High Performance Carbon Black Pigments for Semi-Conductive Compounds

Technical Information 1387

orion

Delivering sustainable solutions

Global trends of rapid urbanization, increasing energy consumption, and integration of renewable poser supplies into electrical grids require innovative and durable energy saving solutions. The Wire & Cable industry therefore introduced High Voltage (HV) Cables as a solution to highly efficient power grids. Essential features of HV Cables are low energy loss during long-distance transmission of electricity, excellent durability, and service life – the solution to allow energy generation where it is most efficient and distribute it to commercial and residential customers.

Carbon black pigment is one of the key raw materials used in semi-conductive compounds to manufacture HV Cables for transportation of electric current and Medium Voltage (MV) cable for electricity distribution. Carbon black pigments impart electrical conductivity to the conductor shield and insulation shield. The semi-conductive layer in HV cables facilitates homogeneous distribution of the electrical field, thus reducing the electrical stresses to the cable's Polymer components and supporting achieving long service life of the HV cables.

High performance carbon black pigments for semi-conductive compounds

Orion Engineered Carbons with its innovation ethic, has developed a new carbon black pigments (CBP) in response to the industry end use needs. The new PRINTEX® HV and XPB 711 acetylene black with high cleanliness and superior dispersibility imparts excellent surface smoothness and high conductivity to the compound and makes it ideal for use in HV Cables.

This technical bulletin addresses the key performance and functional attributes of Orion's carbon black pigments and their suitability for semi-conductive compounds utilized in HV and MV Cables.

PRINTEX®, HIBLACK® & AROSPERSE – Our solutions for HV cables

Orion produces carbon black pigments by means of several process technologies: Furnace Black process, Degussa Gas Black process, Lamp Black process, Thermal Black process, Acetylene Black process. With our technical capabilities and expertise, we can provide the market with functional carbon black pigments having suitable chemical and physical properties. Especially geared towards the stringent needs of the HV cable application, Orion developed the new premium grades **PRINTEX® HV** and **XPB 711 Acetylene Black**.

Table 1

CBP attributes Cable key requirements

CBP attributes Cable key requirements	Dispersibility	Low sulfur impurities	Pellet quality & integrity	Cleanliness	CBP Particle morphology
Excellent surface smoothness	●		●	●	●
High conductivity	●				●
Balanced melt flow rate	●				●
Low strand corrosion	●	●		●	
Ease of handling and processing			●		●
Long service life of cable	●	●		●	

Key performance requirements for carbon black pigments in HV cables

Table 2

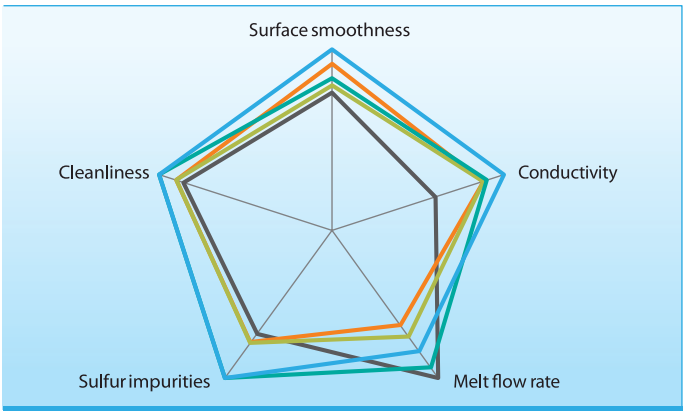
Product recommendations

Product	Performance attributes			Voltage of cable (kV)			Technical attributes	
	Dispersibility	High cleanliness	Low sulfur	Low < 5	Medium 5 – 46	High 60 – 150	Conductivity	Surface smoothness
PRINTEX® HV	●	●	●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●
PRINTEX® Alpha	●	●	●	● ● ●	● ● ●	● ●	● ●	● ●
HIBLACK® 420B	●			● ● ●	● ●		● ●	● ●
HIBLACK® 150B	●			● ● ●	●		●	●
AROSPERSE® 11	●			● ● ●	● ●		● ●	● ●
SEB® 2002	●	●						
XPB® 711 (Acetylene Black)	●	●	●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●

Product recommendations

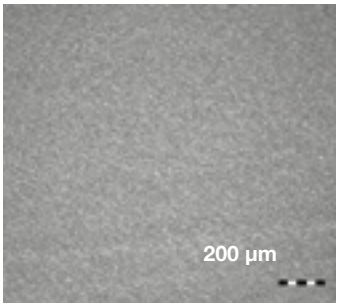
Special attributes

The following charts illustrate the relative merits of the recommended carbon black pigments measured at same loading level in HV Cables.

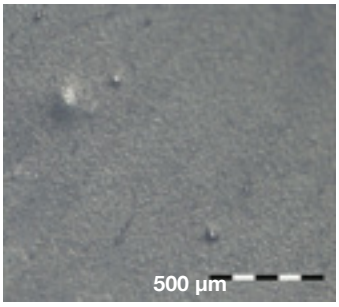


- Good Surface Smoothness of extruded tapes made with the semi-conductive compounds is indicative of low electrical stresses and water tree failures in power transmission cables.
- Conductivity measured by volume resistivity of the semiconductive compounds at various specified temperatures and at equal carbon black pigment loading indicates efficiency.
- Higher Melt Flow Rate translates into lower compound viscosity and easier processing.
- Cleanliness is defined as low ionic and any types of particulate impurities in carbon black pigments. Low level of such contaminants prolongs the service life of cables and minimizes potential for failures in the field.
- Low Sulfur Impurities prolong the service life and performance of power transmission cables.

Excellent surface smoothness of semi-conductive tape



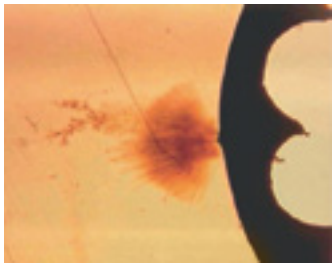
Poor surface smoothness of semi-conductive tape



Surface smoothness of tapes made with semi-conductive compounds directly influences the service life of HV Cables.

No trees

Water & electrical treeing



Electrical and water trees lead to insulation breakdown and failure of the power transmission cable resulting in sudden interruption of power transmission.

Regional availability

The featured products are currently available in the following regions:

Regional availability

Product	Europe	NAFTA	Asia
PRINTEX® HV	●	●	●
PRINTEX® alpha	●	●	●
HIBLACK® 420B	●	●	●
HIBLACK® 150	●	●	●
AROSPERSE® 11	●	●	●
SEB 2002	●	●	●
XPB 711	●	●	●

Regulatory compliance

Carbon Black Pigments from Orion comply with most global regulatory requirements including CONEG, REACH, etc. Rigorous quality standards are followed during the production, handling and storage of these grades. The products are supported by an extensive and competent sales, technical and customer support staff around the world. For additional details and to verify compliance with specific regulations, please contact us.

Quality standards

Orion follows rigorous quality procedures and standards during production, handling and storage of pigment blacks to ensure that the product consistently meets the requirements for these applications.

Delivering sustainable solutions

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