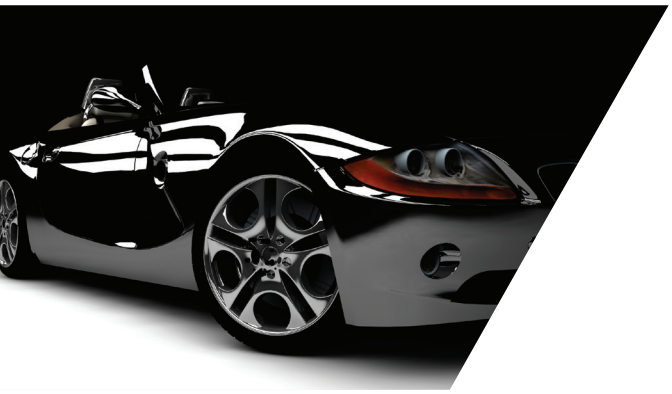
CABOT

SPECIALTY CARBON BLACKS

EMPEROR® 1800 SPECIALTY CARBON BLACK

Easily Dispersible High Jetness Carbon Black for Water-Based Coatings



EMPEROR® 1800 SPECIALTY CARBON BLACK
DEEP BLACK COLOR WITH EASY PROCESSING

Historically, formulators of water-based deep black coatings had to balance color performance with dispersion ease and formulation stability. Typically the only way to achieve deep, jet-black color in water-based formulations was to increase dispersant loading or extend milling time.

Our high color carbon black for water-based formulations, EMPEROR 1800 carbon black, represents a major step forward. EMPEROR 1800 carbon black, designed for automotive basecoats and deep black masstone applications, breaks the tradeoff between color performance and dispersibility. Formulating with EMPEROR 1800 carbon black allows coatings manufacturers to achieve deep, jet black color while minimizing dispersants and dispersing time, resulting in lower overall formulation costs.

EMPEROR 1800 carbon black achieves superior performance through optimized design of the pigment morphology and the surface chemistry. EMPEROR 1800 carbon black utilizes our proprietary technology of chemical pigment modification. The pigment surface is designed for water-based systems and delivers performance superior to conventional oxidized carbon black.

EMPEROR® 1800 specialty carbon black product benefits

Superior color performance

EMPEROR 1800 carbon black delivers black color that is superior to other competitive products (shown in Figure 1). High jetness and deep blue undertone are a result of the surface treatment that makes it possible to disperse to individual aggregates.

Easy dispersion

EMPEROR 1800 carbon black can reduce dispersion time by up to 85% compared to the competitor benchmarks (shown in Figure 2). Ionic surface groups on the pigment enable a mechanism called electrostatic stabilization in water-borne systems, that automatically separates the pigment particles. Grinding time is shortened, dispersion costs are reduced, and fluctuations in color due to dispersion quality variation are reduced.

Highest level of dispersion stability

EMPEROR 1800 carbon black exhibits excellent dispersion stability, long shelf life and ensures consistent final film properties. Electrostatic stabilization inhibits re-ogglomeration of pigment particles upon aging.
(shown in Figure 3)

Minimized use of dispersant additives

EMPEROR 1800 can reduce the amount of dispersant required to achieve optimal performance by more than 50% (Shown in Figure 4). Because the surface treatment helps to disperse the pigment in water, formulators can use lower loadings of dispersant than required for conventional oxidized carbon black.

Figure 1:
Superior color performance

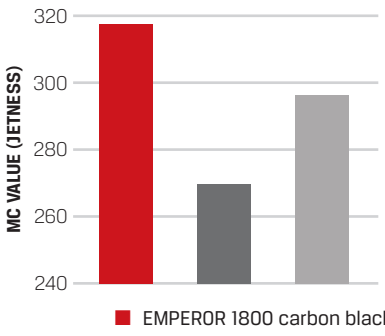
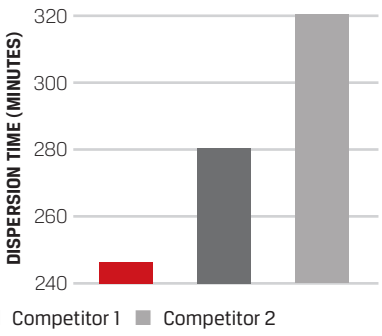
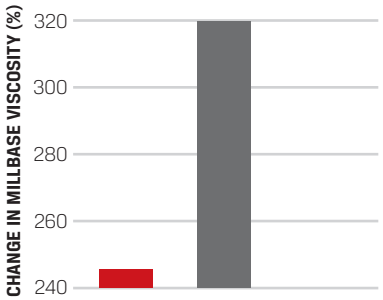


Figure 2:
Easy dispersion



EMPEROR 1800 carbon black Competitor 1 Competitor 2

Figure 3:
Level of dispersion stability

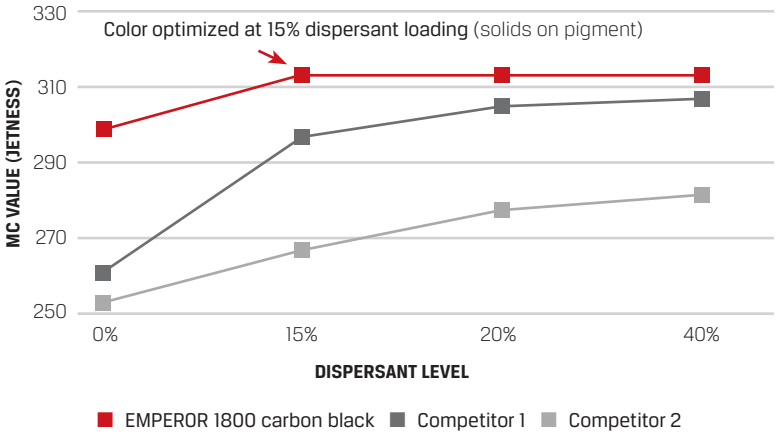


Y-axis shows % change in viscosity when the millbase is heat aged.

Displayed as initial Viscosity/Final Viscosity* 100

EMPEROR 1800 carbon black Oxidized Pigment

Figure 4:
Reduced use of dispersant



EMPEROR 1800 carbon black Competitor 1 Competitor 2

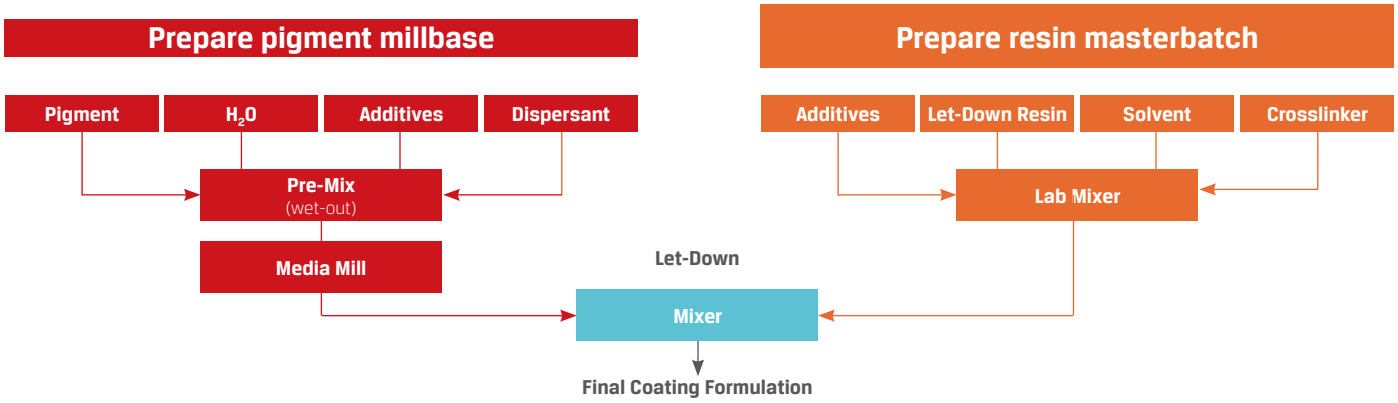
EMPEROR® 1800 carbon black formulation guide

This document can be used as guidance for achieving optimal color performance when working with EMPEROR 1800 specialty carbon black.

Sample formulation process

Below is an example of a three step process to create a high color coating with EMPEROR 1800 carbon black.

1. Prepare the pigment millbase
2. Prepare the resin masterbatch
3. Let-down the millbase with the masterbatch



1. Preparing the pigment millbase

- Premix water and neutralizing agent together under good agitation
- Post-add defoamer to the above under good agitation
- Post-add dispersant to the above under good agitation
- Post-add carbon black slowly into the premix then mix for another 5 minutes at 4,000 RPM
- Re-circulate through Eiger mill at 10 m/s tip speed for another 2.5 minutes using 1.0 mm zirconium media
- Discharge, then test pH and viscosity of the millbase

Example formulation

Raw Material		Content (% by weight)
Neutralizing Agent	AMP™ 95	2.00
Defoamer	FoamStar® SI 2292	3.00
Dispersant	Baker Petrolite® D1038	4.05
Carbon Black Pigment	EMPEROR 1800	10.00
	Water	80.95

Carbon black loading (%)	10.00
Total solids (%)	13.80
Dispersant loading %	15.00

2. Prepare resin masterbatch

- Premix defoamer, wetting agent, leveling agent, solvent, and crosslinker together
- Post add the premix slowly into the resin under good agitation then mix for another 5 minutes
- Mix for 20 minutes then discharge and test for pH and viscosity

Example formulation

Raw Material		Content (% by weight)
Resin	Setalux® 6801-AQ24	88.89
Defoamer	FoamStar® SI 2292	1.33
Wetting Agent	Surfynol® 104 DPM	1.33
Leveling Agent	BYK® 348	.29
Solvent	DPM	2.60
Crosslinker	Cymel® 373	5.56

Total Solids (% weight)	26.8
Crosslinker (% weight)	20.8

3. Letdown the millbase with the resin masterbatch

- Post add the millbase to the masterbatch letdown under good agitation
- Mix for 20 minutes, then discharge

	Content (% by weight)
Masterbatch letdown	92.78
Millbase	7.22

Carbon Black Pigment Loading	2.79
Total solids	25.86

Formulation optimization

Some guidelines to follow to optimize the formulations with EMPEROR 1800 carbon black:

- Select a dispersing aid that is compatible with EMPEROR 1800 carbon black and the coating resin
- Optimize dispersant loading relative to EMPEROR 1800 carbon black loading
- Optimize the millbase grindtime
- Select appropriate additives

Dispersing aid selection

For optimal color performance, consider using Baker Petrolite D1038 dispersing aid.
In our tests, D1038 dispersing aid delivers excellent color performance in acrylic and polyester coating systems.

If D1038 is unavailable, consider the following alternatives:

- DISPERBYK® 192 dispersing aid
- Efka® 4585 dispersing aid
- TEGO® 760W dispersing aid

Optimizing dispersant loading

Color performance is highly dependent on optimal loading of the selected dispersing aid. Cabot highly recommends that formulators conduct a loading study to identify the optimal recipe for their system.

Traditional oxidized carbon blacks can require dispersant loading as high as 50% (active solids dispersant on carbon black) or more to achieve optimal performance. EMPEROR 1800 carbon black allows formulators to use significantly less dispersant. In general, formulators might consider using 10% loading of active dispersant on carbon black as the baseline for a loading study.

Optimizing grinding time

EMPEROR 1800 carbon black delivers exceptional color performance when ground for the optimal amount of time and when the pigment agglomerates are fully dispersed. Both under-grinding and over-grinding can decrease color performance.

To optimize milling time for your custom formulation, Cabot recommends a milling study. When planning this study, remember that EMPEROR 1800 carbon black requires significantly less grinding time.

In general, formulators might want to consider decreasing milling time by 80% when working with EMPEROR 1800 carbon black compared to standard oxidized black. This 80% reduction should be the baseline for a milling time study.

Selecting additives

Leveling agents

In many formulations, a wetting and leveling agent is employed to achieve good, continuous film formation. Wetting and leveling agents can also reduce film defects, such as orange peel, cratering and shrinkage.

Formulators might consider using the following wetting and leveling agents with EMPEROR 1800 carbon black.

Leveling agent	Amount (wt. % of total wt. finish formulation)
BYK® 346	0.3 - 0.6
FoamStar® SI 2210	0.05 - 0.2
Hydropalat® WE 3370	0.2 - 0.4

Defoamers

Controlling foam can be difficult in water-based formulations. Adding a defoaming agent in these formulations can reduce the negative effects.

Formulators might consider using the following defoaming additives with EMPEROR 1800 carbon black.

Defoaming agent	Amount (wt. % of total wt. finish formulation)
FoamStar SI 2292	0.15 – 0.5
FoamStar SI 2210	0.3 – 0.5
NOPCO NS-1	0.1 – 0.2
BYK® 024	0.1 – 0.2

If you have specific questions or concerns about formulating EMPEROR 1800 carbon black, please contact your Cabot representative.

Cabot: A Proud History and Global Reach

Cabot Corporation is a global performance materials company, and we strive to be our customers' partner of choice. We have been a leading manufacturer for more than 135 years. Our global reach enables us to partner closely with our customers to meet the highest standards for performance, quality, and service.

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