



SPECIALTY CARBON BLACKS

SPECIALTY CARBON BLACKS

FOR PLASTIC FILM AND
SHEET APPLICATIONS





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 product performance through superior color and premium UV protection

We offer carbon blacks that are used in a variety of film and sheet applications including consumer and food packaging, industrial film, lamination, carrier bags, refuse bags, geosynthetics and agricultural films. Whether you need covering power, premium UV protection, or both, we have developed a specialty carbon black for your needs. In addition, our specialty carbon blacks are clean, maintaining the aesthetic quality of your final product.

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. While some products have performed successfully in plastic applications for more than 50 years and are top choices for the industry, we continue to innovate and develop new products to drive our customers' product performance.



Products for film and sheet applications

There are four key film and sheet applications where specialty carbon blacks provide enhanced performance and functionality:

- ◆ Premium packaging and lamination film
- ◆ Agricultural mulch and silage film
- ◆ Geosynthetics and geomembranes
- ◆ General purpose / utility film and sheet

Premium packaging and lamination film

Packaging and lamination applications comprise a significant portion of all plastic film and sheet end uses. In all of these end-uses, surface smoothness, opacity, and dispersibility performance are key performance parameters. In addition, we offer specialty carbon blacks that meet both U.S. FDA and European Union food contact standards.

For packaging and lamination needs, we feature the products highlighted in Figure 1.

Agricultural mulch and silage film

Mulch films help farmers improve the productivity by suppressing weed growth, maintain humidity and protecting roots from climatic extremes. Silage film and silage stretch wrap is used to produce and store fodder for livestock. Its uses include hay bale wrapping and covering of green fodder to promote anaerobic fermentation. Ensuring that these films perform over their useful life, specialty carbon blacks offer UV protection to prevent polymer degradation while preventing any loss in mechanical properties.

Based on these performance needs, we feature the products highlighted in Figure 2.

Figure 1:
Carbon blacks for packaging and lamination

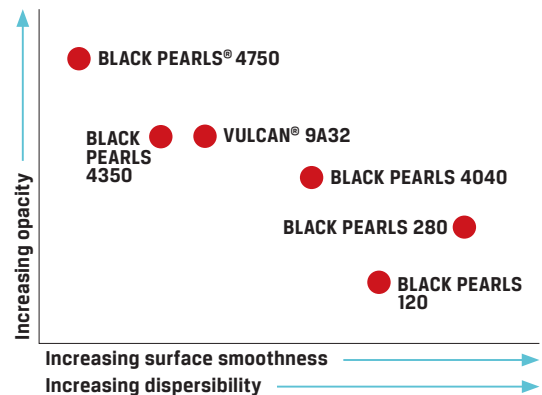
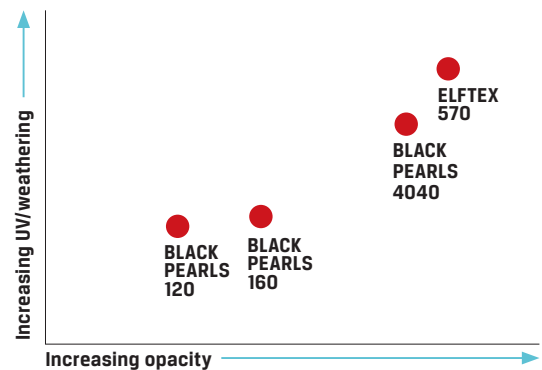


Figure 2:
Carbon blacks for mulch and silage film

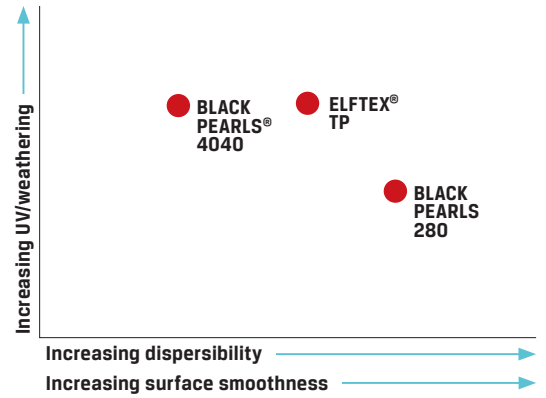


Geomembrane applications

In construction applications, geomembranes are flexible or semi-rigid sheets that create barriers to liquid and gas transfer. They are used as landfill liners and covers, pond liners, tunnel liners and for containment or storage of water or wastes. UV protection is important for geomembranes, as they can be exposed to the elements for long periods of time. In addition, maintaining mechanical film integrity is critical, so specialty carbon blacks that offer high levels of dispersibility are important to reduce film imperfections that can lead to failure.

To meet these needs, we feature the products highlighted in Figure 3.

Figure 3:
Carbon blacks for geomembranes



Performance

Our specialty carbon blacks provide important performance benefits for both film and sheet applications. These include:

- ◆ Opacity to keep out light or keep in heat
- ◆ Deep black coloration
- ◆ Film smoothness to provide aesthetic quality and maintain mechanical integrity
- ◆ UV protection to prevent polymer degradation

The importance of each performance benefit depends on the application and drives the carbon black selection process.

Opacity

Opacity of a film is the extent to which it is opaque, or not transparent. By measuring the transmission of light through a film, one can measure the film's opacity - the lower the level of light transmission, the higher the opacity and vice versa. In applications such as refuse sacks that hide sack contents and agricultural films that are used to prevent weed growth, opacity performance is critical.

Opacity is a function of three parameters directly related to the film itself:

- ◆ Absorption coefficient, a function of the type of carbon black and polymer
- ◆ Thickness of film
- ◆ Carbon black concentration

Thus, film opacity can be modified by modifying the carbon black/polymer pairing, film thickness and/or carbon black concentration. By selecting the most appropriate Cabot carbon black for your application, you can achieve high levels of opacity performance with reduced loading and cost.

Figures 4 and 5 illustrate the dependency of film opacity on film thickness and pigment loading, respectively, for four of our products. For very thin film applications, VULCAN[®] 9A32, ELFTEX[®] 570 and BLACK PEARLS[®] 4040 specialty carbon blacks have the most opacifying power and can achieve high levels of opacity in thin films with low loading. For applications where less opacity is required and/or higher loadings are acceptable, BLACK PEARLS 120 specialty carbon black provides a cost-effective solution.

For additional product comparisons, please contact your Cabot representative.

Figure 4:
Opacity vs. film thickness

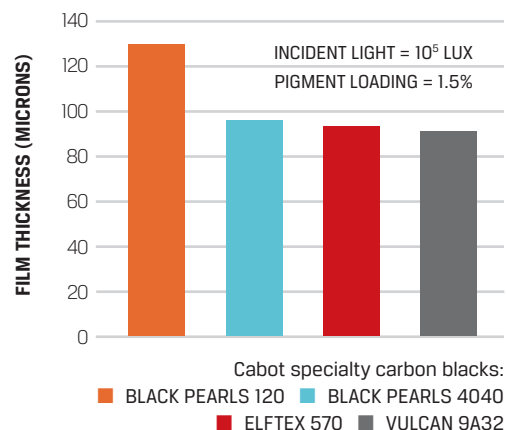
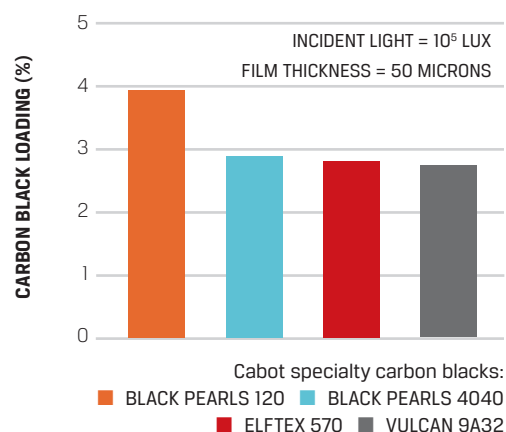


Figure 5:
Opacity vs. pigment loading



Film smoothness

Our specialty carbon blacks provide physical cleanliness and dispersion that is needed to achieve this excellent film smoothness. As shown in figure 6, poor dispersion leads to only partial de-agglomeration of particles which can cause surface defects. In contrast, excellent dispersion achieves full de-agglomeration, minimizes surface defects and leads to high levels of opacity and UV performance.

While all of our carbon blacks can perform well with regard to film smoothness, BLACK PEARLS® 4040, ELFTEX® 570, and VULCAN® 9A32 specialty carbon blacks offer exceptional performance. Figure 7 presents this data in the form of pip, or defect, count versus pigment loading. For comparison with other Cabot products, please contact your Cabot representative.

Weatherability

Long term exposure to sunlight leads to the degradation of plastic materials resulting in a deterioration of physical properties, changes in color, or chalking of part surfaces. Plastic films and sheet can lose their flexibility, mechanical strength and opacity. To limit or postpone the degradation, carbon black particles can work as light stabilizers in polymers by absorbing UV radiation. The UV radiation is not damaging to carbon black and carbon black's presence slows or prevents the destructive absorption of the radiation by the polymer itself.

Carbon black's efficiency as a UV absorber mostly depends on the primary particle size and aggregate structure of a specific carbon black, as well as the level of dispersion within a polymer. At the same loading, carbon black aggregates made from fine primary particles present more surface area to incident light – and hence a larger UV absorption efficiency – than carbon blacks made from larger primary particles. This phenomenon is illustrated in Figure 8.

Figure 6: Dispersibility comparison

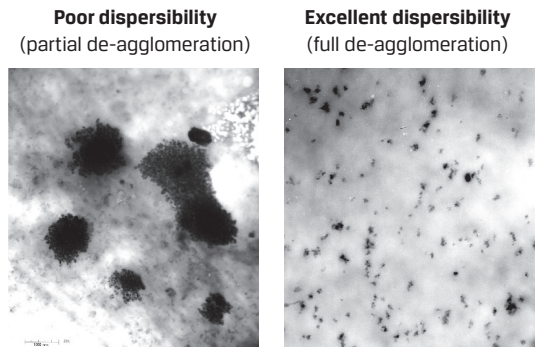


Figure 7: Film smoothness vs. pigment loading

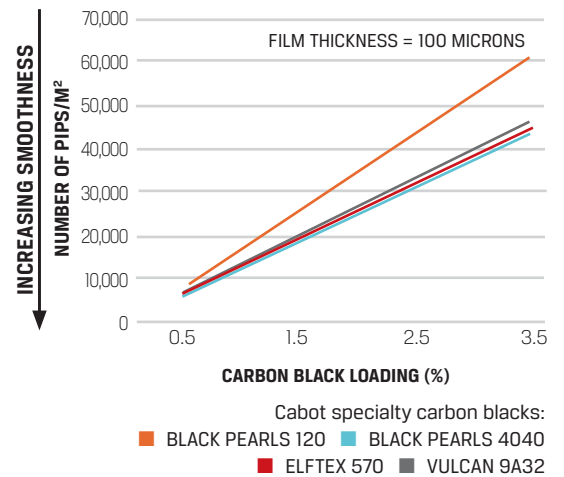
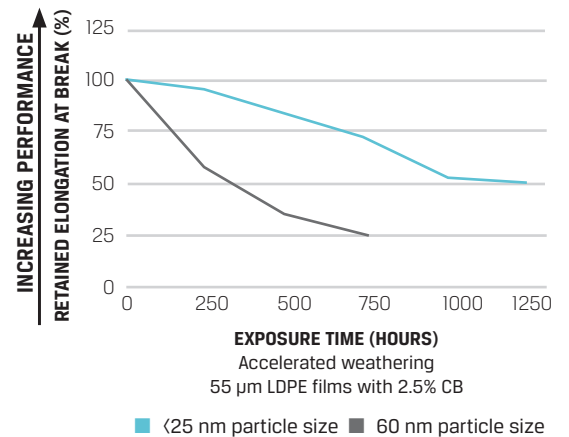


Figure 8: Effect of primary particle size on weathering performance



The appropriate carbon black loading level depends on film thickness, exposure conditions and type of carbon black selected. Optimum UV protection is typically achieved at mass loadings between 2% and 3% in the final compound. Figure 9 illustrates the relationship between loading and UV performance for carbon blacks of two primary particle sizes.

The weatherability performance of three specific Cabot products is presented in Figure 10. ELFTEX® 570 and BLACK PEARLS® 4040 specialty carbon blacks perform significantly better than BLACK PEARLS 120 specialty carbon black. As a result, ELFTEX 570 and BLACK PEARLS 4040 specialty carbon blacks offer superior film lifetime.

Dispersibility and mechanical performance

Beyond opacity, film smoothness and weatherability, plastic film and sheet must maintain an appropriate level of mechanical performance. Our carbon blacks for film and sheet applications are specifically selected to help customers create formulations that meet their performance needs without sacrificing mechanical properties.

Figure 9:
Effect of loading levels on ultraviolet light absorption

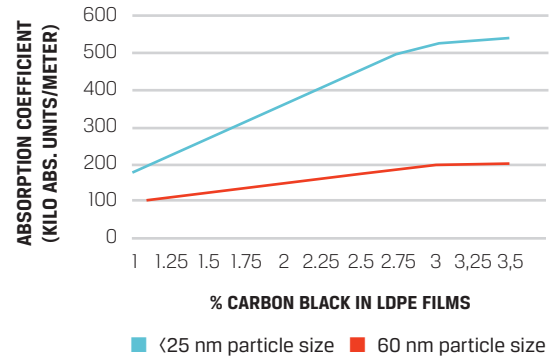
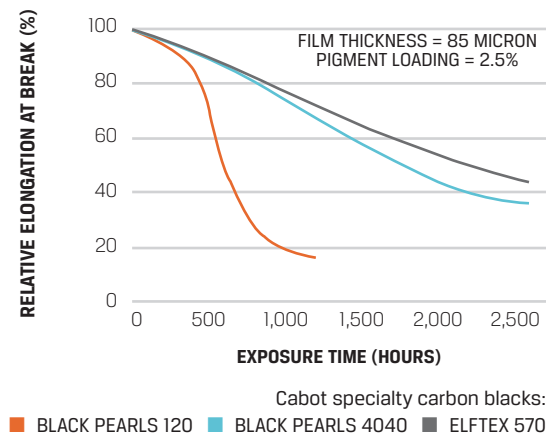


Figure 10:
Weatherability performance



Processability

Processability refers to the ease with which a customer can incorporate an additive into a formulation. It is a key design consideration and we understand the need to provide products that provide the proper performance benefits, as well as a high level of processability, which is measured along three dimensions:

- ◆ Dispersibility
- ◆ Dilutability
- ◆ Polymer Compatibility

Dispersibility

As discussed above, adequate dispersion of carbon black within polymers is necessary for proper final product performance. Please contact us for assistance with selecting and incorporating the right specialty carbon black for your performance needs.

Masterbatch dilutability

Our carbon blacks are often formulated into masterbatches that are then used by compounders. Masterbatch dilutability is a measure of how easily a masterbatch can be distributed in, or mixed with, the dilution polymer. When masterbatch dilution is inadequate, non-homogenous pigmentation, lower UV performance and poor mechanical properties may occur.

Dilutability of a masterbatch is linked to its viscosity as measured by melt flow index (MFI). At a standard dosage in a masterbatch, all carbon blacks will reduce MFI and increase viscosity of the neat polymer, but by selecting the most appropriate carbon black, masterbatch formulators and customers can obtain a masterbatch with dilutability that meets their needs and saves substantial formulation cost.

Polymer compatibility

We offer carbon black products that can be used in almost all polymer systems, though certain products are most suitable for certain applications. For film and sheet applications, a variety of products are available for the dominant polymers, including LDPE, HDPE, and LLDPE, as well as for more exotic systems.

Technical data

Specialty carbon black product	Description
BLACK PEARLS® 120	General purpose low color speciality black with low to medium weatherability. Offers blue undertones and higher loading.
BLACK PEARLS 160	General purpose low color specialty black suitable for a broad range of tinting applications. Easy to disperse, this economical specialty black allows higher loadings in most systems.
BLACK PEARLS 280	General purpose, easy to disperse carbon black offering UV/weatherability characteristics.
BLACK PEARLS 4040	Specialty carbon black offering good UV protection and covering power in a variety of plastic film applications, especially in agricultural film.
ELFTEX® 570	Multi-purpose specialty black for coloration and UV / weatherability performance across plastic applications including general purpose molding, agricultural film, and coarse staple fiber.
ELFTEX TP	Standard p-type specialty black that meets all ISO-standards for fully-formulated pipe compound. Its high cleanliness characteristics also make it also suitable for other applications.
VULCAN® 9A32	Industry standard for UV protection in plastic applications where weathering and cleanliness are paramount.
BLACK PEARLS 4350	Specialty black offering medium jetness with excellent dispersibility and masterbatch dilutability; suitable for use in plastic materials that are intended to comply with U.S. Food & Drug Administration (FDA) requirements. ^{1, 2}
BLACK PEARLS 4750	Specialty black offering offering an excellent combination of jetness and blue undertone; suitable for use in plastic materials that are intended to comply with U.S. Food & Drug Administration (FDA) requirements. ^{1, 2}

The data in the table above are typical test values intended as guidance only, and are not product specifications. Product specifications are available from your Cabot representative.

1. Information current at publication. For assurance that a carbon black product can be used in food contact applications, a Cabot issued food contact certification statement is required. Please contact your local Cabot representative.
2. This product meets U.S. Food and Drug Administration (FDA) requirements (21 CFR 178.3297) for contact with food when used as a colorant in polymers.

SPECIALTY CARBON BLACKS FOR PLASTIC FILM AND SHEET APPLICATIONS

Film and sheet sub-application				Food contact regulatory compliance		Representative physical properties					
Packaging and lamination	General purpose and utility	Agricultural	Geomembrane	EU	US FDA	ASTM D-1510	ASTM D-2414	ASTM D-3265	ASTM D-1514	ASTM D-1509	ASTM D-1513
						Iodine number (mg/g)	OAN (cc/100g)	Tint (%)	325 mesh residue (ppm)	Moisture as packed (%)	Pellet density (kg/m ³)
	•	•				30	65	58	<200	<10	510
	•	•				36	90	60	<200	<1.0	450
•	•		•			43	121	60	<200	<1.0	365
•	•	•	•	•		82	101	102	<25	<1.0	389
•	•	•	•	•		121	114	115	<50	<1.0	345
•		•	•	•		92	98	106	<25	<1.0	375
•	•	•		•		142	118	120	<30	<1.0	352
•				•	•	116	70	121	<100	<1.0	443
•				•	•	260	120	145	<200	<3.0	307

Additional references

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

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