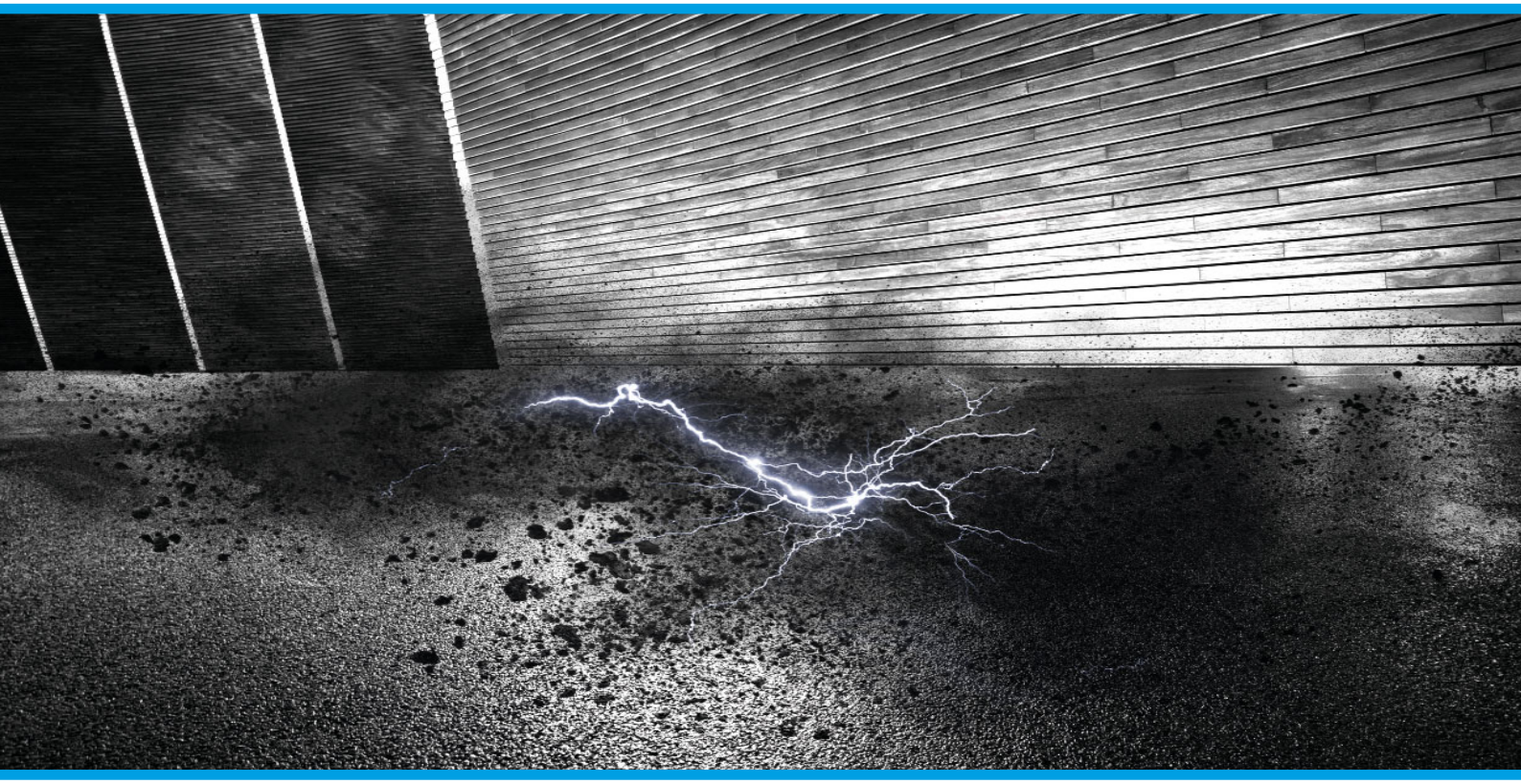
ACETYLENE BLACK
Clean and rich in Carbon

Technical Information 1486



orion ENGINEERED CARBONS

Focused. Innovative. Responsive.

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1 Acetylene Black

1.1 Production

In 1987, the company SN2A settled in Berre l'Etang, France, and began the production of Acetylene Black. Almost 30 years later Orion Engineered Carbons acquired the company in 2018 and is since then able to offer our customers various Acetylene Black products.

The plant produces several 1000 tons per year of Acetylene Black, dragged from the base-material acetylene gas. This gas is partly burnt in parallelly operating furnace units. It gets thermally decomposed at very high temperature in each furnace. Afterwards the combustion gases and the Acetylene Black get separated, densified and transferred to the bag filler system. Compared to Furnace Black, as a standard in the Carbon Black market, Acetylene Black convinces by its high purity and hardly any traces of contaminations.

These advantages result from acetylene as pure feedstock, compared to the heavy fuel oils of the Furnace Black process. Another advantage appears from a sustainability perspective: The yield within the Acetylene Black process is much higher than in the Furnace Black process leading to only 100 kg CO_2 per ton of Acetylene Black compared to more than 5 tons CO_2 per ton of Furnace Black. Internal research within our company has disclosed, that further savings and reductions are possible making the process an even more attractive alternative.

1.2 Packaging

The outstanding production process enables us to provide various types of Acetylene Blacks, which differ in their physical and chemical characteristic, but not in their degree of purity and carbon content. These Y-grades are globally available. Acetylene Blacks will be shipped in either paper or polyethylene bags. Depending on the customer needs the bags range from a volume of 4 kg to 25 kg. Another shipment opportunity are our new innovative Minibags. They are available in all types of elastomer-based materials and suitable for powder and beaded Carbon Blacks.

Minibags possess various advantages for the customer: Depending on the material, they are meltable and water soluble at different heat levels and melting points. In form of aluminum bags, the Minibags provide the advantage of a very high moisture resistance. Customers have the option to define the melting point, weight per bag, bag material and the product. Minibags reduce waste disposal costs and thereby lead to an economic benefit. Except the Aluminium bags, all Minibags get incorporated into the production without opening them and enable thereby a dust-free production process.

2 Benefits of Acetylene Black

2.1 Batteries

Acetylene Black is a very suitable conductive carbon additive and popular for many kinds of batteries and energy storage applications, like fuel-cells and electric-double-layer capacitors ("Supercaps").

In primary batteries, such as zinc-carbon-, zinc-air- and lithium-primary batteries it serves as a conductive additive and ensures the electrical conductivity of the cathode. For example, Acetylene Black is an indispensable additive for zinc-carbon batteries to keep the cell dry, due to its ability to pick up the liquid electrolyte in the voids of the high structured aggregates.

Acetylene Black is an essential additive in rechargeable lithium-ion batteries. It is used in small dosages in the cathode and covers the surface of the active material, forming a 3D conductive network to ensure that the non-conductive active material within the battery is electrically connected with each other and the current collector. By this, the electrical current flows and the battery can perform.

Acetylene Black has unrivalled purity needed for lithium-ion batteries, while providing excellent electrically conductivity. Its purity characteristics make Acetylene Black very valuable for battery applications, as metallic impurities and moisture may lead to unwanted side reactions and have a negative impact on the battery's performance and durability. Our lithium-ion battery grade PRINTEX® kappa 100 with its strictly controlled quality is superior to other Carbons Blacks based on other feedstocks.

In lead-acid batteries Acetylene Black improves the performance of emerging start-stop/hybrid electrical vehicles and stationary energy-storage applications. Acetylene Black achieves a higher dynamic charge acceptance and a long cycle life during micro-cycling at partial state of charge. It enhances the electrical conductivity of the electrode, increase the formation efficiency and reduces the residual sulfate level. Acetylene Black also fosters the electrical conductivity at the end of discharge, when the content of isolated $PbSO_4$ crystals in negative active mass increases substantially.

2.2 Special Applications

Acetylene Black can be used to manufacture graphite molded parts, such as carbon brushes, carbon contacts, sinter bearings and a lot of similar products. Its high thermal conductivity and highest purity improve the characteristics of graphite molded parts. The high purity results in very homogenous graphite structure in the final product meeting the industry requirements of minimum impurity.

2.3 Rubber

For the curing process of a tire a so-called rubber bladder is inserted into the uncured, green tire. After the mold is closed the bladder is inflated by a hot medium, such as steam or hot air, the pressure increases to make the green tire flow into the mold, taking on the tread pattern. To guarantee a good heat transfer from the hot medium to the green tire the thermal conductivity of the bladder should be as good as possible. At the same time the bladder should stay flexible over many cycles of inflating and deflating.

Acetylene Black is used in tire bladder compounds because it has a higher thermal conductivity than other Furnace Carbon Blacks at similar loadings due to a much higher graphitization degree. This characteristic accelerates the vulcanization process of the green tire, reduces cure times, increases throughput per curing unit and energy consumption in the tire plant.

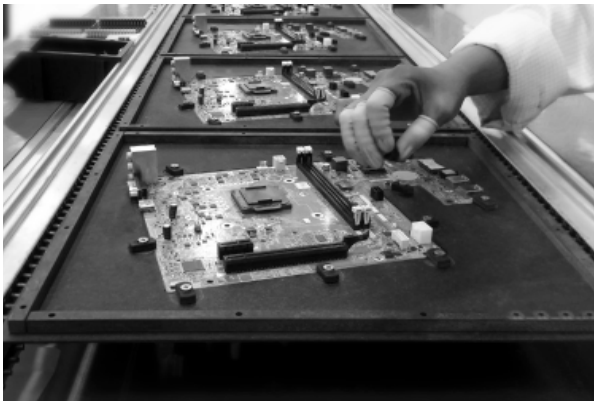
2.4 Adhesives and Sealants

Rheological control, pigmentation and conductive modification are the three functions of Acetylene Black in adhesives and sealants. Its high structure leads to an excellent dispersibility making Acetylene Black very convenient for regulating the rheologic characteristics of the application, such as the viscosity and thixotropy in thermosets like unsaturated polyesters or epoxy resins.

Next to the rheological control, Acetylene Black also works as a pigment to give the final application, like epoxy or silicon resins, its black color. Due to its conductive characteristics, Acetylene Black enables conductive modifications to the application. Its hydrophobic surface area comes along with an economic advantage, as the resulting outstanding moisture resistance can save the drying process within manufacturing.

2.5 Conductive Compounds

Whenever highest purity, lowest moisture pick-up (through hydrophobic surface area) together with good electrical conductivity define the high demands on a conductive polymer compound Acetylene Black is a highly recommendable product. These key features are typical for Acetylene Blacks and mark the difference to regular Furnace Blacks. Since comparatively high pigment loading is needed to achieve electrical conductivity in polymers Orion is providing Acetylene Black in variable degree of compaction.



2.6 Wires & Cables

Acetylene Blacks are used for extra-high voltage (EHV) power cables, fulfilling the three required characteristics of highest cleanliness level, very smooth surfaces and good conductivity. Medium, high and EHV power cables contain internal semi-conductive layers: One is located around the conductor (inner semi-conductive layer) and the other one on the outside of the insulation (outer semi-conductive layer) to control the electrical field around the metal conductor. A Carbon Black addition of 30 to 40 % ensures, that the aimed conductivity in these layers is achieved.

Additionally, the smoothness of the surface is improved by Carbon Black. EHV power cables require exceptionally contamination free Carbon Black, as any defect inside or on the surface shortens the lifetime of the cable endangering the requirement of lasting at least 30 years. Acetylene Black accomplishes all three requirements at best. Its high structure level and excellent pellet quality leads to an outstanding performance with regards to the processability and dispersibility. These advantages make Acetylene Black a highly attractive alternative compared to other standard Carbon Blacks used in the industry.

3 Products

Y50A

Parameter	Method	Unit	Value
BET Surface Area	ASTM D 6556	m^2/g	70
Acetone Absorption Stiffness		$cm^3/5\ g$	34
Bulk Density		g/cm^3	0.1
Ash Content	ASTM D 1506	%	<0.01
Electrical Resistance		Ωxcm	0.5
Sulfur	ICP-OES	%	<0.05

YS

Parameter	Method	Unit	Value
BET Surface Area	ASTM D 6556	m^2/g	110
Acetone Absorption Stiffness		$cm^3/5\ g$	31
Bulk Density		g/cm^3	0.07
Ash Content	ASTM D 1506	%	<0.01
Electrical Resistance		Ωxcm	0.5
Sulfur	ICP-OES	%	<0.05

Y70

Parameter	Method	Unit	Value
BET Surface Area	ASTM D 6556	m^2/g	70
Acetone Absorption Stiffness		$cm^3/5\ g$	32
Bulk Density		g/cm^3	0.07
Ash Content	ASTM D 1506	%	<0.01
Electrical Resistance		Ωxcm	0.5
Sulfur	ICP-OES	%	<0.05

Y160

Parameter	Method	Unit	Value
BET Surface Area	ASTM D 6556	m^2/g	70
Acetone Absorption Stiffness		$cm^3/5$ g	29
Bulk Density		g/cm^3	0.16
Ash Content	ASTM D 1506	%	<0.01
Electrical Resistance		Ωxcm	0.5
Sulfur	ICP-OES	%	<0.05

PRINTEX® kappa 100

Parameter	Method	Unit	Value
OAN Oil Absorption Number	ASTM D 2414	ml /100 g	300
BET Surface Area	ASTM D 6556	m^2/g	67
Ash Content	ASTM D 1506	%	<0.05
Moisture Content (as packed)	Orion Method	ppm	<500
Sieve residue 45 µm	ASTM D 1514	ppm	<5
Iron content	Orion Method	ppm	<5

Y200

Parameter	Method	Unit	Value
DBP	IAQ 09012 LAB	ml/100 g	202
Magnetizable Metals	IAQ 91005 LAB	ppm	<10
Absorption Stiffness	IAQ 91002 LAB	ml/5 g	>18
Moisture	IAQ 91003 LAB	%	<0.1
Ash Content	IAQ 91004 LAB	%	<0.5
Bulk Density	IAQ 91001 LAB	g/l	200
Sulfur	ICP-OES	%	<0.05

4 Acetylene Black Characteristics

Acetylene Black impresses by its high degree of purity and its clean nature. It possesses the best and lowest contamination values among all Carbon Blacks.

Acetylene decomposes at very high temperatures into the elements carbon and hydrogen. This is the basis for the very clean Acetylene Black process. The high level of purity is achieved because, unlike in other Carbon Black manufacturing processes, no aromatic oils based on coal tar or mineral oil, natural gas or coal tar distillates are used as raw materials.

Acetylene Black does not only contain very little heavy metal traces but also shows excellent performance with regards to the content of Polycyclic Aromatic Hydrocarbons, as the following two tables indicate.

Their values are given for informational purposes only in order to enable you to do an overall assessment on such substance concentrations in your final product. They should not be considered guaranteed specifications or be conclusive on the absence of substances not mentioned.

4.1 Heavy Metal

Y50A, Y70, Y160, Y200 may contain traces of heavy metals. Through random Carbon Black sampling the following data were obtained:

Element	%
Aluminium	< 0.01
Barium	< 0.001
Chromium, total	< 0.0005
Copper	< 0.003
Manganese	< 0.003
Nickel	< 0.001
Tin	< 0.003
Antimony	< 0.001
Boron	< 0.003
Chromium (VI)	*
Lead	< 0.001

Element	%
Mercury	< 0.0001
Selenium	< 0.001
Arsenic	< 0.001
Cadmium	< 0.0001
Cobalt	< 0.001
Lithium	< 0.0005
Molybdenum	< 0.003
Strontium	< 0.003
Zinc	< 0.001
Organotin compounds	*

* Based on random tests, the production process and our present knowledge an experience Chromium (VI) and Organotin compounds are not contained in Carbon Black

4.2 Polycyclic Aromatic Hydrocarbons (PAH)

Substance	CAS-No.	ppm [mg/kg]	according to	
Benzo(a)anthracene	56-55-3	< 0.1	(EU) No 1272/2013 [a]	PAH-list AfPS-GS-2014-01 [b]
Chrysene	218-01-9	< 0.1		
Benzo(b)fluoranthene	205-99-2	< 0.1		
Benzo(j)fluoranthene	205-82-3	< 0.1		
Benzo(k)fluoranthene	207-08-8	< 0.1		
Benzo(e)pyrene	192-97-2	< 0.1		
Benzo(a)pyrene	50-32-8	< 0.005		
Dibenzo(a,h)anthracene	53-70-2	< 0.1		
Benzo(g,h,i)perylene	191-24-2	< 0.1		
Indeno(1,2,3-cd)pyrene	193-39-5	< 0.1		
Acenaphthylene	208-96-8	Sum < 0.5		
Acenaphthene	83-32-9			
Fluorene	86-73-7			
Phenanthrene	85-01-8			
Pyrene	129-00-0			
Anthracene	120-12-7			
Fluoranthene	206-44-0			
Naphthalene	91-20-3	< 0.2		
Total of 18 PAHs (according) to PAH-list of AfPS-GS-2014-01 for GS-Mark certification)		< 0.5		

[a] Referring to the PAHs as listed in Comission Regulation (EU) No. 1272/2013 of 6 December 2013 amending Annes XVII to Regulation (EC) No. 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) as regards Polycyclic Aromatic Hydrocarbons.

[b] Information in regards to GS-Mark: Total of 18 PAHs (according to PAH-List AfPS-GS-2014-01 for GS-Mark certification).

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