
DELTA SC®
Surface Control Additives
delta
little makes difference
MORDRY®
Driers
DELTA FC®
Foam Control Additives
DELTA DC®
Dispersion Control Additives
DELTA S®
MORDRY®
Specialty Additives

Dispersion Control Additives

When dispersing pigments, one frequently encounters problems such as flocculation, insufficient color or transparency, poor rheological qualities or stability. With our dispersion control additives, you can ensure your pigment and filler particles will keep apart for quite long and thus avoid any (re)-flocculation or settling that may occur in your liquid formulations.

Delta Specialties offer a comprehensive range of dispersion control additives (low and high molecular weight) for solvent and water-based systems to help you optimize your dispersions in coatings, printing inks and plastics (composite).

Types of Dispersion Control Additives

Delta Specialties manufactures 2 types of dispersion control additives:

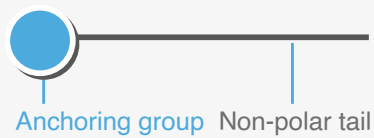
1 - Low molecular weight wetting and dispersing agents (**DELTA** DC® 4000 series)

Properties:

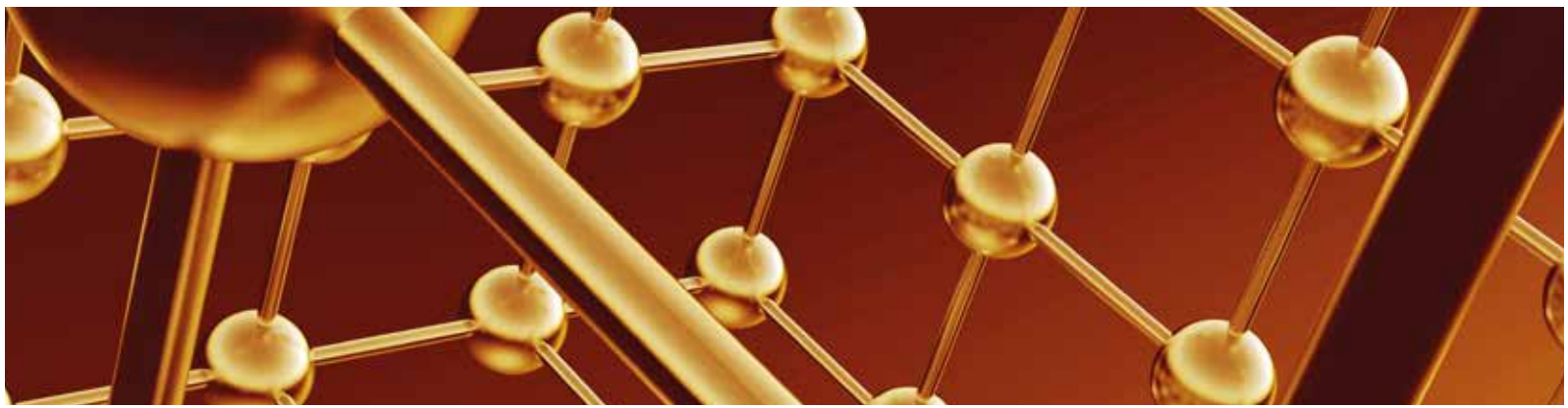
- 800 g/mol < Molecular weight < 2,000 g/mol.
- Categorized according to their chemical structure and the nature of their hydrophilic groups (amphoteric, cationic … etc).
- The interaction of their polar groups with the pigment surface and the behavior of the non-polar chains in the medium determine their effectiveness.
- Only used for stabilizing inorganic pigments and extenders.

Mode of Action:

- The polar heads will form hydrogen bonding interactions between different pigment units resulting in a network that enhances the separation of the particles (controlled flocculation).
- This interaction is of great importance in this class of dispersion control additives since the relatively low molecular weight will not give sufficient steric hindrance.
- Inorganic pigments are usually metal oxides, which contain positive metal ions and negative oxide ions. These ions are good anchoring points, where the anchoring groups that build-up the polar head of the dispersion control additive can attach to (polar interactions).
- Unfortunately this type of charge interaction is not possible with organic or black pigments.



DELTA DC® 4000 series



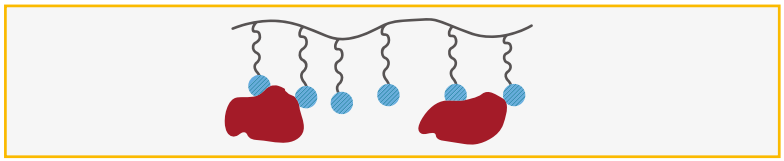
2 - High molecular weight wetting and dispersing agents (**DELTA** DC® 3000 series)

Properties:

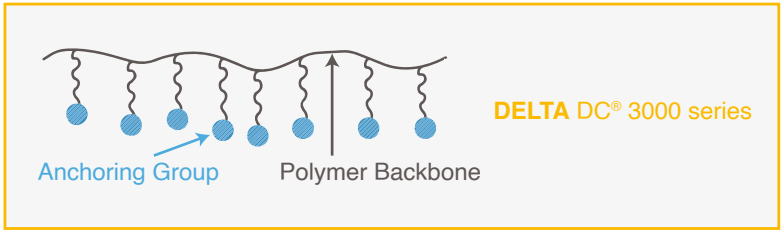
- 5,000 g/mol < Molecular weight < 30,000 g/mol.
- They are built of branched or long linear molecules, which in general have a polyurethane or polyacrylate structure.
- Designed to adsorb via special groups with high affinity towards specific sites on the pigment surface. These are called anchoring groups, and are built in at strategic points on the polymer backbone.
- Suited for inorganic and organic pigments, in addition to carbon black pigments.

Mode of Action:

- Anchoring groups enable strong interaction between the dispersion control additive and the pigment surface.
- This interaction is much stronger than in the case of the low molecular weight types as the dispersion control additive is bound to numerous sites on the surface via the anchoring groups, assuring an efficient steric hindrance between the solid particles by keeping them apart.



- The remaining parts of the dispersion control additive act as a steric barrier to the surroundings by stretching into the liquid phase preventing flocculation.
- These parts have a good affinity with the solvent and the resin system, so the compatibility with the liquid phase is increased and the viscosity of the paint system is reduced as a desired side effect.
- Organic pigments molecules consist mainly of the elements C, H, O and N. These atoms are not charged and are connected to each other through covalent bonds. Despite the fact that the main interaction between the anchoring groups and pigment surface is hydrogen bonding, this mechanism applies for both organic and inorganic pigments.
- Inorganic pigments are usually treated with different types of polar organic compounds which enable this interaction to take place as it does by the organic pigments.



The compatibility of the dispersion control additive chain in various vehicles is determined by its chemical nature. Therefore different chemistries were developed by Delta Specialties, which are divided according to their chemical composition into two groups:

- **Polyurethane-based:** They have a branched backbone, with a 3 dimensional network structure. On various places of this network structure, different anchoring groups are introduced. They are compatible with systems from medium to high polarity. They reduce the viscosity of the mill-base greatly and therefore promote the use of higher pigment loading during grinding (pigment concentrate applications). However, since viscosity and tendency for settling may increase in the case of high density pigments (inorganic pigments), it is essential to use a rheological modifier or an anti-settling agent next to the polyurethane-based dispersion control additives.
- **Polyacrylate-based:** They have linear structures with a carbon-carbon backbone, which bears various functional side groups and short chains. They bear groups, which participate in the anchoring of the pigment. Others play a role in the solvation of the acrylate in the liquid medium, or induce a sterical hindrance, that thwarts the re-agglomeration, after the adsorption of the polymer onto the pigment surface. They are compatible with systems from non-polar to very high polar systems and do not reduce the viscosity as much as in the first class. This allows the polyacrylate-based dispersion control additives to promote anti-settling behaviour as well.

Choosing a Dispersion Control Additive

To achieve the best de-flocculation/stability effect of pigment dispersions, one must consider three main points:
- Compatibility of the dispersion control additive with the vehicle
- Quantity of the dispersion control additive in relation to pigment
- Proper application procedure

A quick preliminary test can be carried out to ensure that no major errors are made in the initial choice of the dispersion control additive. The test is done by mixing the dispersant with the main letdown vehicle in the ratio 90:10. The mixture should be clear. It might be necessary in some cases to shake the mixture with glass beads (1:1 by weight) using a shaker like Skandex® for 1 hour. The mixture must then be clear. The extra mixing is needed to find out whether the dispersant is difficult to incorporate or is completely incompatible.

This test, however, is not indicative of the effectiveness of the dispersing agent. It can only predict possible deficiencies in de-flocculation performances (loss of gloss) and, in the case of mixed pigments, the risk for floatation.

Addition levels used in the case of low molecular weight dispersion control additives are generally low and thus can easily be determined. In the case of high molecular weight dispersion control additives, it is of prime importance to use the right addition level in order to achieve an optimum pigment dispersion.

From past experience, a handy calculation method has been developed that will minimize initial testing trials.

For inorganic pigments, the percentage of high molecular weight dispersant (as active material) used on pigment is usually 10% of the oil absorption value*.

For carbon black pigments, the minimum percentage (as active material) used on pigment is 20% of the DBP-value**.

(*)Oil Absorption (OA) value of a pigment is defined as the number of grams of linseed oil absorbed by 100g of the pigment.

(**)DBP (Dibutylphtalate) -value is defined as being the volume of Dibutylphtalate absorbed by 100g of carbon black pigment.

The required percentage for organic pigments is more difficult to determine. The BET-value*** is a good starting point. For yellow, orange and red pigments, the percentage (as active material) used on pigment is 50% of the BET-value. For phthalo-cyanine blue, phthalo-cyanine green, maroon and violet pigments, with BET-values lower than 50 m^2/g, the percentages(as active material) used on pigment are 50% of the BET-value.

The general guideline for calculating the amount of high molecular weight dispersion control additive required to stabilize a certain type and quantity of pigment will be correct in most cases. However, organic pigments might require amounts of dispersants beyond or below the calculated ones.

Such unexpected required amounts are dependant on the way the pigment is pre-treated. Many pigments are pre-treated nowadays, in such a way that they can be dispersed easier than the untreated ones.

Please take a look at our website www.delta-specialties.com (select 'Technical Information' and then 'Pigment list') where you can have access to a list (sorted by pigment color) containing a large number of commercially known pigments with their respective technical information (color index, supplier name, BET-value...etc).
In case a pigment is not listed in, please contact your pigment supplier to get the required value (OA, BET or DBP) for your calculation of dispersant dosage.

We will be delighted to establish a tailored formulation for you should you find difficulties collecting the technical information from your supplier. All you have to do is to send our Technical Service team a small sample of your pigment.

(***) BET-value is defined as being the surface area of a pigment per its weight; and is determined by N_2 adsorption method according to Brunauer, Emmet and Teller.

High-Molecular Weight Wetting & Dispersing Agents

Dispersion Control Additives

● Highly Recommended
● Potentially Suitable

Product Name	Chemical Type	Active Ingredients %
DELTA DC® 3080	Polyester Polymer	52
DELTA DC® 3750	Sodium Polyacrylate	43
DELTA DC® 3740	Ammonium Polyacrylate	43
DELTA DC® 3591	Polyester-based	40
DELTA DC® 3047	Polyurethane-based	35
DELTA DC® 3046	Polyurethane-based	40
DELTA DC® 3013	Anionic Polyester-based	>98
DELTA DC® 3011	Polyurethane-based	60
DELTA DC® 3009	Polyurethane-based	60
		Solvent-based coatings
●		●		●	●	●			Acid curable
●				●	●	●	●	●	Acrylic OH-functional
●				●	●	●	●	●	Acrylic self-crosslinking
				●	●	●	●	●	Acrylic thermoplastic
				●	●	●	●	●	Long-oil alkyd
				●	●	●	●	●	Medium-oil alkyd
●				●	●	●	●	●	Short-oil alkyd
●				●	●	●	●	●	Alkyd & PE OH-functional
●				●	●	●	●	●	Alkyd & PE OH-melamine
					●	●	●	●	Chlorinated rubber
					●	●	●	●	Solvent-based epoxy
					●	●	●	●	Solvent-free epoxy
●						●			Nitrocellulose
				●					Unsaturated polyester
				●		●			Silicon resin
					●	●			Vinyl copolymer
									Water-based coatings
	●	●	●						Acrylic emulsion
	●	●	●						Acrylic water reducible
			●						Alkyd emulsion
			●						Alkyd melamine
			●						Alkyd water reducible
			●						Epoxy
			●						Polyester melamine
			●						Polyurethane emulsion
			●						2K water-based polyurethane
									Printing inks
				●					UV curable
									Packaging (gravure & flexo)
			●						Water-based
									Composite
				●		●	●	●	Gelcoats
				●					Laminating
				●					Lay-up & spray-up

Dispersion Control Additives

● Highly Recommended
● Potentially Suitable

Product Name	DELTA DC® 4296	DELTA DC® 4244	DELTA DC® 4274	DELTA DC® 4242	DELTA DC® 4211	DELTA DC® 4208	DELTA DC® 4207	DELTA DC® 4075	DELTA DC® 4073	DELTA DC® 4071	DELTA DC® 4066	DELTA DC® 4065	DELTA DC® 4054	DELTA DC® 4044	DELTA DC® 4010M	DELTA DC® 4007	DELTA DC® 4001
Active Ingredients %	>98	>98	>98	>98	>98	>98	>98	90	50	52	52	52	52	52	50	70	30
Solvent-based coatings																	
Acid curable															●		
Acrylic OH-functional										●	●	●					
Acrylic self-crosslinking										●							
Acrylic thermoplastic										●							
Long-oil alkyd	●	●		●		●	●			●	●	●	●	●		●	●
Medium-oil alkyd	●			●		●	●			●						●	
Short-oil alkyd	●			●		●	●			●	●	●				●	
Alkyd & PE OH-functional											●	●			●		
Alkyd & PE OH-melamine											●	●			●		
Chlorinated rubber					●								●			●	●
Solvent-based epoxy										●							
Solvent-free epoxy		●			●					●				●			
Nitrocellulose										●	●	●			●		
Unsaturated polyester			●		●											●	
Silicon resin																	
Vinyl copolymer		●												●		●	
Water-based coatings																	
Acrylic emulsion			●					●	●	●							
Acrylic water reducible			●					●	●	●							
Alkyd emulsion			●					●	●	●							
Alkyd melamine			●						●	●							
Alkyd water reducible			●						●	●							
Epoxy			●						●	●							●
Polyester melamine			●						●	●							
Polyurethane emulsion			●						●	●							
2K water-based polyurethane			●						●	●							
Printing inks																	
UV curable																	
Packaging (gravure & flexo)	●	●		●	●	●	●			●		●		●		●	
Water-based			●					●	●	●							
Composite																	
Gelcoats		●	●	●	●									●	●		
Laminating		●	●		●									●	●		
Lay-up & spray-up		●	●		●									●	●		

Additives for Coatings, Printing Inks, Adhesives and Composites

little makes difference

www.delta-specialties.com

MEA. INDIA. TURKEY. CANADA

Egypt:
Building 22A, 10th District,
6th of October City.
Tel.: +20 2 36862607
info@delta-specialities.com

India:
Plot No.C 343, Indira Nagar, 2nd Floor,
TTC Industrial Area, Pawane, Navi Mumbai,
MH 400705 Maharashtra, India
Tel.: +91 771 589 8361
info.india@delta-specialities.com

North America:
1128 Woodington Lane Oakville, ON, L6H 7T9,
Canada
Tel: +1 289 400 4572
info.canada@delta-specialities.com

Asia-Pacific:
259/383 Soi pridee Panomyong 15,
Yaek 5, Sukhumwit 71, Phra Kanong Nua,
Vattana Bangkok 10110 Thailand
Tel: +66 0 831 335 030
info.asia@delta-specialties.com

Turkey:
Kemal Turkler Mh. Sumer Cd. Huma Sk.
16A/23, Sancaktepe / Istanbul, Turkey
Tel : +90 532 437 1750

ISO 9001 2015 CERTIFIED

OHSAS 18001:2007