faster electrode filling
- Ease of processing
- Non-agglomerated carbon particles

**LAB** Porocarb® Lead
- Improved endurance
  - Increased cycle life for 17.5% DoD test
- Enhanced dynamic charge acceptance (DCA)
  - More than doubled charge acceptance for DCA
- Higher deep-discharge capacity
  - Long-lasting power supply

**CAP** Porocarb® S-Cap
- Enhanced low temperature performance
  - Maintained ion transport
- Higher power
  - Low internal resistance
- Improved cycle-life performance
  - Homogeneous mass transport
Porocarb® – Join the Future of Functional Carbon Additives

Heraeus Porocarb® is defining a new generation of advanced electrode additives for batteries. With its designed, well-defined internal porosity, Porocarb® is the first conductive additive that not only ensures electronic connectivity within the electrode, but also enhances ionic conductivity within the electrode. Even at highest levels of electrode compression and loading, Porocarb® ascertains open pathways within the electrode that help with electrolyte supply and distribution during filling and operation.

Porocarb® porous carbon powders enable advanced electrochemical systems which were previously not achievable using standard carbon conductive additives.

THE CARBON ADDITIVE ROADMAP

State-of-the-art

- Carbon Black

- Primary Particle Diameter: Tens of nanometer
- Aggregate Size: Hundreds of nanometer
- Rheology: High shear forces needed to break aggregates
- Within the Electrode: Provides short distance electronic path
  - Contributes to micro- and mesoporosity
  - Obstructs macroporosity

Upcoming

- Carbon nano fibers (CNF) and Carbon nano tubes (CNT)

- Diameter 15 nm CNT – 150 nm CNF
- Length 3–8 µm up to 100 µm
- Rheology:
  - High shear forces needed to break aggregates
- Within the Electrode:
  - Provides middle to long distance electronic path
  - Contributes to micro- and mesoporosity
  - Obstructs to a lesser extent macroporosity
  - High shear forces
  - Potentially toxic

Heraeus

- Porocarb®

- Diameter of particles in tunable range of micrometer
- Rheology:
  - No aggregation and easy to disperse
- Within the Electrode:
  - Creates ionic and electronic conductive pathways
  - Provides defined meso- and macroporosity
  - Maintains open porosity
  - Non-toxic
Porocarb® – Customized to Your Needs

For all our synthetic grades, we can offer a variety of customized post treatments in order to meet your system's requirements such as graphitization, particle sizing, surface treatments and more.

The carbon functional additive platform Porocarb® fulfills the requirements on a carbon support and kinetic additive for other electrochemical power sources as well.

Porocarb® grades with high amount of mesopores have been successfully applied in applications where nucleation and confinement of discharge products is required, such as Lead Acid and Lithium Sulfur cells or conversion electrodes.

Full or partial graphitization leads to Porocarb® grades with extremely high electrochemical corrosion resistance, which are useful in fuel cells as catalyst support, and in redox flow batteries as surface enhancer for the electrode.
Heraeus Porocarb® is defining a new generation of advanced electrode additives for batteries. With its designed, well-defined internal porosity, Porocarb® is the first conductive additive that not only ensures electronic pathways to break aggregates but also contributes to micro- and mesoporosity.

Within the Electrode:

- Rheology: tunable range of micrometer to disperse
- Diameter of particles in electronic conductive pathways

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Our mission is to develop innovative products and solutions for our customers and provide world-class scientific and technical support to help them compete and succeed in a fast-changing market. Our team of highly qualified engineers, scientists and technicians use state-of-the-art-instruments and cutting edge technologies to continuously develop and improve our carbon products and manufacturing processes.
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LAB

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- Maintained ion transport
- Higher power
- Low internal resistance
- Improved cycle-life performance
- Homogeneous mass transport

**Additional Benefits**

- **Lithium-Ion Batteries**
  - 20% Higher Energy Density
  - 15% Increased Capacity Retention
  - 15% Savings in NMP
  - 30% More Cycle Life
  - 30% More Charge Acceptance
  - 15% Increased Capacity Retention
  - 20% Higher Energy Density

- **Lead-Acid Batteries**
  - 48% Higher Deep-discharge Capacity
  - 100% More Cycle Life
  - 123% More Charge Acceptance

- **Ultra- & Supercaps**
  - 30% Better Low Temperature Performance
  - 30% Improved Cycle-life Performance

For more information, visit [www.heraeus-porocarb.com](http://www.heraeus-porocarb.com)