

HIGH PERFORMANCE
CARBON BLACKS

AUTOMOTIVE WEATHER STRIPPING APPLICATIONS WITH HIGH ELECTRICAL RESISTIVITY REQUIREMENTS

Global Products

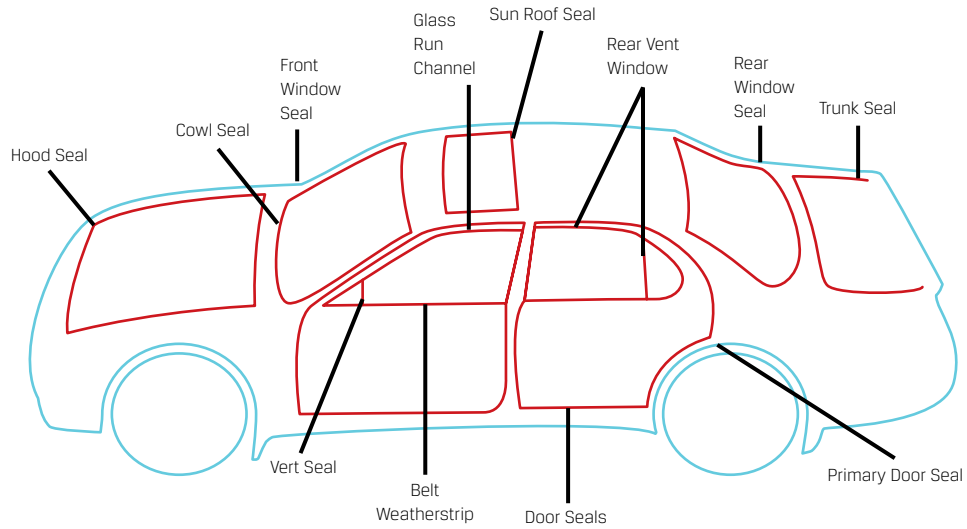
OVERVIEW

The weather stripping on vehicles plays an important role in preventing water from leaking inside the passenger compartment and in reducing wind noise and dampening sound to improve ride quality for both drivers and passengers. Because weather stripping also is important to the overall aesthetics of the vehicle, its appearance when new and over time is a key consideration for car manufacturers as well.

In addition, as the automotive industry focuses more and more on reducing the overall weight of vehicles to improve fuel economy and reduce greenhouse gas emissions, the use of lighter weight metals – such as aluminum and magnesium – is increasing. This trend is driving high electrical volume resistivity (EVR) specifications on rubber parts such as weather stripping that may come into contact with dissimilar metals in order to avoid contact corrosion issues.

CARBON BLACK AND WEATHER STRIPPING

A standard passenger car often requires 50 meters of weather stripping to seal its doors, windows, hood and trunk from the outside environment. Carbon black is of major importance in meeting the manufacturing, functional, aesthetic and cost requirements of automotive weather stripping in addition to the EVR. In typical EPDM-based rubber weather stripping compounds the carbon black content can be up to 30-35wt%.



CARBON BLACK AND HIGH EVR

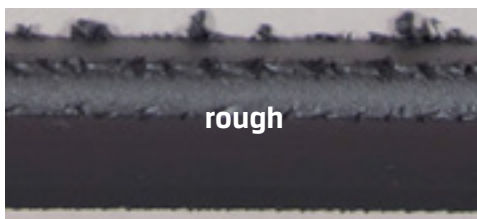
High EVR in the rubber part can help prevent contact corrosion issues between the rubber part and the car body, inserts or clamps. As a result, many car manufacturers are starting to specify an EVR from 10^9 up to $10^9 \Omega \cdot \text{cm}$ for automotive weather stripping.

A typical EPDM-based dense weather stripping part today contains up to 30-35 wt% carbon black for performance, processing and cost reasons and has a EVR level around 10^3 - $10^4 \Omega \cdot \text{cm}$. Rubber manufacturers are challenged to achieve high EVR specifications while also maintaining other application performance and manufacturing requirements at an effective total cost.

For example, a drastic reduction in carbon black wt% in the EPDM rubber compound along with a strong increase in white filler content to meet EVR specifications from 10^6 up to $10^9 \Omega \cdot \text{cm}$ can lead to a variety of issues:

- ◆ Faster wear of extruder dies and mixer rotors
- ◆ Increased specific gravity of rubber compounds and higher final part weight
- ◆ Deterioration in properties (for example, tensile strength and sealing)
- ◆ More difficult compound processing and extrusion (for example, rough edges and surfaces)

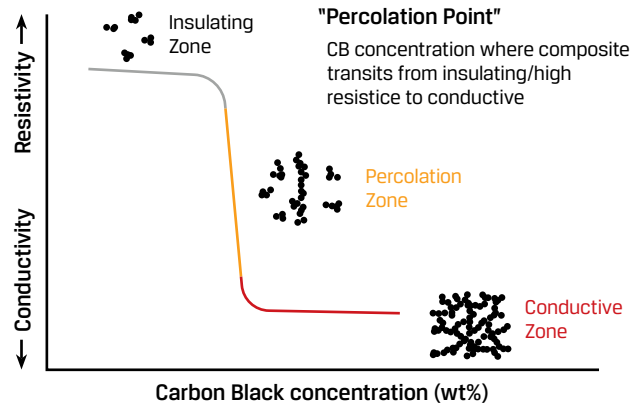
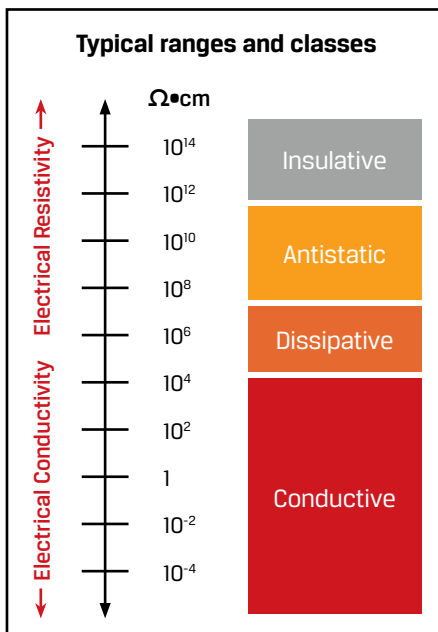
Compromised extrudability: rough extrudate surface & edges



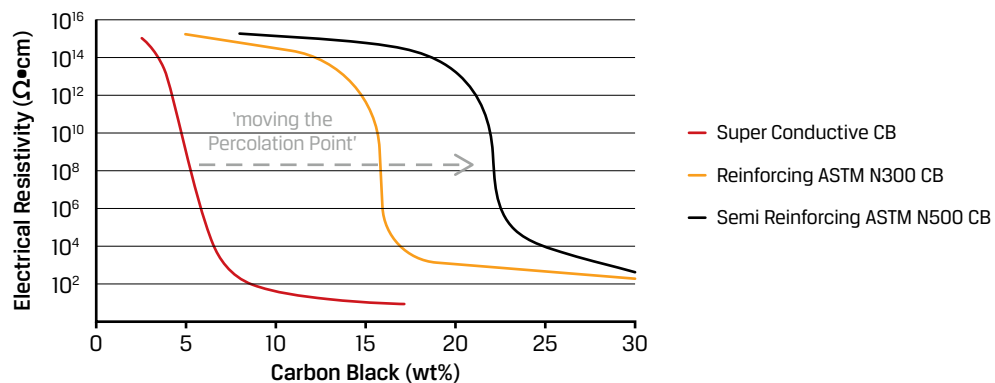
UNDERSTANDING ELECTRICAL PROPERTIES IN RUBBER COMPOUNDS

Electrical conductivity is the ability of a material to conduct electric current. Electrical resistivity is the reciprocal of conductivity.

Unfilled rubbers are insulative. Metals, as well as carbon blacks, are electrically conductive. Carbon black, however, requires a critical volume fraction to create a conductive path in rubber compounds:



The critical concentration for percolation varies by carbon black type and level of dispersion. Super conductive carbon blacks require a much lower quantity than regular reinforcing and semi-reinforcing ASTM carbon black.



CARBON BLACKS FOR AUTOMOTIVE WEATHER STRIPPING WITH HIGH EVR

Cabot now offers carbon blacks for automotive weather stripping applications with high EVR requirements from our SPHERON® product family, which is engineered for performance.

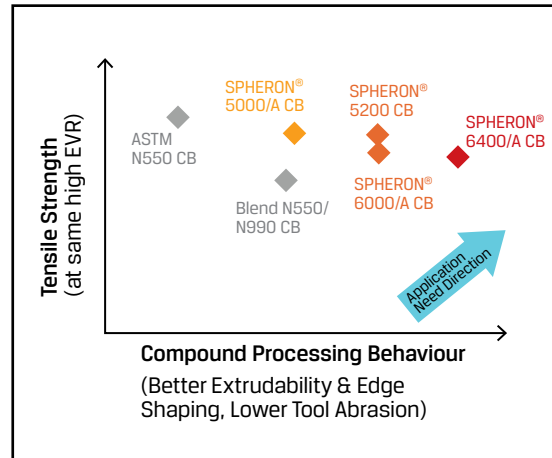
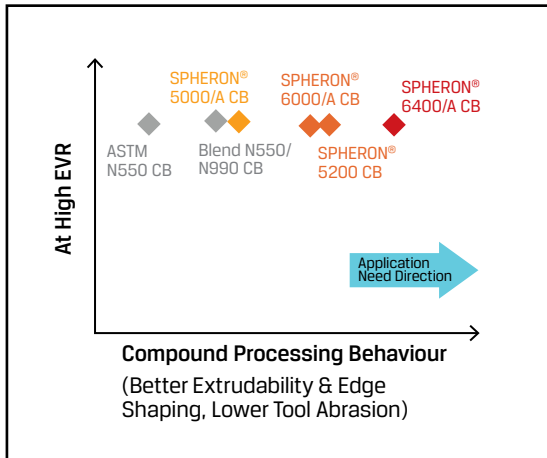
- ◆ SPHERON 6400 and 6400A, SPHERON 6000 and 6000A, and SPHERON 5200 carbon blacks offer an improved balance at a given high EVR in compound processability and application properties compared to typical ASTM N500, N600 and N700 product morphologies used in automotive weather stripping today.

SPHERON 6400A and 6000A carbon blacks are from our SPHERON A series, which have a very low amount of impurities for excellent dispersion, reduced scrap rates and Class A weather stripping surface finishes when compared with standard ASTM-type semi-reinforcing carbon blacks.



PRODUCT PERFORMANCE IN EXTRUDED RUBBER APPLICATIONS

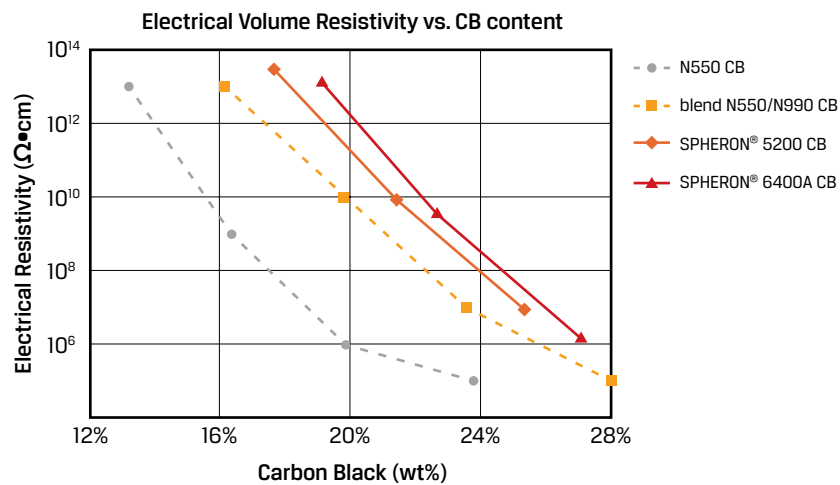
◆ At equal hardness phr loadings



Overall, relative performance ranking:

- ◆ SPHERON 5000 and 5000A **GOOD**
- ◆ SPHERON 6000 and 6000A CB, SPHERON 5200 **BETTER**
- ◆ SPHERON 6400 and 6400A **BEST**

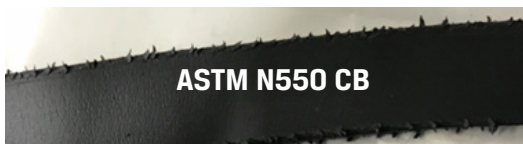
1) SPHERON 6400 and 6400A, and SPHERON 5200 carbon blacks enable higher loadings of CB to reach percolation than standard ASTM CB based solutions in a 75 Shore EPDM test formulation (100 EPDM, 35 paraffinic oil, sulfur cure system, adjusted CB & white fillers phr).



2) SPHERON 6400 and 6400A, SPHERON 6000 and 6000A, and SPHERON 5200 carbon blacks enable a higher phr with good properties and compound extrudability compared to other carbon black solutions in a standard 75 Shore EPDM test formulation (100 EPDM, 35 paraffinic oil, sulfur cure system).

Application CTQ	Lab Test	ASTM N550 CB	Blend of ASTM N550/N990 CB	SPHERON® 5000/A CB	SPHERON® 6000/A CB	SPHERON® 5200 CB	SPHERON® 6400/A CB
	CB content, (wt%)	~20	~25	~25	~26	~27	~28
Hardness	Shore A	75	75	75	75	75	75
Electrical Resistivity	EVR, (ohm.cm)	10 ⁶	10 ⁶	10 ⁶	10 ⁶	10 ⁶	10 ⁶
Strength	Tensile Strength, (MPa)	8	7	9	9	9	8
Compound Processing	Expected Extrudability Rating	★	★★★★	★★★★	★★★★★	★★★★★	★★★★★

3) SPHERON 6400 and 6400A carbon blacks' impact on compound extrudability at a given, high EVR level is superior to that offered by ASTM N550 carbon black as illustrated below in photos taken from compound extrudates under the same conditions with a standard 75 Shore EPDM test formulation (100 EPDM, 35 paraffinic oil, sulfur cure system) having an EVR at 10⁸ Ω•cm.



ASTM N550 CB

ASTM N550 CB: 53 phr (~17 wt% CB)
White Fillers: 115 phr
Density: 1,330 g/liter



SPHERON 6400/A CB

SPHERON 6400/A CB: 76 phr (~24 wt% CB)
White Fillers: 90 phr
Density: 1,300 g/liter



ABOUT CABOT CORPORATION

Cabot Corporation (NYSE: CBT) is a global specialty chemicals and performance materials company, headquartered in Boston, Massachusetts. The company is a leading provider of rubber and specialty carbons, activated carbon, inkjet colorants, cesium formate drilling fluids, fumed silica and aerogel.

For more information on Cabot's carbon black products for industrial rubber product applications, please visit the company's website at cabotcorp.com/industrialrubberproducts or by contacting our sales offices in the appropriate region:

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