

ENGINEERED MINERAL FILLERS TO DRIVE OPTIMAL BATTERY PERFORMANCE



ENGINEERED MINERAL FILLERS TO DRIVE OPTIMAL BATTERY PERFORMANCE



A HOT CHALLENGE

Effective thermal management of electric vehicle (EV) battery systems is critical in maximising energy storage capacity, driving distance, cell longevity and safety. Excess heat can significantly reduce a battery's performance and lifespan.

Polymeric materials (both thermosets and thermoplastics) used in the construction of EV battery systems provide design flexibility, but their low thermal conductivity restricts heat dissipation.

To overcome this challenge, thermally conductive and electrically insulative mineral fillers are used to create polymer composites which remove excess heat, helping to keep the battery system within its ideal operating temperature range between 15 - 35°C.

DEGRADATION

DESIRED OPERATING TEMPERATURE RANGE

SLUGGISH ELECTRO-CHEMISTRY POWER LIMIT DURING DISCHARGE



OPERATING TEMPERATURE

MAXIMISE HEAT DISSIPATION WITH **BORATHERM[™]** MINERAL FILLERS

BORATHERM[™] SG (ATH) and BORATHERM[™] SA (Spherical Alumina) have been specially developed to help skilled formulators maximise the heat dissipation properties of polymer composites e.g. EV battery systems.

Drawn from Sibelco's extensive range of minerals, BORATHERM™ SG and BORATHERM™ SA are thermally conductive and electrically insulative, whilst the particle morphology ensures good flowability. This optimal combination of properties makes both materials ideal mineral fillers for silicone, epoxy, polyurethane and other matrices.

All of our products are backed by the highest standards of technical support, ensuring that you get the very best performance from our materials within your formulation. Our global network of research and technical centres enables us to continuously improve our offering and create new solutions to meet the changing needs of our customers.

BORATHERM[™] SA

BORATHERM[™] SA is a spherical alumina with a narrow particle size distribution. Almost perfectly spherical particles enable optimal packing, material flow and heat transfer.

Combined with a low specific surface area, BORATHERM™ SA's particle sphericity also allows for good flowability of the formulated material.



GRANULOMETRIC DATA & PHYSICAL CHARACTERISTICS

Typical values. These values do not represent a specification.

		SA0050	SA0080	SA0380	SA0700	SA0050N	SA0080N	SA0400N	SA0600N	Method
D ₅₀	μm	6	9	46	72	6	8	40	62	Laser diffraction
Specific Surface Area	m²/g	0.3	0.2	0.2	0.1	0.4	0.3	0.1	0.1	Nitrogen Physisorption (BET)
Moisture	%	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	ISO 787/2
рН		6-8	6-8	6-8	6-8	6-8	6-8	8-10	8-10	ISO 787/9
Density	g/cm³	4	4	4	4	4	4	4	4	Internal
Hardness		9	9	9	9	9	9	9	9	Mohs' scale
Thermal Conductivity	W/m*K	36	36	36	36	36	36	36	36	
Electrical Conductivity	µS/cm	48	51	21	25	60	57	141	121	Internal

5 um



5.0

To maximise the thermal performance of the polymeric composite, the right combination of fillers is essential.

The thermal percolation effect is achieved when filler particles are in contact with each other within the matrix, thus leading to a significant increase in thermal conductivity.

THERMAL CONDUCTIVITY OF BORATHERM™ SA FORMULATION IN CURED EPOXY AT VARIOUS LOADING LEVELS:





INSETS SHOW SCANNING ELECTRON MICROSCOPY IMAGES OF THE CROSS-SECTION OF THE CURED EPOXY SYSTEM.

BORATHERM[™] SG

Engineered from aluminium trihydrate, BORATHERM™ SG is an excellent conductor of heat whilst being electrically non-conductive and also flame retardant.

Specially designed to offer an ultra-low surface area and large particle sizes, BORATHERM™ SG is perfectly suited for formulations needing good flowability. The specific gravity of grades is 2.4 g/cm³.

For applications with even higher demands for electrical insulation, we have developed BORATHERM™ SG-E as a demagnetised option.

We offer a range of additional ATH grades should the products detailed below not be suitable for your application.





GRANULOMETRIC DATA & PHYSICAL CHARACTERISTICS

Typical values. These values do not represent a specification.

		SG25/10	SG30 LV	SG150 E	SG200 E	Method
D ₅₀	μm	13	10	60	90	Laser diffraction
Specific Surface Area	m²/g	2.77	4.0	0.21	0.25	Nitrogen Physisorption (BET)
Magnetics	ppm	0.2		7	7	Internal
Moisture	%		0.3	0.2	0.2	ISO 787/2
рН	-	9	9	9	9	ISO 787/9
Bulk density	g/cm³	1.0	0.7	1.1	1.3	ISO 787/11
Hardness		3	3	3	3	Mohs' scale

Please contact us for more detailed technical data and information about these products.



The combination of BORATHERM[™] SG and BORATHERM[™] SA grades can be used to provide lower density composites (as compared to pure alumina alternatives) without compromising on thermal performance.

This graph shows the optimum trimodal combination of BORATHERM™ SG and BORATHERM™ SA grades to achieve a high level of thermal conductivity in a 1K polyurethane matrix. The major part of the filler package contains BORATHERM™ SG200 E. These polymer composites provide lower density as well as incorporating flame-retardant properties.



THERMAL CONDUCTIVITY OF TRIMODAL FILLER PACKAGE CONSISTING OF BORATHERM™ SG AND BORATHERM™ SA GRADES AT VARIOUS LOADING LEVELS IN A 1K POLYURETHANE MATRIX.



This graph shows the effect of the ratio between two different fillers (at a loading of 70%) on the viscosity of the epoxy system filled with a combination of BORATHERM™ SG200 E and BORATHERM™ SA0080 (red) and BORATHERM™ SG200 E and BORATHERM™ SA0050 (blue).



VOLUME BASED VISCOSITY STUDY - BORATHERM™ SG200 E WITH BORATHERM™ SA

BORATHERM[™] SG200 LVS

BORATHERM[™] SG200 LVS is a blended grade produced from carefully selected synthetic aluminum hydroxide (ATH).

This product is used in applications where heat-dissipation and fire-retardancy are critical, for example in thermal interface materials (including electronic vehicle battery heat management), casting resins for power transformers and in potting and encapsulating materials for electric and electronic applications. The number of magnetic particles is maintained at a low level, making the materials ideally suited for electronic applications.

Because the particle size distribution of BORATHERM[™] SG200 LVS is already optimized, blending with other finer or coarser aluminum-containing grades is no longer needed to obtain optimum packing density, resulting in the right balance between flow and thermal conductivity.





GRANULOMETRIC DATA & PHYSICAL CHARACTERISTICS

Typical values. These values do not represent a specification.

		SG200 LVS	Method
+ 212 µm	%	0.01	Dry Sieving
D ₁₀	μm	3	Laser diffraction
D ₅₀	μm	55	Laser diffraction
D ₉₇	μm	160	Laser diffraction
Specific surface area	m²/g	1	Nitrogen Physisorption (BET)
Oil Absorption	g/100g	13	Internal
Moisture	%	0.2	ISO 787/2
рН		9	ISO 787/9
Bulk density	g/cm³	1.2	ISO 787/11
Hardness		3	Mohs' scale

ATH BLEND

ADDITIVES

SUBMICRON GROUND ALUMINA BORATHERM[™] GA

BORATHERM[™] GA6 grade is often used in combination with BORATHERM[™] SA and BORATHERM[™] SG grades in order to enhance a formulation's particle packing, flow properties and thermal conductivity.

We also offer BORATHERM[™] GA6 S21.5 grade a surface modified submicron ground alumina tailored to improve the stability and shelf-life of thermally conductive uncured polymeric composites.



GRANULOMETRIC DATA & PHYSICAL CHARACTERISTICS

Typical values. These values do not represent a specification.

		GA6	GA6 S21.5	Method
D ₅₀	μm	0.8	0.8	Laser diffraction
Specific Surface Area	m²/g	6.5	5.1	Nitrogen Physisorption (BET)
Moisture	%	0.2	0.1	ISO 787/2
рН	-	6-8	-	ISO 787/9
Density	g/cm³	4	4	Internal
Bulk Density	g/cm³	1	1	ISO 787/11
Hardness	-	9	9	Mohs' scale
Thermal Conductivity	W/m*K	36	36	
Coating	%	-	1.5	Internal

HUNTITE/HYDROMAGNESITE

BORATHERM[™] H5

BORATHERM™ H5 is produced from carefully selected, naturally occurring, platy, sedimentary mineral, mainly comprising partially hydrated magnesium calcium carbonate.

The chemical composition of both raw material and final product is closely monitored with particle size kept within a narrow variation. Its particles' platy shape and very fine size make BORATHERM™ H5 an effective rheology modifier in aqueous suspensions and other fluids.



GRANULOMETRIC DATA & PHYSICAL CHARACTERISTICS

Typical values. These values do not represent a specification.

		H5 F13	Method
D ₅₀	μm	0.5	Sedigraph
Specific Surface Area	m²/g	18	Nitrogen Physisorption (BET)
Moisture	%	0.6	ISO 787/2
рН	-	10	ISO 787/9
Density	g/cm³	2.7	Internal
Bulk Density	g/cm³	3	ISO 787/11
Hardness	-	2-3	Mohs' scale
Coating	%	3	Internal



With over 100 production sites across 31 countries, Sibelco is one of the world's leading providers of industrial minerals and other material solutions.

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We create materials that power progress. Our products help to build homes, cities and vehicles; to support the supply of electricity, food and clean water; to create new technologies like smartphones, low-energy lighting and solar panels.

We do this within a robust sustainability framework, always balancing economic performance with environmental stewardship and social responsibility.



FIND OUT MORE

If you are looking for high-performance, proven filler materials to enhance thermal management, please get in touch today to learn more about BORATHERM™ SA and BORATHERM™ SG.

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APAC

EMEA



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