

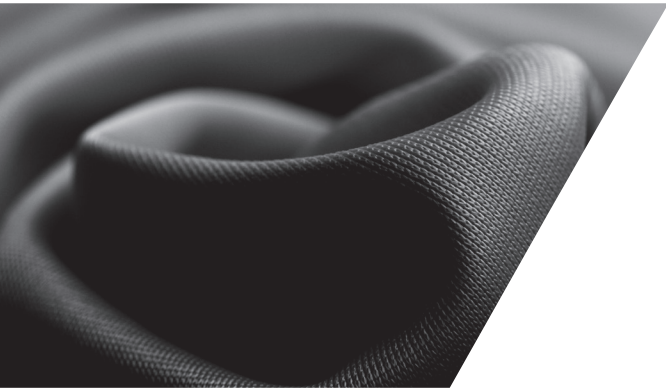


SPECIALTY CARBON BLACKS

SPECIALTY CARBON BLACKS

FOR SYNTHETIC FIBER AND
TEXTILE FABRICS





Performance and leadership in black plastics

Cabot Corporation is a global performance materials company and we strive to be our customers' commercial partner of choice. We have been a leading manufacturer of carbon black and other specialty chemicals for more than 130 years, and we have supplied additives to the plastics industry since its inception.

Our global reach enables us to work closely with customers to meet the highest standards for performance, quality and service. Our global production network and three applications development facilities provide our customers with global service capabilities as well as the latest technical innovations.

Global reach

We support customers around the world in our global production and applications development centers

◆ North America

Canada
Mexico
United States

◆ South America

Argentina
Brazil
Colombia

◆ Europe, Middle East & Africa

Belgium
Czech Republic
France
Germany
Italy
Latvia
Norway
Switzerland
The Netherlands
United Arab Emirates
United Kingdom

◆ Asia Pacific

China
India
Indonesia
Japan
Korea
Malaysia
Singapore

With approximately 4,500 employees worldwide, we continue to create a diverse environment rooted in values and sustainability.

We operate 44 manufacturing sites in 21 countries, all with local management teams. We have a global footprint in order to serve our customers throughout the world.

Delivering exceptional color and cleanliness for fiber and textile applications

For the fiber and textile industries, we offer a portfolio of specialty carbon blacks that deliver exceptional color performance and physical cleanliness enabling processors to maintain consistent, reliable production. Our specialty carbon blacks can help reduce the occurrence of undesirable features of dyes for synthetic fiber applications, including inconsistent fiber characteristics, low high color fastness and negative environmental impacts. Our specialty carbon blacks allow customers to produce synthetic fibers with highly reproducible characteristics, strong color fastness, minimal colorant migration and with a low environmental impact.

Our products are suitable for use in a range of polymers, including polyester, nylon and polypropylene.

Our brands

We supply a diverse product range of specialty carbon black products to meet performance and processability requirements across many industries and end uses. Offered in pellet and powder form, our long-established products for plastics include VULCAN[®], ELFT[®] and BLACK PEARLS[®] specialty carbon blacks.



Products for fiber and textile applications

We offer products that can meet the performance needs for fine denier, staple fiber and industrial applications.

High-cleanliness specialty carbon blacks for fine denier applications

Apparel and textile applications that use fine denier fibers based on polyesters and nylons typically require strong color performance. High cleanliness of carbon blacks (e.g., low ash and grit content) enables better spinnability and higher melt polymer filterability which, in turn, are necessary to achieve the desired strong color performance. Our BLACK PEARLS® 5560, 4560i and 3560 carbon blacks have the required level of cleanliness, as measured by pressure across a screen, to meet these requirements. Each of these three products is regularly tested for cleanliness as part of our quality control processes. Relative product performance is illustrated in Figure 1.

Standard-cleanliness specialty carbon blacks for coarse staple fiber applications

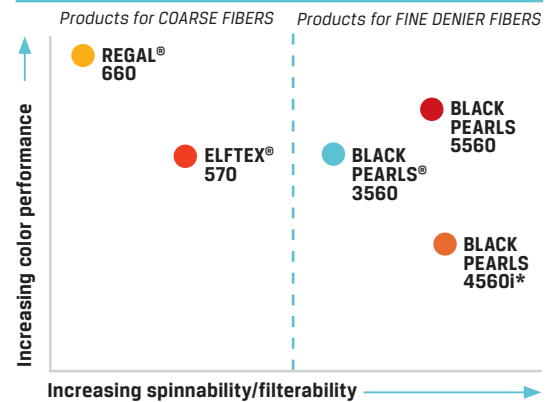
Coarse staple fiber applications include floor coverings, woven blankets and other types of textiles that do not require fine denier fiber. For these relatively coarse denier applications that typically utilize nylon, polypropylene, and polyester, color performance is typically the most important characteristic, while filterability and spinnability of the compound are often less critical compared with fine denier applications. As shown in Figure 1, our products for these applications include ELFTEX® 570 and REGAL® 660 specialty carbon blacks.

Specialty carbon blacks for industrial filament

Industrial filament applications include safety belts, ropes, industrial fabrics and other uses where strength is paramount. These applications often use nylon as the primary resin and consistency of physical properties of filaments is critical; thus, dispersibility of carbon black is important to achieve required performance. BLACK PEARLS® 5560, 4560i and 3560 specialty carbon blacks, as well as ELFTEX® 570 specialty carbon black, are typically used in these applications; their relative performance is shown in Figure 1.



Figure 1: Specialty carbon blacks for fine denier and other synthetic fibers



Product performance

The critical carbon black design parameters for most fiber and textile applications include:

- ◆ Color performance
- ◆ Carbon black cleanliness
- ◆ Processability

Color performance

Color is measured along three axes:

- ◆ L* (color strength, also known as jetness or masstone) values represent white/black or light/dark
- ◆ a* values represent red/green
- ◆ b* (blue tone) values represent yellow/blue

With respect to carbon black, L* and b* are most relevant values. Low L* values are preferable (indicating a darker, or more black, color), as are increasingly negative b* values (indicating a bluer undertone). Our products for fiber and textile applications have been specifically designed to deliver excellent jetness and blue undertone.

The color performance of our carbon blacks in synthetic fibers is primarily driven by four elements:

- ◆ Carbon black morphology
- ◆ Carbon black concentration in the fiber
- ◆ Dispersion quality of the carbon black in the fiber (related to masterbatch dilutability and carbon black dispersibility)
- ◆ Fiber characteristics such as titer, dullness and texture

Figures 2 and 3 illustrate color performance of BLACK PEARLS 5560 and 4560i specialty carbon blacks. For comparison with other Cabot products, please contact your Cabot representative.

Figure 2: Color performance of polyester fibers containing Cabot carbon blacks vs. carbon black loading

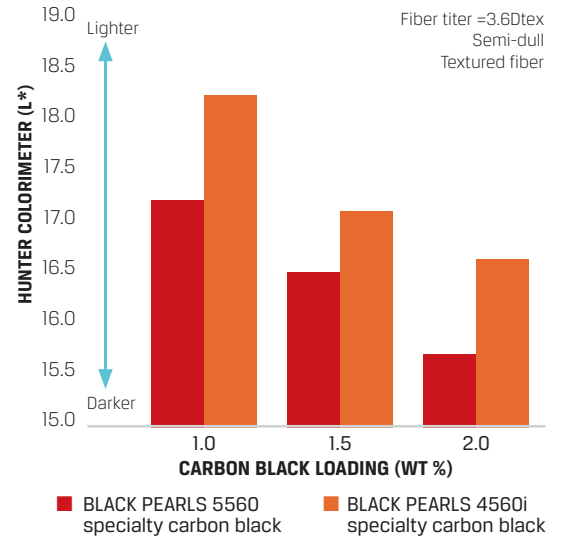
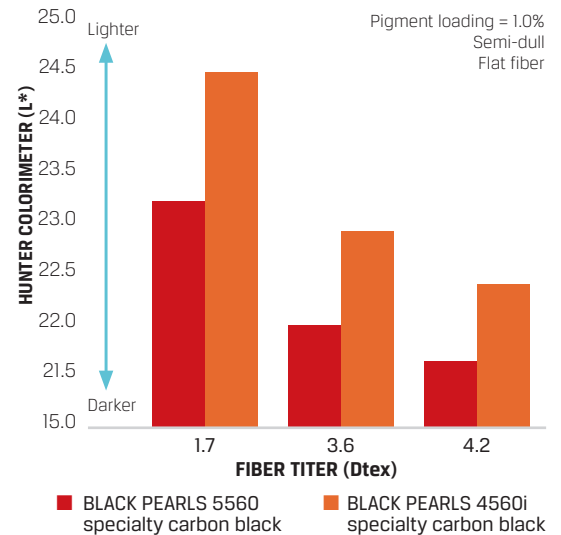


Figure 3: Color performance of polyester fibers containing Cabot carbon blacks vs. fiber titer



Carbon black cleanliness

Highly clean carbon blacks that can be well-dispersed can help fiber producers achieve excellent compound filterability and spinnability, which can facilitate longer, more efficient production runs with minimal spin breaks. Our BLACK PEARLS® 5560, 4560i and 3560 specialty carbon blacks have been engineered to offer consistently exceptional physical cleanliness and dispersibility.

Filterability of a compound is correlated to the yield and efficiency of the fiber production. Poor compound filterability reduces the operational lifetime of the two filter media (i.e., the central polymer filtration system, or CPF and the spin-pack filter) commonly installed on polyester fiber production lines before the spinnerets. Spinnability refers to the ability of a compound to resist filament breakages during the spinning process and achieve maximum spin yields.

Figures 4 and 5 illustrate the theoretical relationships between filterability and spinnability performance, as measured by filter pressure change over time, of neat resin, a compound containing a standard specialty carbon black and a compound containing a high cleanliness specialty carbon black, such as BLACK PEARLS 5560, 4560i, or 3560 specialty carbon blacks. Performance results will vary greatly depending on numerous factors including compounding method, compounding equipment and other factors, but a compound incorporating a high-cleanliness specialty carbon black will typically perform much better than a compound containing a standard carbon black.

Figure 4: Theoretical CPF pressure change vs. time

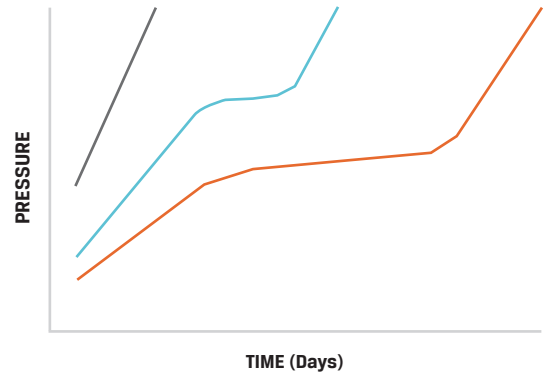
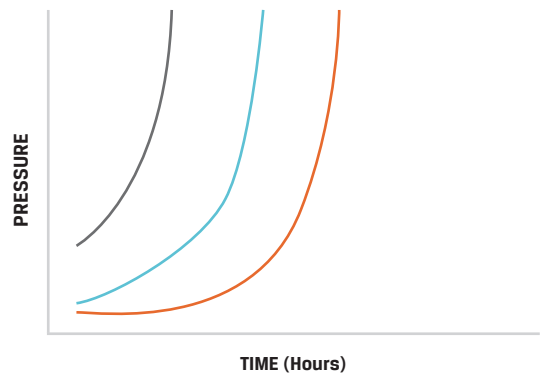


Figure 5: Theoretical spin-pack filter pressure change vs. time



Polyester resin with:

- NO CARBON BLACK
- HIGH CLEANLINESS SPECIALTY CARBON BLACK
- STANDARD CLEANLINESS SPECIALTY CARBON BLACK

Polyester resin containing equal loadings of standard and high cleanliness specialty carbon blacks

Processability

Processability refers to the ease with which carbon black can be incorporated into a compound. Processability is a key consideration in compound formulation and we understand the need to create carbon black products that provide the required performance benefits as well as a high level of processability as measured along three dimensions:

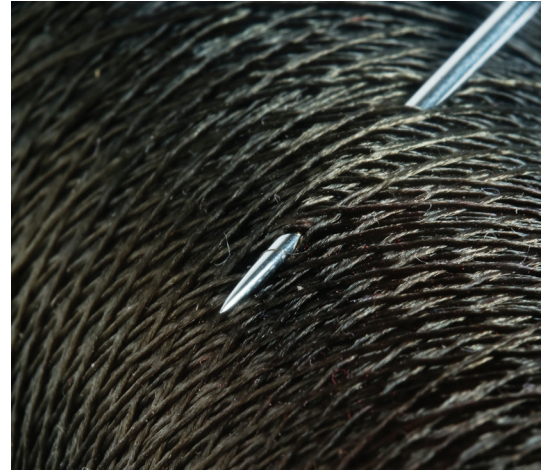
- ◆ Dispersibility
- ◆ Masterbatch viscosity and maximum carbon black loading
- ◆ Polymer compatibility

Dispersibility

Good dispersibility is critical for achieving the following important processing and product attributes in fiber and textile applications:

- ◆ Filterability and spinnability
- ◆ Color performance
- ◆ Minimal impact on mechanical properties of the base polymer

Each of these characteristics are influenced by the degree of carbon black dispersion in the compound, a measure of the level to which carbon black aggregates are evenly distributed in a compound. Poor dispersion is reflected in only partial de-agglomeration of aggregates which can cause filter plugging, fiber breakages and surface and mechanical defects. In contrast, excellent dispersion provides a high degree of de-agglomeration and facilitates a homogeneous distribution of carbon black within the polymer matrix, leading to good filterability and spinnability.



Masterbatch viscosity and carbon black loading

For fiber applications, our carbon blacks are generally formulated into masterbatches that are then incorporated into a compound that is used for fiber spinning. Masterbatch dilutability describes how easily a masterbatch can be distributed in, or mixed with, a dilution polymer. Dilutability of a masterbatch is linked to its viscosity as measured by its melt flow index (MFI). Compared to a neat polymer, a masterbatch made from the same polymer and a standard dosage of carbon black will have a lower MFI (higher viscosity). However, by selecting the most appropriate carbon black, masterbatch formulators can tailor masterbatches to meet their specific dilutability requirements.

Figure 7 shows that at the same carbon black loading, masterbatches made with BLACK PEARLS® 4560i specialty carbon black are much more fluid (higher MFI) than masterbatches incorporating BLACK PEARLS 3560 and 5560 specialty carbon blacks. As a result, masterbatches that contain BLACK PEARLS 4560i specialty carbon black may have higher concentrations of carbon black than comparable masterbatches made with BLACK PEARLS 3560 and 5560 specialty carbon blacks, without exhibiting a decline in performance.

Polymer compatibility

We offer a range of carbon black products that can be used in most common polymer systems. For fiber applications, the dominant polymers are polyester, nylon and polypropylene, and typical respective uses are described in Table 1.

Figure 7: MFI of polypropylene masterbatches containing Cabot high cleanliness specialty carbon blacks (35 wt%)

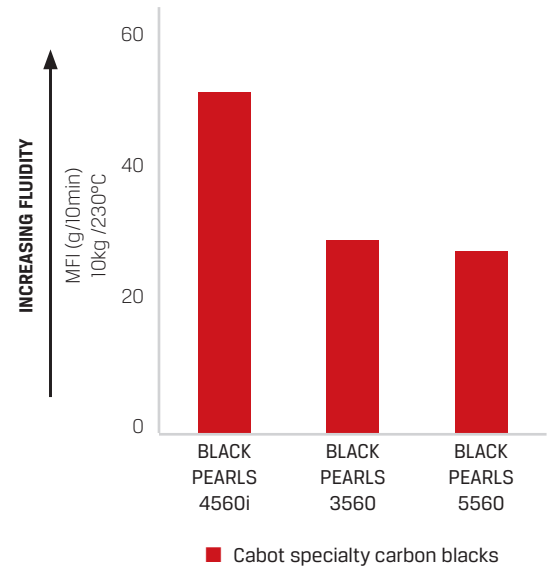


Table 1: Typical uses of synthetic fibers

| | |
|---------------------------------|---|
| Polyester fiber | <ul style="list-style-type: none"> ◆ Textile filament for various applications including apparel and home furnishings and industrial applications ◆ Staple fibers that are incorporated into fiber blends ◆ Textile filament used for rubber reinforcement and high strength fabrics |
| Nylon (PA) fiber | <ul style="list-style-type: none"> ◆ Clothing (e.g., sport wear, lingerie, pantyhose) ◆ Home furnishing (e.g., carpets) ◆ Industrial products (e.g., nets, ropes and tire cords) |
| Polypropylene (PP) fiber | <ul style="list-style-type: none"> ◆ Non-woven fabrics ◆ Home furnishings ◆ Automotive applications |



Product data

| Specialty carbon black product | Description |
|---|---|
| High cleanliness specialty carbon blacks | |
| BLACK PEARLS® 5560 | High jetness, specialty carbon black for fiber applications providing good blue-tone and exceptional cleanliness for fine denier fiber |
| BLACK PEARLS 4560i | Specialty carbon black delivering superior cleanliness and processability (higher MB loadings) for fiber applications |
| BLACK PEARLS 3560 | Specialty carbon black that offers a balance of cleanliness and color for standard fibers (e.g. high end carpets, coarse filaments) |
| Standard cleanliness specialty carbon blacks | |
| ELFTEX® 570 | Multi-purpose specialty carbon black for coloration and UV / weatherability performance across plastic applications including coarse staple fiber |
| REGAL® 660 | Regular carbon black for applications where moderate to high levels of cleanliness are not required. |



Additional references

This Product Application Guide provides specific information about our specialty carbon blacks for use in fiber and textile applications. For other application-specific product recommendations and broader product portfolio information, please visit cabotcorp.com or contact your Cabot representative.

NORTH AMERICA

Cabot Corporation Business
and Technology Center
157 Concord Road
P.O. Box 7001
Billerica, MA 01821 - USA

Technical service
T +1 800 462 2313

Customer service
T +1 678 297 1300
F +1 678 297 1245

SOUTH AMERICA

Cabot Brasil Industria
e Comercio Ltda.
Rua do Paraiso 148 - 5 andar
04103-000 Sao Paulo,
Brazil

T +55 11 2144 6400
F +55 11 3253 0051

EUROPE

SIA Cabot Latvia
101 Mukusalas Street
Riga, LV-1004,
Latvia

T +371 6705 0700
F +371 6705 0985

MIDDLE EAST & AFRICA

Cabot Dubai
P.O. Box 17894
Jebel Ali Free Zone
LOB 15, Office 424
Dubai

United Arab Emirates
T +971 4 8871800
F +971 4 8871801

ASIA PACIFIC

Cabot China Ltd.
558 Shuangbai Road
Shanghai 201108
China

T +86 21 5175 8800
F +86 21 6434 5532

JAPAN

Cabot Specialty Chemicals Inc.
Sumitomo Shiba-Daimon Bldg. 3F
2-5-5 Shiba Daimon,
Minato-ku
Tokyo 105-0012
Japan

T +81 3 6820 0255
F +81 3 5425 4500

The data and conclusions contained herein are based on work believed to be reliable, however, Cabot cannot and does not guarantee that similar results and/or conclusions will be obtained by others. This information is provided as a convenience and for informational purposes only. No guarantee or warranty as to this information, or any product to which it relates, is given or implied. This information may contain inaccuracies, errors or omissions and CABOT DISCLAIMS ALL WARRANTIES EXPRESS OR IMPLIED, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AS TO (i) SUCH INFORMATION, (ii) ANY PRODUCT OR (iii) INTELLECTUAL PROPERTY INFRINGEMENT. In no event is Cabot responsible for, and Cabot does not accept and hereby disclaims liability for, any damages whatsoever in connection with the use of or reliance on this information or any product to which it relates.

The BLACK PEARLS, ELFTEx and REGAL names are registered trademarks of Cabot Corporation.



CABOT 

cabotcorp.com

© 2016 Cabot Corporation.
R02 9/2016