COLOUR BLACK FW 171
for top quality high jet water-borne automotive and powder coatings

Technical Information 1262

orion ENGINEERED CARBONS

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Introduction

The performance requirements of specialty carbon black used for automotive basecoats are becoming increasingly stringent with regard to jetness and a bluish undertone. The pigments must be, first and foremost, stable in water-borne systems and feature very high resistance to weathering. An example of this is the two year Florida weathering.

Weatherability also is an important topic for powder coatings. Several technologies are available on the market offering high-end powder coatings showing excellent weatherability. One of the most important system in the European market suitable for outdoor applications is based on hydroxyalkylamide-polyester (HAA-Pes). There is an increasing demand for specialty carbon blacks offering high jetness and bluish undertone when incorporated into these powder coating formulations.

For years now, Orion Engineered Carbons GmbH has been offering pigments that are manufactured by the gas black process which are suitable for high jetness applications. In addition to the gas black process, the furnace black process has also been used for decades to produce high-grade class HCF (high color furnace) blacks for the coatings industry. Orion Engineered Carbons GmbH is the sole manufacturer of specialty carbon blacks capable of offering both HCG and HCF blacks.

The mean primary particle size as well as particle size distribution of the specialty carbon black has the greatest influence on the performance properties – particularly the colorimetric properties of the coating. Generally, in the case of masstone coloring, the jetness increases with decreasing mean primary particle size of the specialty carbon black and of the aggregates present in a coating. As seen from above, the coating takes on an increasing bluish undertone, which elevates the visual perception of blackness.

COLOUR BLACK FW 171

Thanks to a technical modification of the furnace black reactor, it is possible to manufacture a new class HCF (high color furnace) fine particle specialty carbon black called COLOUR BLACK FW 171.

COLOUR BLACK FW 171, which is the subject of this technical information, has crucial advantages that make it superior to competitive products for water-borne and powder coating systems:

- Very small mean primary particle size
- Very narrow primary particle size distribution
- Very narrow aggregate size distribution

Thanks to these properties, comprehensive field tests clearly demonstrate that COLOUR BLACK FW 171 possesses very high jetness with high stability in water-borne coating systems. This jetness is manifested in a distinct bluish undertone.

Milling of COLOUR BLACK FW 171: A typical binder free mill base formulation for COLOUR BLACK FW 171 is given in Table 1. In order to improve the dispersion of the pigment and stabilize the water-borne mill base, it is recommended to use between 50 % and 100 % of active wetting agent related to COLOUR BLACK FW 171. A very suitable additive for this purpose is TEGO Dispers® 760W (Tego Chemie, 35 % active). After the initial wetting out of the pigment using a dissolver (5 minutes at a peripheral speed of 10 m/s) milling is done using standard laboratory shaker, Zirconium beads (1.0 – 1.6 mm) and a dispersing time of one hour. The viscosity of the mill base is water like. Fineness of grind is below 10 µm.

Table 1

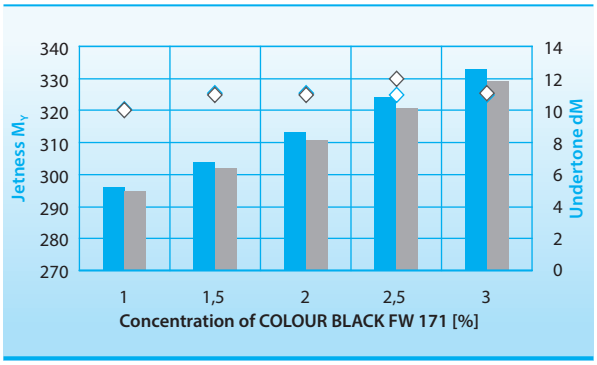
Deionizised water	60.5 g
TEGO Dispers® 760W, 35%	26 g
TEGO Foamex® 830	0.38 g
AMP 90	0.12 g
COLOUR BLACK FW 171	13 g
Total	**100 g**
Wetting agent to specialty carbon black	**70 %**
Specialty carbon black concentration	**13 %**

Recommended mill base formulation for COLOUR BLACK FW 171

The concentrated paste can be letdown using standard water-borne binder systems leading to high gloss, high jetness coatings with a strong bluish undertone and low haze.

Results for water-borne coating systems

Figure 1



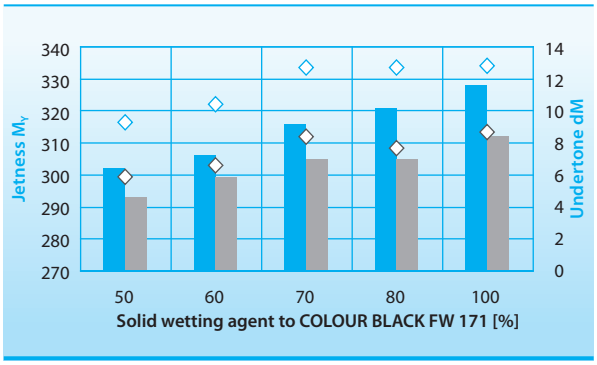
■ M_Y, through glass ■ M_Y, commercial BC/CC
◇ dM, through glass ◇ dM, commercial BC/CC

Influence of the concentration of COLOUR BLACK FW 171 on jetness and stability for a letdown based on Alberdingk® U710 and a commercial PUR basecoat/acrylate clearcoat system. The ratio of wetting agent to specialty carbon black is 70 %.

Figure 1 displays the influence of COLOUR BLACK FW 171 concentration on the jetness and stability in a standard laboratory letdown containing Alberdingk® U710 (30 % Solids, Alberdingk & Boley GmbH) and a commercial PUR basecoat/acrylate clearcoat system. Even with a specialty carbon black concentration of 1.5 % – as typically used for automotive basecoats – a very high jetness (M_Y > 300) and strong bluish undertone (dM ~ 11) is achieved.

Several wetting agents have been tested for stabilization of COLOUR BLACK FW 171. Beside TEGO Dispers® 760W (35 % active) we recommend Disperbyk® 190 (Byk Chemie, 40 % active). Figure 2 show the influence of the amount of both wetting agents on colorimetric properties of COLOUR BLACK FW 171. At a ratio of wetting agent to COLOUR BLACK FW 171 of 70 % no further improvement of stability dM could be found but still an increase of jetness. For a good balance of colorimetric properties and costs we recommend to use about 70 % of wetting agent related to the amount of COLOUR BLACK 171.

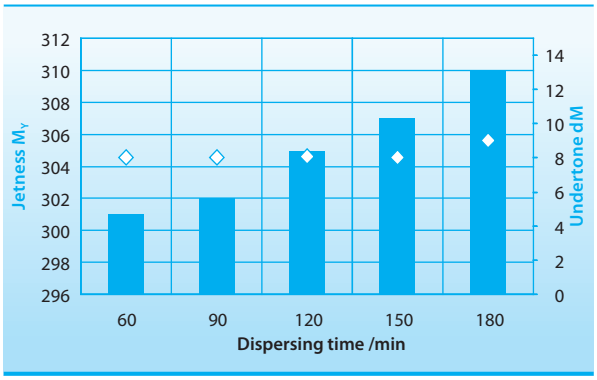
Figure 2



■ M_Y, Tego Dispers® 760W ■ M_Y, Disperbyk® 190
◇ dM, Tego Dispers® 760W ◇ dM, Disperbyk® 190

Influence of the concentration of wetting agent on jetness and stability. Ratio of COLOUR BLACK FW 171 to solid binder is 10 %. The overall specialty carbon black concentration is 2.4 %. As binder Alberdingk® U710 is used.

Figure 3



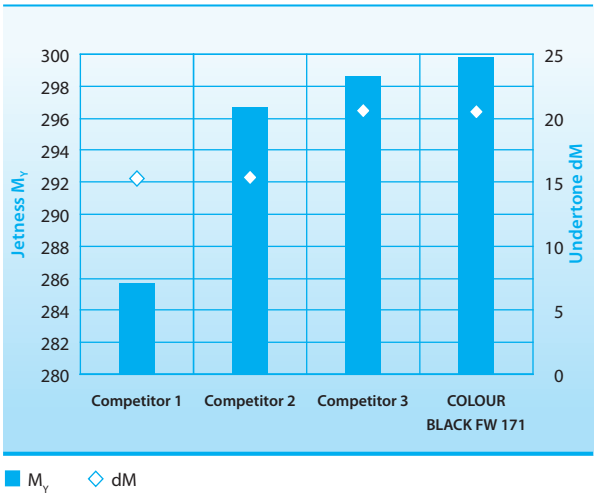
■ M_Y ◇ dM

Influence of dispersing time on jetness and stability of COLOUR BLACK FW 171 in a market system based on a PUR basecoat/acrylate clearcoat formulation. The overall specialty carbon black concentration is 1.1 %. The ratio of wetting agent to COLOUR BLACK FW 171 is 50 %.

Due to its outstanding performance, COLOUR BLACK FW 171 was successfully evaluated in several commercial coating systems.

Figure 3 shows the influence of dispersing time on colorimetric properties of COLOUR BLACK FW 171 in a market system based on a PUR basecoat/acrylate clearcoat formulation. One demand of the market is a very stable milling behavior without sedimentation. Milling was done in a mixture of water and customer binder adding 50 % of TEGO Dispers® 760W related to COLOUR BLACK FW 171. There was no negative influence of dispersing time. Jetness of the letdowns with 1.1 % of COLOUR BLACK FW 171 increased by 9 points when the milling time was increased from 60 min to 180 min. No change in stability was observed.

Figure 4



Colorimetric properties of COLOUR BLACK FW 171 in comparison to several competitor specialty carbon blacks in a market system based on a PUR basecoat/acrylate clearcoat. Concentration of specialty carbon black in the letdown is 1 %. Wetting agent related to specialty carbon black is 80 %.

Figure 4 show the colorimetric results of COLOUR BLACK FW 171 for another PUR basecoat/acrylate clearcoat system found in the market in comparison to several competitor specialty carbon blacks. In this case the concentration of the specialty carbon blacks in the water like, binder-free mill base was 15.6 % and the ratio of wetting agent to specialty carbon black was 80 %. Milling was done using standard laboratory conditions. The concentration of the specialty carbon black in the letdown was 1 %. Very high jetness values combined with very strong bluish undertone was obtained for COLOUR BLACK FW 171. No competitor specialty carbon black could match the level of COLOUR BLACK FW 171.

Results for powder coating

Evaluations were done in a hydroxyalkylamide-polyester (HAA-Pes) powder coating formulation. Powder coatings based on hydroxyalkylamide-polyester show excellent weatherability and are very suitable for outdoor applications. The test formulation is given in table 2.

Table 2

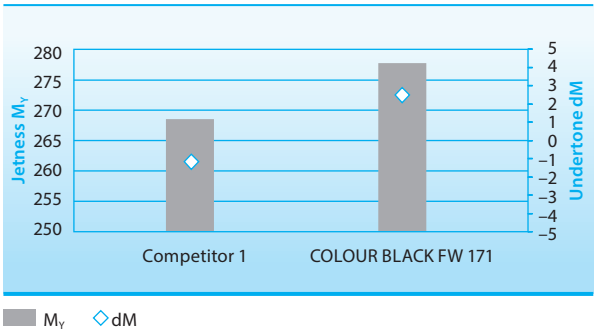
VESTAGON® HA 320 (Evonik Industries)	3.3 g
URALAC® P 865 (DSM N.V.)	68.2 g
Specialty carbon black	1.5 g
RESIFLOW® PV 88 (Worlée Chemie GmbH)	1.5 g
Benzoine	0.5 g
Blanc Fixe F (Sachtleben Chemie GmbH)	25 g
Total	**100 g**
Specialty carbon black concentration	**1.5 %**

Hydroxyalkylamide-polyester (HAA-Pes) powder coating test formulation

The powder coating was milled and classified prior to spray application. The fraction between 25 µm and 63 µm was applicated onto Q-panels with a final film thickness between 60 µm and 80 µm.

COLOUR BLACK FW 171 was tested in comparison to a competitor specialty carbon black with a comparable primary particle size. COLOUR BLACK FW 171 shows a significantly higher jetness and better stability compared to the competitor specialty carbon black as shown in figure 5.

Figure 5



Colorimetric properties of COLOUR BLACK FW 171 in comparison to a competitor specialty carbon black with a comparable primary particle size in a hydroxyalkylamide-polyester (HAA-Pes) powder coating formulation. Concentration of specialty carbon black is 1.5 %.

Summary:

Environmental coatings will gain further importance in comparison to solvent-containing systems. The results shown above for COLOUR BLACK FW 171 in our standard laboratory system as well as in several coating systems found in the market clearly prove that COLOUR BLACK FW 171 is an outstanding product for tinting high jetness black water-borne coatings. Highest jetness levels combined with very strong bluish undertones, high gloss and low haze can be obtained.

COLOUR BLACK FW 171 also shows excellent colorimetric properties in powder coatings suitable for outdoor applications.

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