CABOT

VULCAN® XC Series
Carbon Blacks

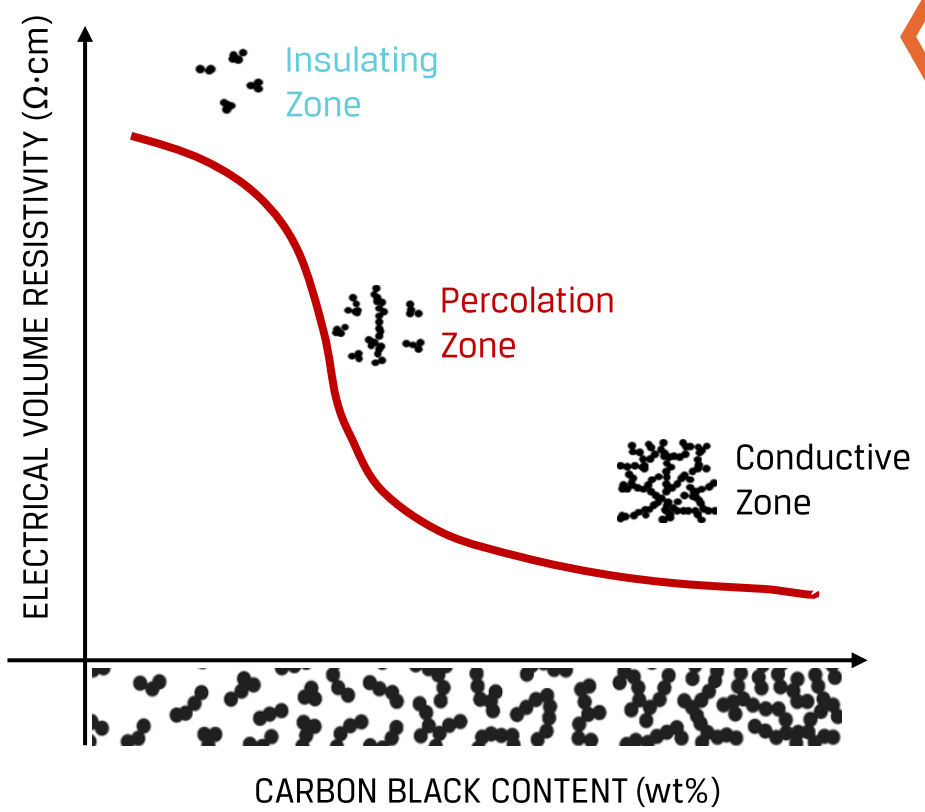
CONDUCTIVE SOLUTIONS FOR RUBBER APPLICATIONS

START ›››

eApplication Guide

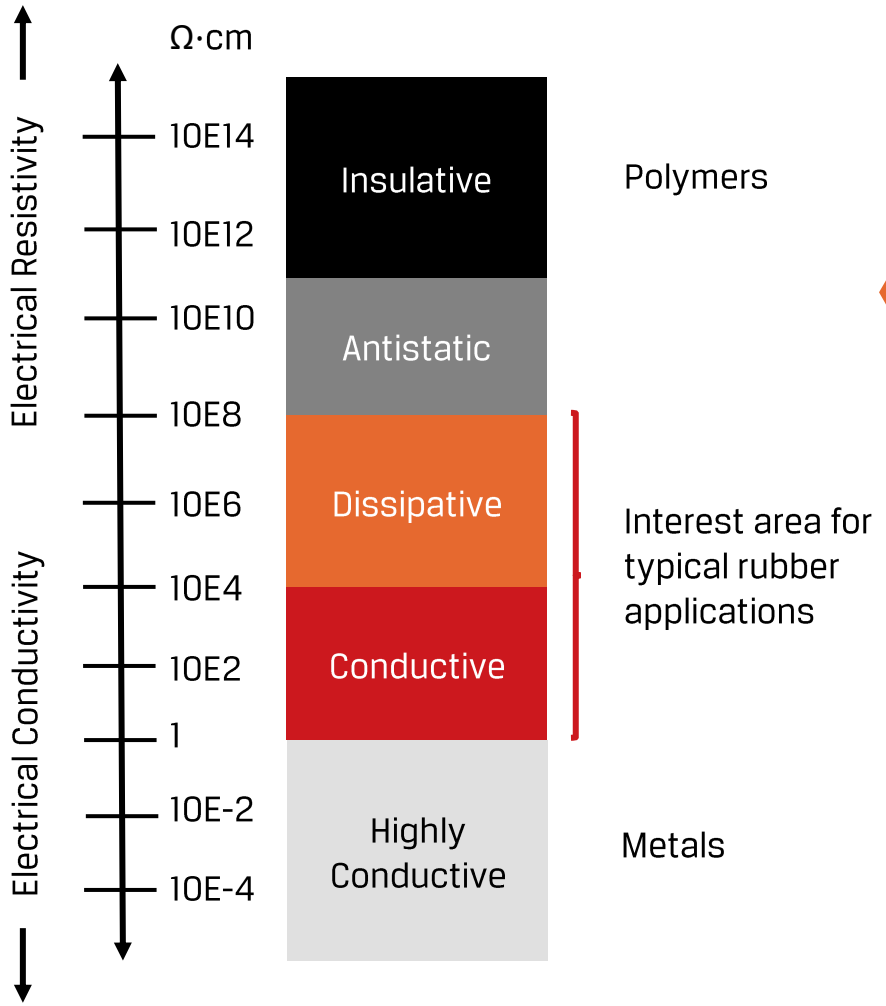
Carbon Black As a Conductor

- Carbon black is used as a reinforcing filler in rubber compounds in a wide range of applications, including tires, hoses, seals and conveyor belts.
- Carbon black is typically added to improve mechanical properties and durability, but it can also strongly enhance the electrical conductivity of rubber compounds.
- At a certain concentration in rubber – the percolation point – carbon black particles will be close enough to form an electrical contact, resulting in a drastic conductivity change.



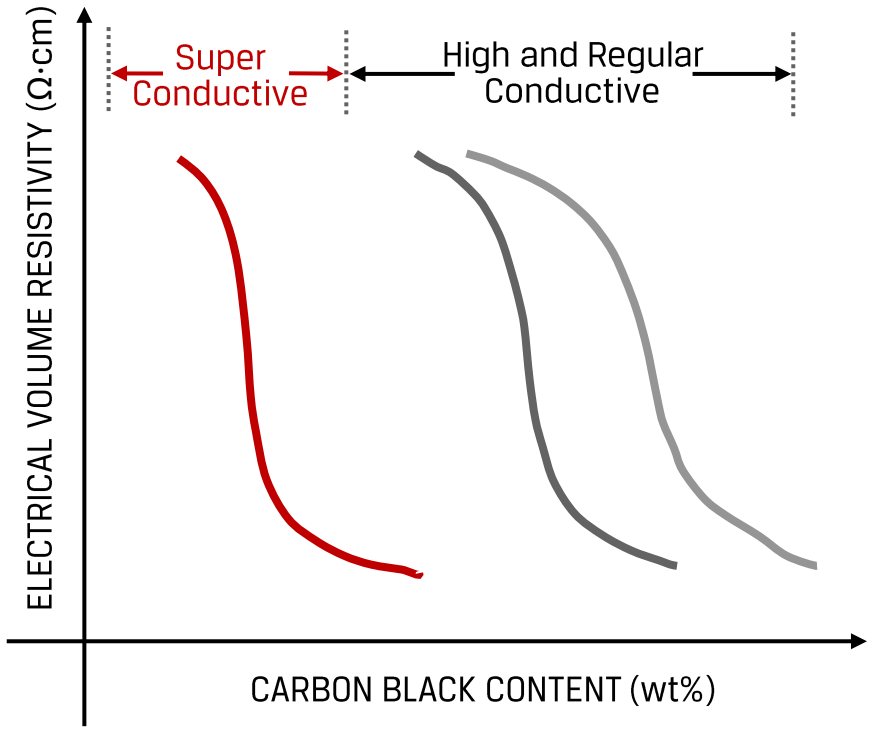
Conductive Rubber Compounds

- The electrical conductivity of rubber compounds can be increased with the addition of carbon black.
- At sufficient loadings of carbon black, the electrical resistance of rubber compounds can be low enough to class them as dissipative or conductive materials.
- Examples of rubber products with electrical conductivity or anti-static requirements are hospital flooring and sheeting; conveyor and power transmission belts; printing rolls; hoses for mining and petroleum applications; and cable screening.



Conductive Classes of Materials

- The percolation points of different carbon blacks occur at different concentrations.
- The critical concentration for percolation depends on carbon blacks' structure, surface area, porosity, surface cleanliness and graphitization level.
- Super conductive carbon black grades require less carbon black than high and regular conductive carbon black grades.



Dissipative Rubber Compounds

- Electrostatic charge buildup can happen in any system in which two non-conductive materials come into contact and move across each other, creating surface charge.
- If the excess charge continues to accumulate, this can lead to an electrostatic discharge (ESD) that can cause various hazards including ignition of flammable materials or damage of electronic components.
- Dissipative rubber compounds mitigate the risks from ESD by allowing the charge to flow away slowly instead of discharging suddenly.
- To minimize the risks of electrostatic discharge, many industrial rubber products have a specification on electrical conductivity to address the need for dissipation of electrical charges.

SERPENTINE BELT

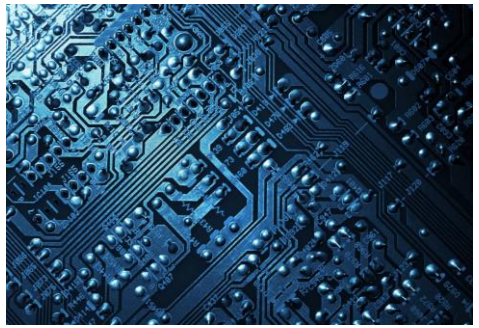
FUEL HOSE

PRINTING ROLL

Conductive Rubber Compounds

- Conductive rubber compounds enable novel component design across a wide range of applications including:
  - Electromagnetic interference (EMI) seals in electronic devices. Conductive rubber components can be easily shaped by die-cutting and can prevent intrusion by water or dust.
  - Conductive shielding in power cables. The shielding mitigates EMI produced by the current and provides a grounding effect.
  - The conductive rubber part in self-limiting switch applications.

EMI SEALS IN ELECTRONICS

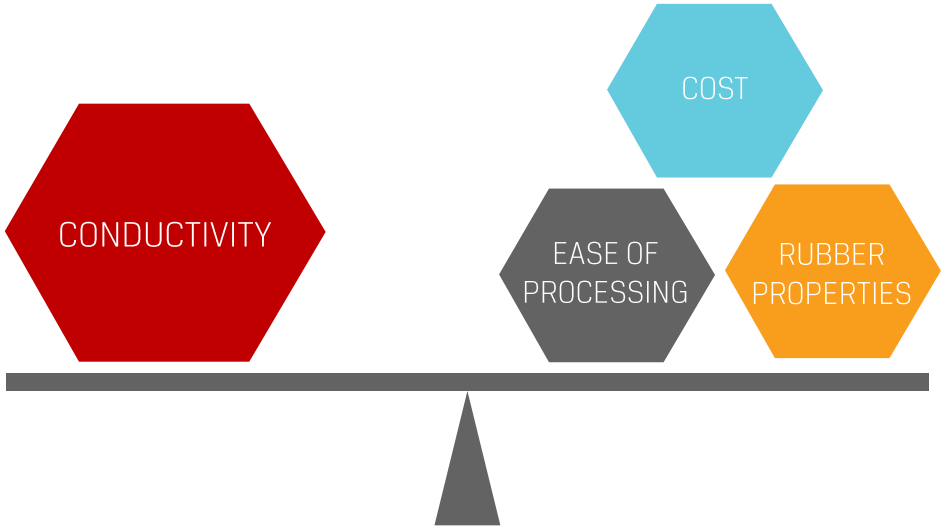


CONDUCTIVE SHIELDING IN POWER CABLES

SAFETY SWITCHES

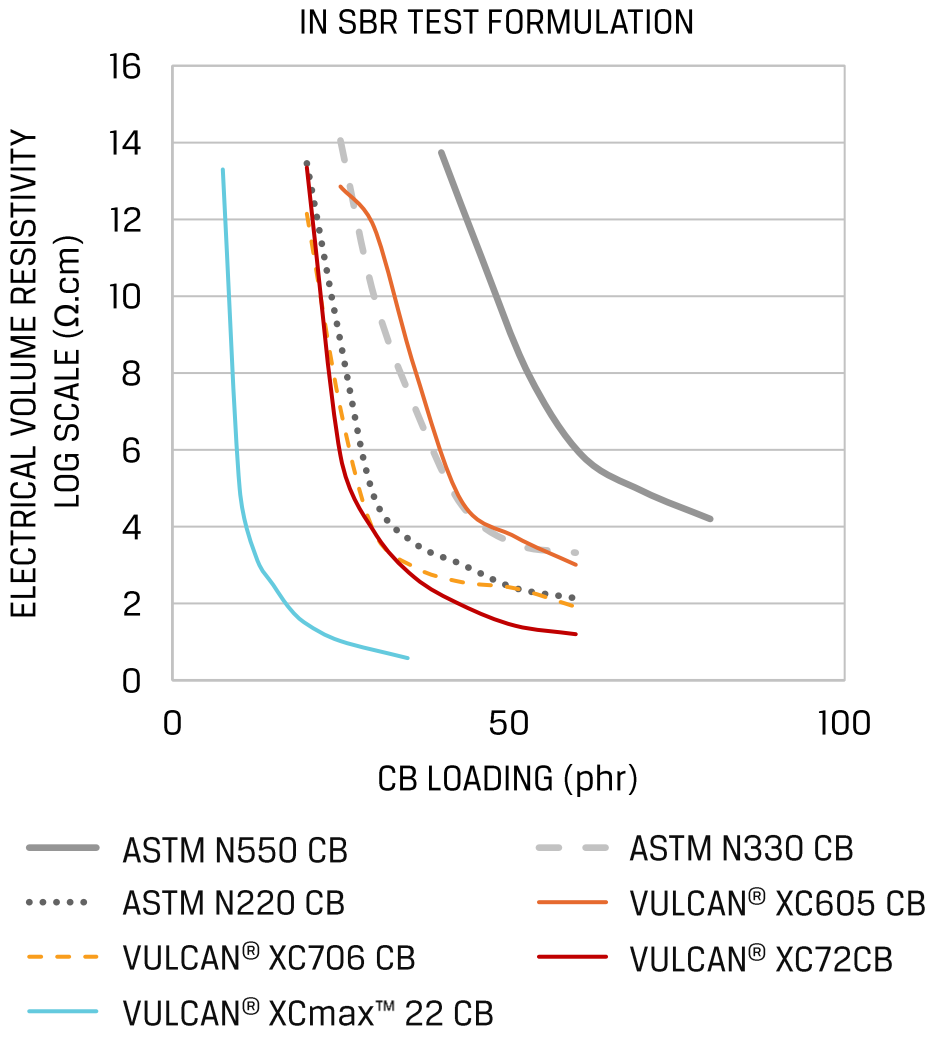
Cabot Conductive Solutions

- Electrical conductivity of the rubber compound is not the only consideration.
- Electrical conductivity must be balanced against other key rubber properties such as viscosity, elongation, hysteresis (Tan D), extrudability, tear resistance and other compound requirements.
- Given the wide variety of rubber applications, one product solution does not fit all situations.
- Cabot offers a conductive carbon black solutions portfolio to meet specific customer application needs.



Cabot Conductive Carbon Blacks

- Standard ASTM carbon blacks may provide acceptable percolation curves but have limitations for meeting other key application requirements.
- Cabot's VULCAN® XC and VULCAN XCmax™ carbon black products are designed to provide more options for optimizing the balance between required conductivity, compound processing and application requirements.



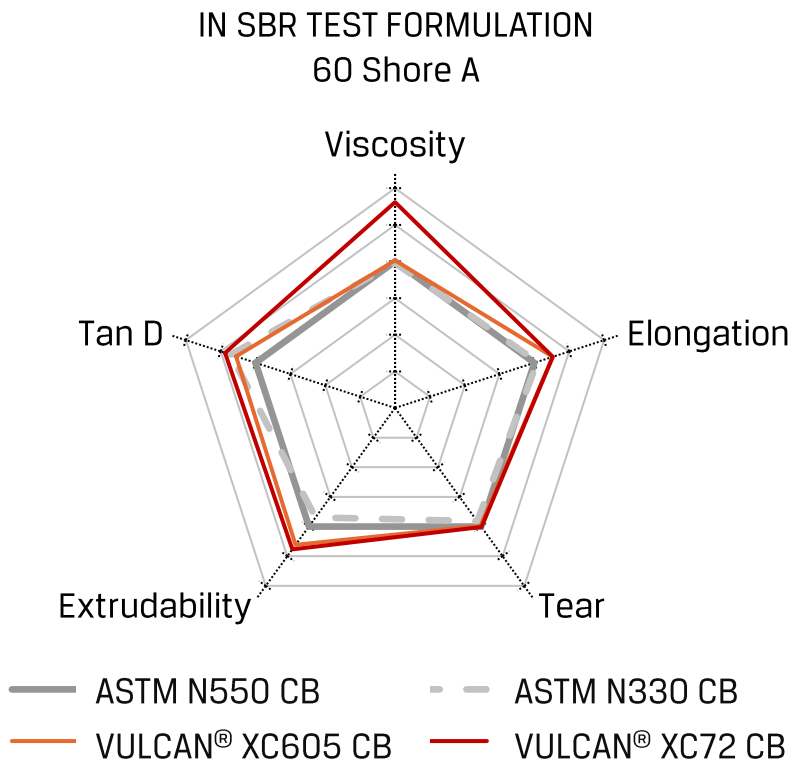
Dissipative Solutions
(< Log 6 Ω·cm)

Manufacturing Challenges

- The semi-reinforcing carbon blacks (e.g ASTM N550 carbon black) used in low and medium hardness applications lack sufficient conductivity for charge dissipation.
- Regular ASTM reinforcing carbon blacks (e.g. ASTM N330 carbon black) have suitable conductivity for dissipative rubber applications but compromise other properties like compound extrudability.

Cabot Solutions

- VULCAN® XC605 carbon black offers sufficient conductivity, along with excellent extrudability with good elongation and tear performance.
- VULCAN® XC72 carbon black offers excellent conductivity while keeping good extrudability. It can be blended with semi-reinforcing carbon blacks to increase conductivity without a compromise in both processability and other rubber properties.



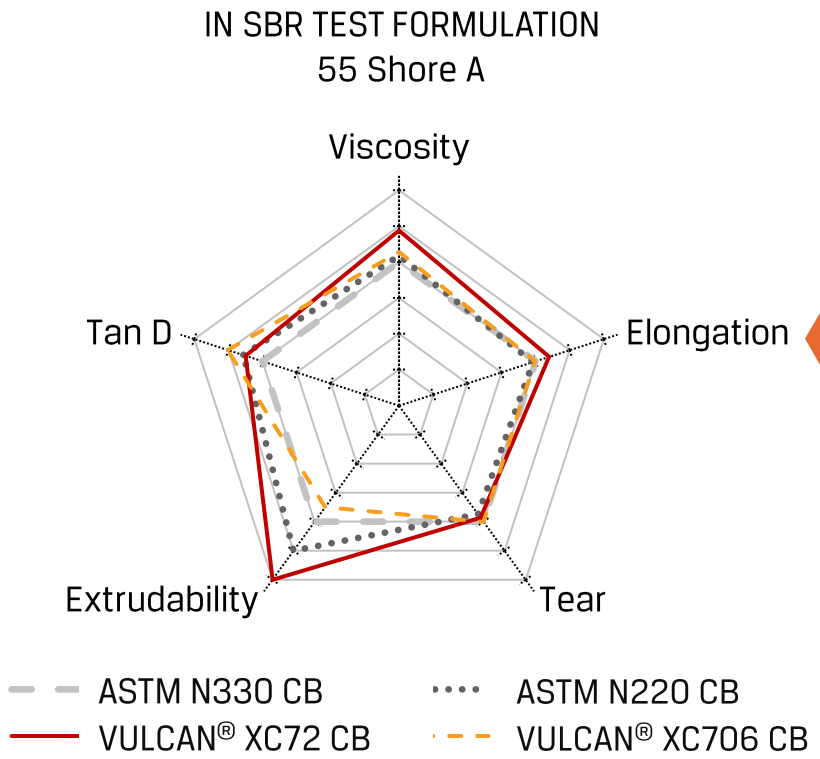
Conductive Solutions
(< Log 4 Ω·cm)

Manufacturing Challenges

- Achieving electrical conductivity with the required rubber and compound processing properties poses challenges for reinforcing carbon blacks such as ASTM N330 and ASTM N220.

Cabot Solutions

- VULCAN® XC72 carbon black provides excellent conductivity with excellent compound extrudability as well as good elongation and tear performance.
- VULCAN® XC706 carbon black provides excellent conductivity with high tear strength and elongation with low compound viscosity and is very suitable for molded applications such as printing rolls, shoe soles, belts and seals.



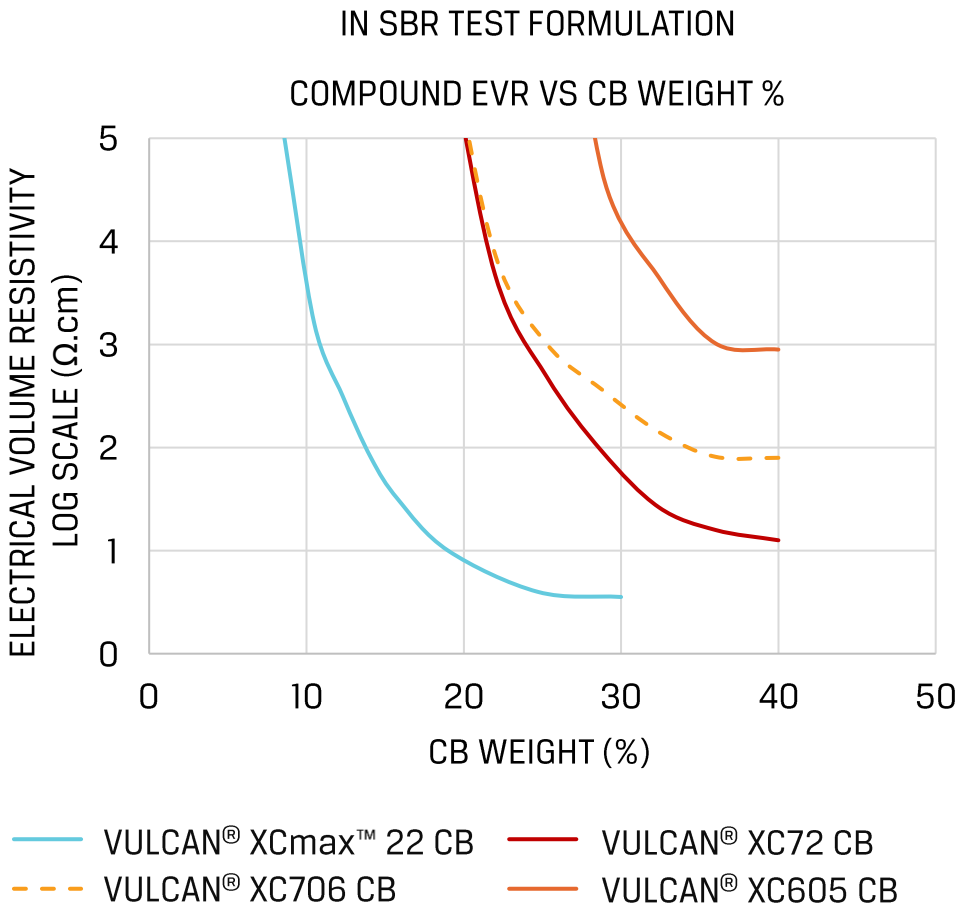
Highly Conductive Solutions
(< Log 1 Ω·cm)

Manufacturing Challenges

- VULCAN® XC72 carbon black has long been an industry standard due to its high electrical conductivity. However, there are specialist applications where an even higher level of conductivity (< Log 1 Ω·cm) is required.

Cabot Solutions

- VULCAN® XCmax™ 22 carbon black has the lowest conductive plateau with conductivity level below 1 Ω·cm. It can make the rubber compound very highly conductive at typical carbon black loadings.



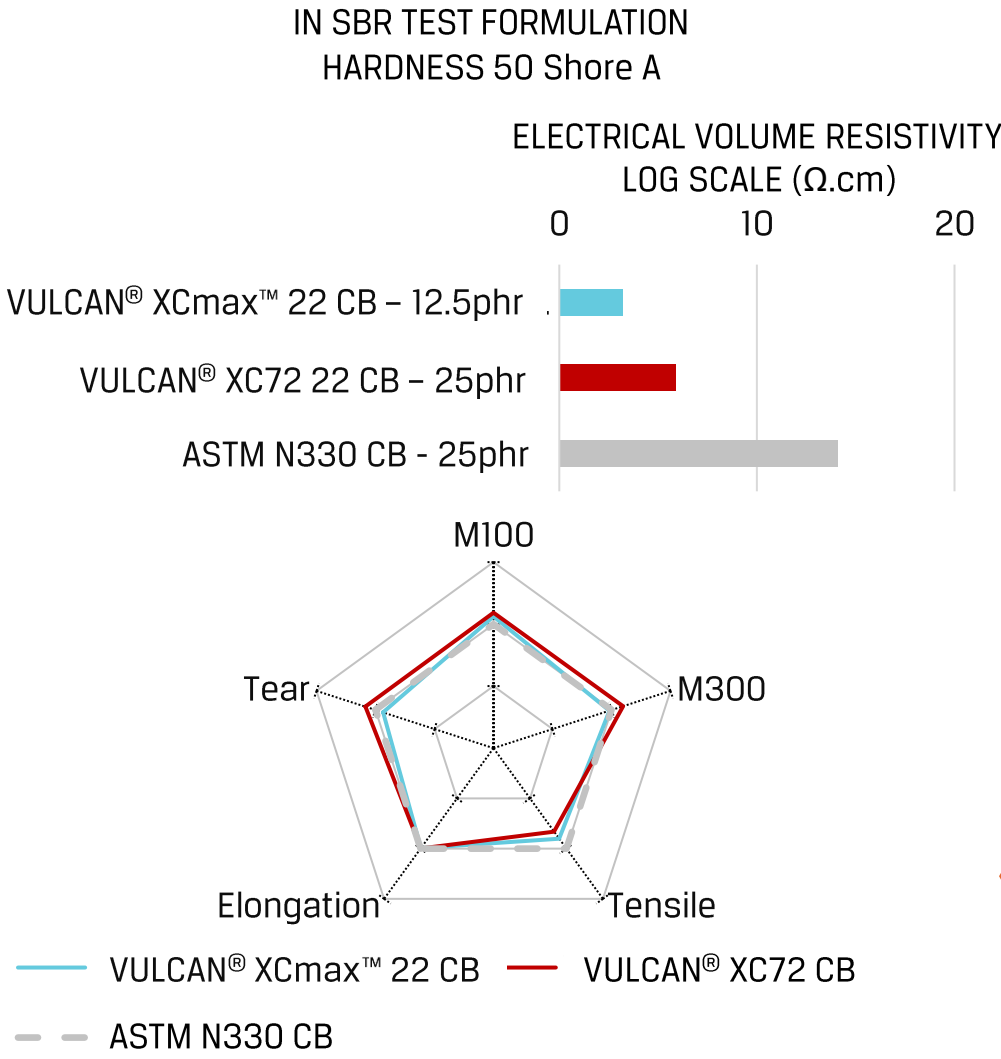
Highly Conductive, Low Hardness Solutions
(< Log 1 Ω·cm)

Manufacturing Challenges

- The addition of carbon black improves conductivity but increases hardness.
- Producing rubber compounds with high electrical conductivity, low hardness and good processing properties is difficult with ASTM grade carbon black products.

Cabot Solutions

- The percolation point for VULCAN® XCmax™ 22 carbon black in rubber occurs at a very low concentration and before hardness rapidly starts to rise.
- For compounds with low hardness, VULCAN® XCmax™ 22 carbon black provides the highest conductivity of the **VULCAN® XC** carbon black series, combined with good rubber property performance.



VULCAN® XC Series Carbon Blacks

PERFORMANCE AT EQUAL CB LOADING	VULCAN® XC605 CB	VULCAN® XC706 CB	VULCAN® XC72 CB	VULCAN® XCmax™ 22 CB
Electrical Conductivity	★★★	★★★★	★★★★	★★★★★
Rubber Reinforcement	★★	★★★	★★★	★★★★★
Compound Extrudability	★★★★★	★★	★★★★	★★★
Mechanical strength	★★★	★★★★★	★★★★	★★★★★
Dynamics, Low Heat Built Up	★★★★★	★★★	★★★★	★

Key: More "★" means better performance

VULCAN® XC605 Carbon Black

General Description

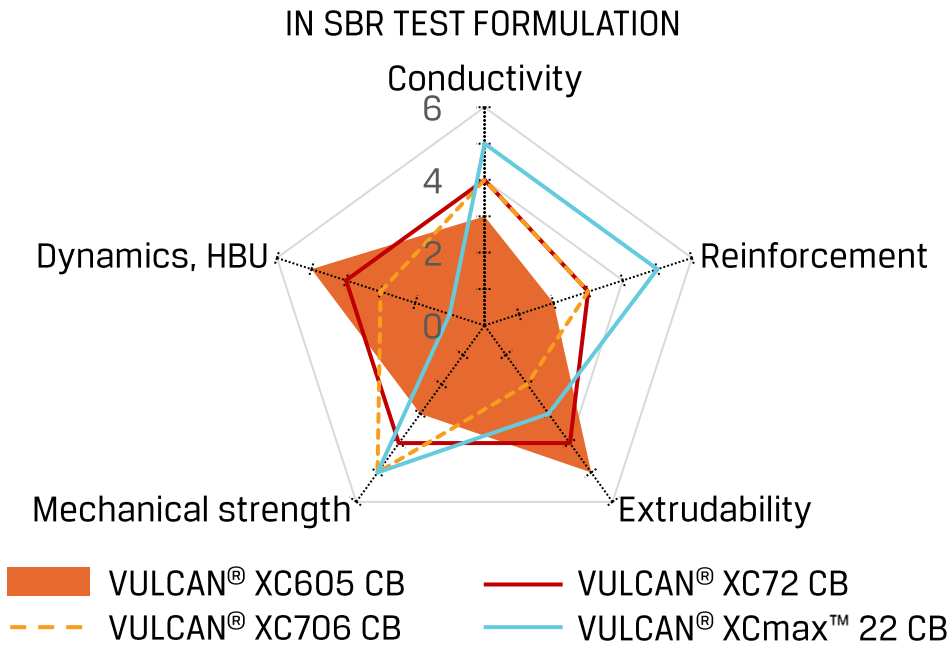
VULCAN® XC605 carbon black is designed to impart electrical conductivity with good dynamic properties and extrudability to rubber compounds.

Performance Features

- Provides sufficient electrical conductivity properties to meet dissipative application requirements at typical carbon black loading levels.
- Very easy to disperse in rubber.
- Compounds with VULCAN® XC605 carbon black have very good extrudability.
- Comparable reinforcement properties to ASTM N300 type carbon blacks with superior dynamic properties.

Typical Applications

- Anti-static and conductive rubber applications.
- Conveyor and power transmission belts.
- Printing rolls.
- Hoses for mining and fuel.
- Cable screening.



VULCAN® XC706 Carbon Black

General Description

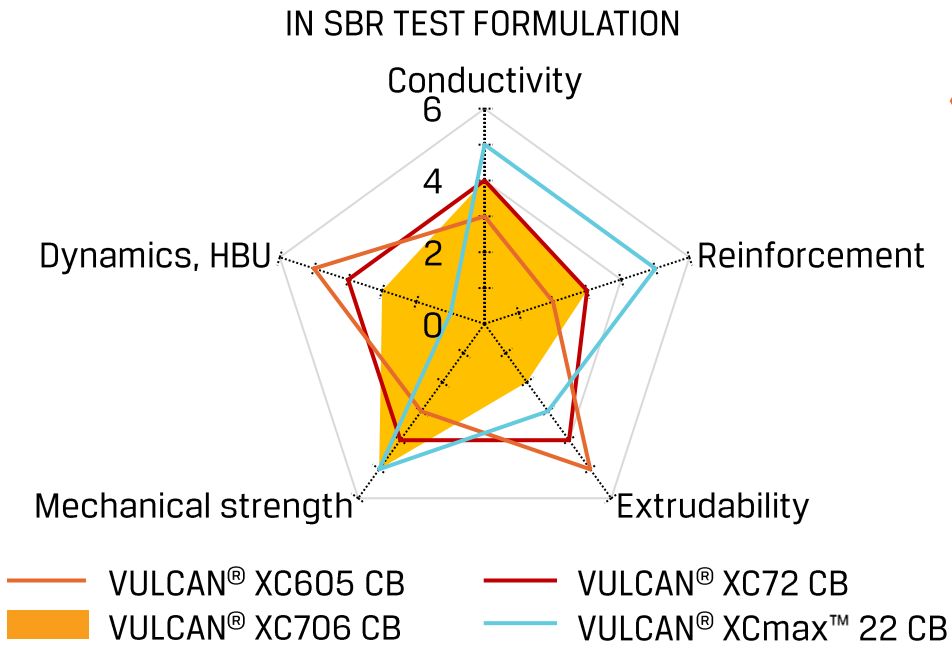
VULCAN® XC706 carbon black offers a combination of electrical conductivity and good reinforcement to rubber compounds.

Performance Features

- Very good electrical conductivity properties in rubber; can meet conductivity requirements without the need for very high carbon black loadings
- Easy to disperse in rubber
- Comparable reinforcement properties to ASTM N200 type carbon blacks with higher mechanical strength and abrasion resistance.

Typical Applications

- Hospital flooring and sheeting.
- Conveyor belts.
- Printing rolls.



VULCAN® XC72 Carbon Black

General Description

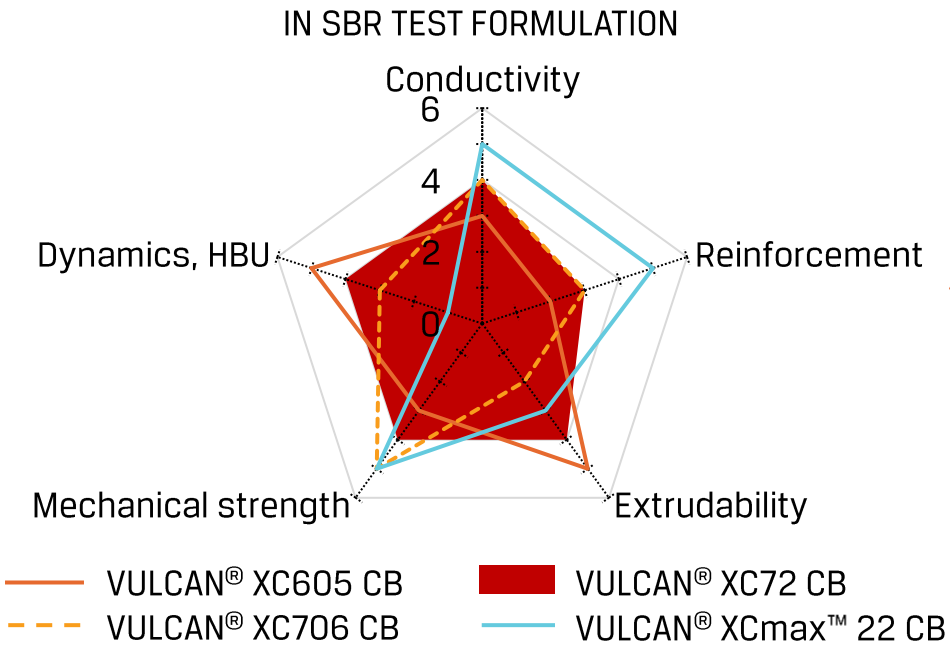
VULCAN® XC72 carbon black is an industry standard with many years of proven conductivity performance in a wide range of anti-static and conductive rubber applications.

Performance Features

- Very good electrical conductivity properties in rubber.
- Easy to disperse.
- Compounds with VULCAN® XC72 carbon black have very good extrudability.
- Comparable reinforcement properties to ASTM N300 and N200 carbon blacks with higher stiffness and low extension modulus.

Typical Applications

- Conveyor and power transmission belts.
- Printing rolls.
- Cable screening.
- Hoses for mining, petroleum.
- Finger trap safety switches.



VULCAN® XCmax™ 22 Carbon Black

General Description

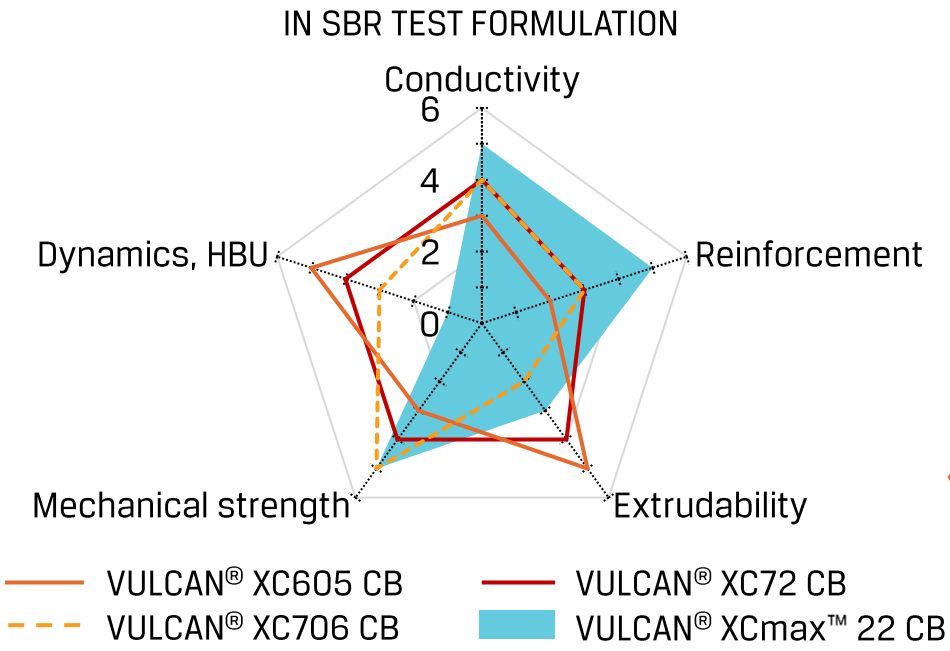
VULCAN® XCmax™ 22 carbon black is a super conductive carbon black that achieves conductivity at 50% or less of the required loading of other Cabot carbon blacks.

Performance Features

- Meets conductivity requirements at very low carbon black loadings and compound hardness levels.
- Can be used to replace a small portion of carbon black in a rubber compound to boost electrical conductivity.
- Very high reinforcement properties beyond those offered by any ASTM type carbon black.

Typical Applications

- EMI seals in electronics.
- Very highly conductive rubber parts in self-limiting switch applications.



Product Selection: VULCAN® XC Series

- Cabot's VULCAN® XC and VULCAN® XCmax™ carbon black solutions provide customers with a choice of products to optimize the balance of electrical conductivity, compound processing and rubber properties.
- Cabot's Application and Technical Solutions Team will work closely with you to solve your challenges by leveraging our decades of knowledge in carbon black material science, elastomer formulation and production, and manufacturing techniques for a wide variety of industrial rubber product applications with electrical dissipative or conductive requirements.

To contact our team, please visit cabotcorp.com/contact