

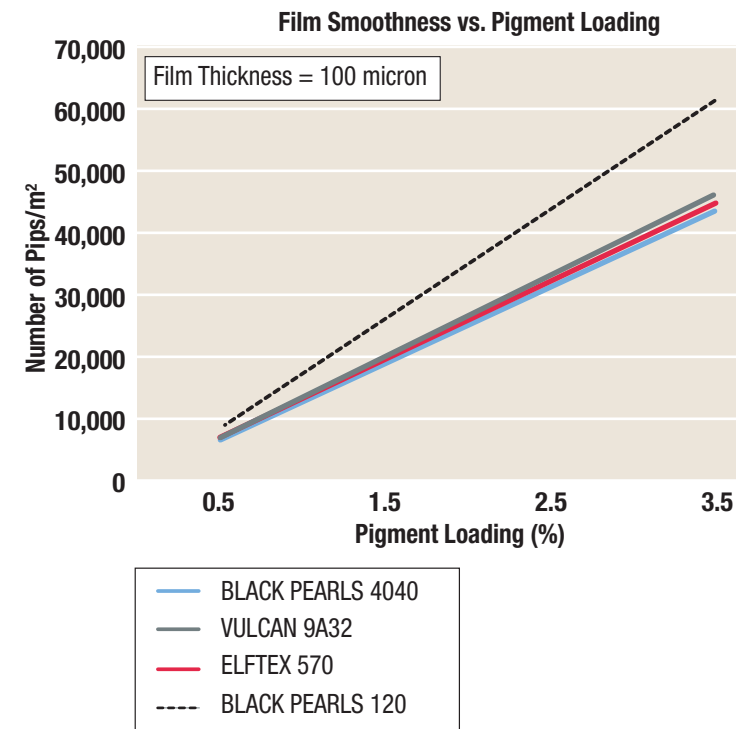
BLACK PEARLS 4040 is designed specifically to serve as a new productivity grade for agricultural film applications.

BLACK PEARLS 4060 and ELFTEX 570 are designed for those agricultural film applications where extreme weatherability is required.

Film Smoothness

The type of black pigment has a primary impact on the final film smoothness one can achieve.

Below graph indicates clearly that the film smoothness performance of BLACK PEARLS 4040, VULCAN 9A21, ELFTEX 570 are similar and superior to BLACK PEARLS 120.



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CARBON BLACKS



Black Pigments for Polyolefin Film Applications



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Black Pigments for Polyolefin Film Applications

Cabot black pigments for polyolefin film applications, **BLACK PEARLS® 4040**, **ELFTEX® 570**, and **VULCAN® 9A32¹** are designed to meet an optimum performance balance in terms of the four key performance criteria important to the film masterbatch producers:

Opacity: the extent to which a medium is opaque, i.e. not transparent. The transmission of light through the film is a way to measure the opacity. The higher the amount of transmitted light, the lower the opacity. For more details, see Cabot brochure “Opacity Test for Black Films”

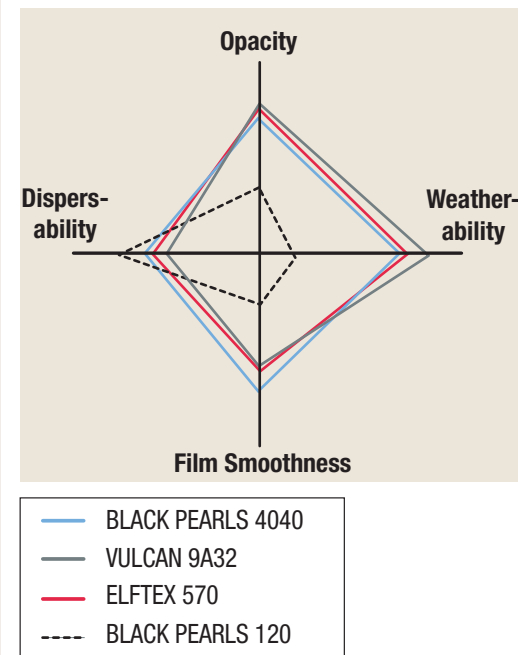
Weatherability: the UV performance or weatherability is defined as the exposure time in an Atlas Ci65A accelerated weathering chamber required to reach 50% of the initial elongation at break. For more details see, Cabot brochure “UV Weathering and Related Test Methods”.

Film Smoothness: a macroscopic method for assessing the pigment dispersion in a film sample. A film is blown or cast and the number of undispersed pigment agglomerates are visually detected and counted in a specified area.

Dispersability: ease with which the black pigment can be wet with the resin and subsequently de-agglomerated.

■ Star Diagram

A visual and accessible way to compare different black pigments on their relative suitability for the polyolefin film application is the star diagram. This star diagram compares the performance of the black pigments in terms of the four key performance criteria. In this star diagram the performance is compared at equal black pigment loading in the film.



Performance improves from chart center

■ Market Segmentation

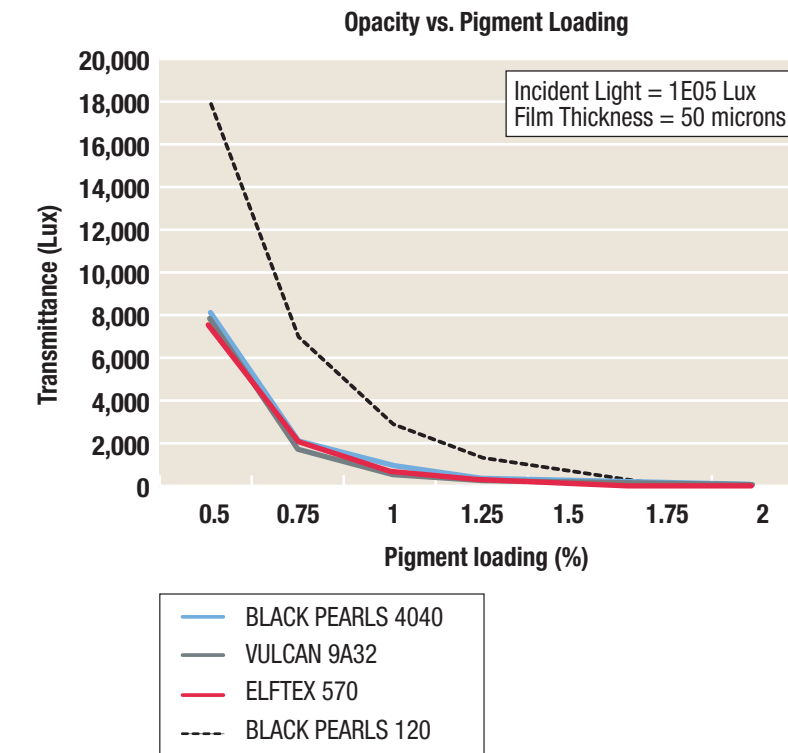
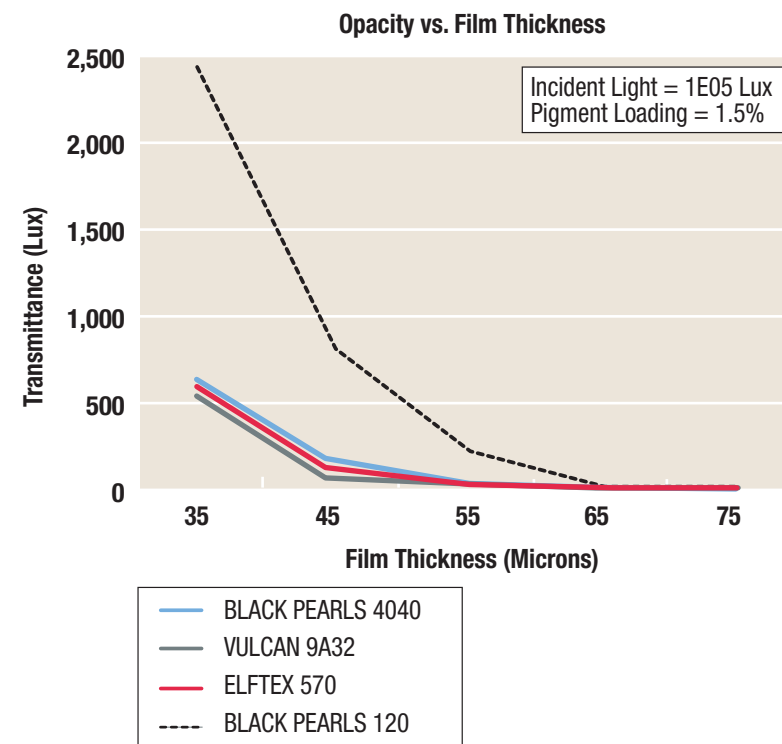
The film market can be usefully segmented as shown below. Each sub-segment may have specific performance requirements, but weatherability and opacity are key requirements expected from black pigments for film.

Segment	Sub-segment	Weatherability	Opacity	Grade Fit
Packaging	Carrier Bags (15 - 70 µm)	-	X	BLACK PEARLS 120, BLACK PEARLS 160
	Refuse Sacks (25 - 90 µm)	-	XX	BLACK PEARLS 120, BLACK PEARLS 160
	Covering Hoods (80 - 120 µm)	XX	XXX	BLACK PEARLS 120, BLACK PEARLS 160
	Industrial Bags (120 - 180 µm)	XX	XXX	BLACK PEARLS 120, BLACK PEARLS 160
Agriculture	Mulch Film (10 - 80 µm)	XXXX	XXXX	BLACK PEARLS 4040, VULCAN 9A32, ELFTEX 570
	Silage Film (90 - 200 µm)	XXXX	XXXX	BLACK PEARLS 4040, VULCAN 9A32, ELFTEX 570
	Stretch Wrap (20 - 30 µm)	XXXXXX	XXXX	BLACK PEARLS 4040, VULCAN 9A32, ELFTEX 570

X = indicates the degree of importance of the performance requirement

■ Opacity

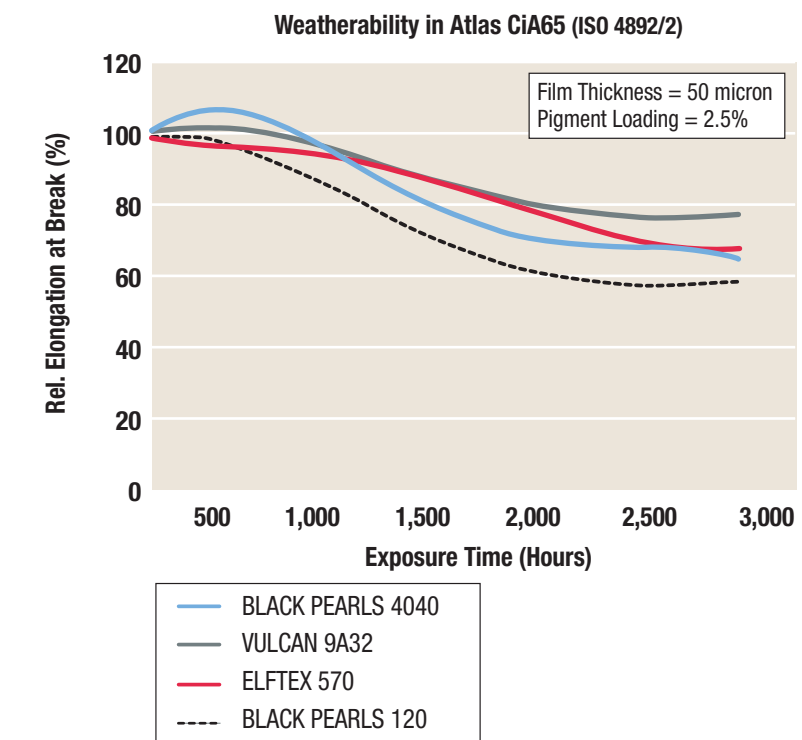
The following graphs show the dependency of film opacity on film thickness and pigment type. For the thinnest film applications grades like BLACK PEARLS 4040, VULCAN 9A32 and ELFTEX 570 are recommended. When compared to BLACK PEARLS 120 they have a significant impact on the final pigment loading needed to achieve a certain opacity level. Those three grades exhibit very similar opacifying power.



■ Weatherability

The following graph indicates the weatherability performance of the four grades in an Atlas Ci65A accelerated weathering chamber. BLACK PEARLS 4040, VULCAN 9A32 and ELFTEX 570 show superior weatherability performance to BLACK PEARLS 120.

Additionally, VULCAN 9A32 and ELFTEX 570 offer superior enhanced film lifetime.



¹ VULCAN 9A32 is not available in Europe