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Borchers' Wetting and Dispersing Additives

Borchi® Gen

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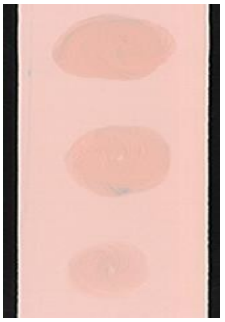
The importance of wetting and dispersing additives in the production of surface coatings is frequently underestimated – and wrongfully so! Dispersing pigments is not only the most time-consuming, but also the most energy-consuming step in the entire production process. An effective additive can help to significantly shorten the grinding time and thus save time and money. In addition, the performance of the wetting and dispersing additive can make a significant contribution to an optimal overall result. Apart from helping to develop gloss and color strength, the dispersing additive also plays a decisive role in stabilizing the paint.

The importance of wetting and dispersing additives is generally not recognized until it is too late. Many defects in the surface coating are attributable to inadequate pigment grinding and thus to the wrong choice of additive. In addition to the poor development of color strength, the following typical defects can occur:

- Changes in shade
- Flocculation
- Flooding/Floating
- Bernard cells
- Rub-out
- Loss of gloss
- Settling

Lack of color strength

Flocculation

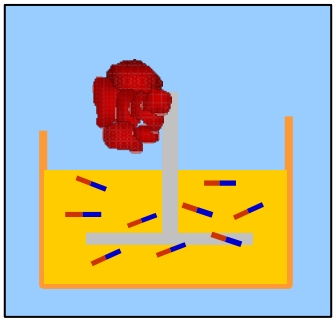


Rub-out

Bénard cells

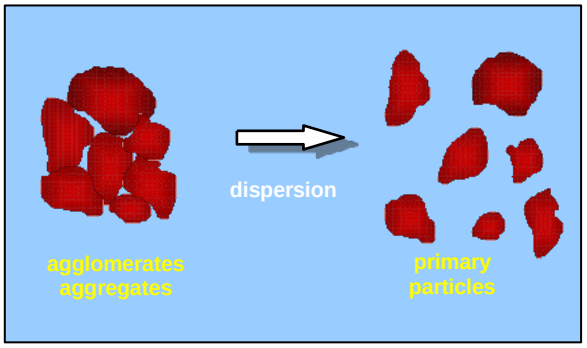
Borchers has the ideal solution for preventing the occurrence of such defects: the Borchi® Gen range of wetting and dispersion additives. Borchi® Gen additives are suitable for all fields of application and exert a positive influence on the desired result throughout the dispersion process and beyond.

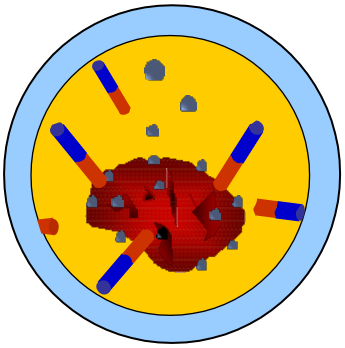
We can divide the dispersion process into three phases:



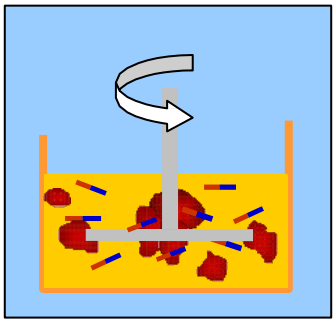
2. Dispersing:
In the second step, the pigment particles, consisting of loosely joined agglomerates and large-area aggregates firmly bound to one another, are broken up by the mechanical energy. Ideally, a fully deflocculated state will arise, in which all pigment particle agglomerates have been broken up into their primary particles.

1. Wetting:
The binder solution penetrates the cavities within the pigment agglomerates and expels the air out of them. In some cases, this may be as much as 75 % of the pigment volume. During this process, a transformation takes place on the pigment surface from a solid/gaseous interface to a solid/liquid interface. The penetration of the binder breaks apart the first loose agglomerates.

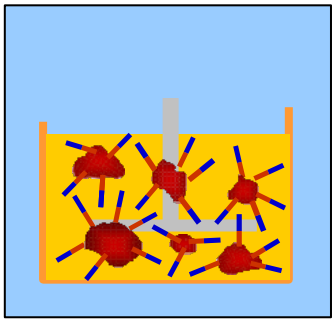




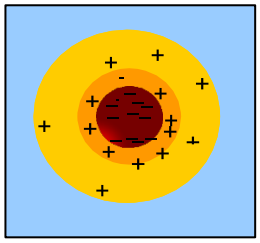
Did you know that just a negligible amount of 0.1% of the energy needed will be expended to break up the strong adhesion between pigment particles? The far major part is mere loss of energy in terms of heat. With an effective dispersing additive, the efficiency of the dispersing process can be significantly enhanced.



3. Stabilizing:
Just as important as breaking up the pigment particles and distributing them homogeneously during the dispersing process is that this state be retained during the subsequent storage and application of the paint. Without the presence of a suitable dispersing additive, reflocculation of the primary particles will occur within a very short time, resulting in a significant drop in color intensity and a loss of gloss. Other undesirable side effects can be a change of color, specks or sedimentation.



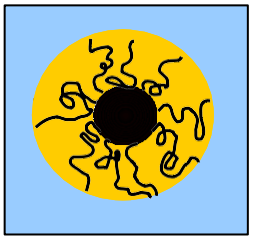
Stabilization of the pigment particles within the binder matrix by the dispersing additives adsorbed on the pigment surface can basically be carried out in two different ways. In polar media, stabilization is usually achieved through the formation of electrical double layers, while the preferred method in non-polar environments is steric repulsion.



Electrostatic stabilization

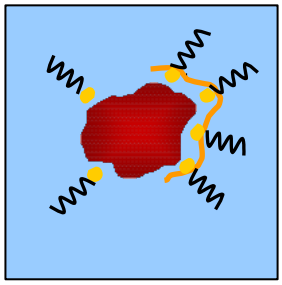
Electrostatic stabilization is based on the repelling of electrostatic charges brought about by the adsorption of an electrically charged dispersing additive on the pigment surface. An electrical double layer forms around the pigment, consisting of a solid layer in the direct vicinity of the surface, and adjacent to it, a diffuse layer. If two such coated pigment particles approach each other, their mutual electric repulsion prevents possible flocculation.

Steric stabilization



In non-polar media, pigment dispersions are generally converted to a stable condition with the aid of **steric stabilization**. This method requires polymer dispersing additives that are capable, via pigment affine groups, of adsorption on the pigment surface, and whose other chain end is freely mobile and projects into the surrounding binder or solvent matrix. This "polymer sheath" prevents the direct contact of two pigment particles, and thus hinders their flocculation. The denser the coverage of the pigment surface and the thicker the polymer layer, the more effective the steric stabilization.

Wetting and dispersing additives can be subdivided into different categories according to various criteria. Apart from the mode of action just described, the molecular weight of the additive is one of the most important distinguishing criteria. As a rule, virtually all of the application-related characteristics are influenced or predetermined by the structure, for example, the suitability for certain types of pigments or the recommended dosage. A distinction is generally made between **high-molecular weight** and **low-molecular weight** wetting and dispersing additives.



Low and high-molecular weight dispersing additives

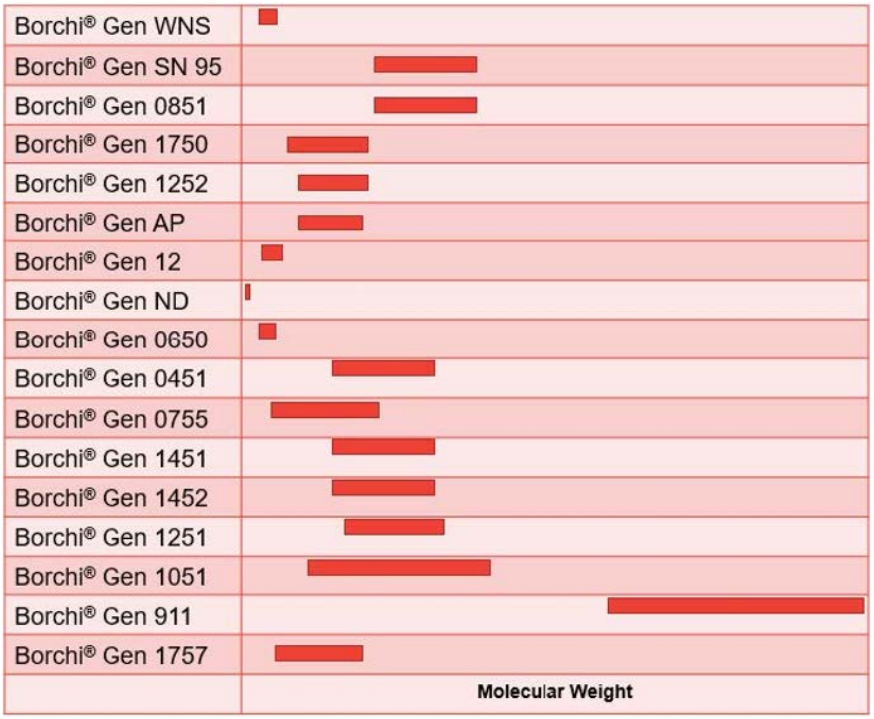
The conventional low-molecular weight types with a molecular weight normally between 1,000 and 2,000 g/mole, are, in turn, subdivided according to their chemical structure into anionic, cationic and non-ionic substances. They often have a linear surfactant-like structure made up of a polar hydrophilic and a non-polar hydrophobic chain-end, which become attached to the pigment surface according to their predominant polarities and are oriented towards the binder interface. In most cases, however, they contain only one or two groups with affinity for pigment, which means that sufficiently strong and lasting adsorption is guaranteed only in the case of inorganic pigments, which have an ionic structure and thus a relatively high polarity on their surface. This plays a major role in terms of the effectiveness of the additive. The stabilization of organic pigments with the aid of conventional, low-molecular weight dispersing additives, on the other hand, is far more difficult because the comparatively low-polar pigment surface offers only weak interactions with the additive and is thus unable to form any sufficiently effective "protective layer" to prevent flocculation of the pigment particles.

This fact was the main reason for developing high-molecular weight wetting and dispersing additives with a mean molecular weight of between 5,000 and 30,000 g/mole. Unlike the low-molecular weight grades, they have far more groups with affinity to pigments. In addition, these groups are specifically geared to the characteristic structure and, as a result, the interactions prevailing on the surface of the organic pigments. They are thus able to produce a lasting and sufficiently thick adsorption layer. The adsorption forces are based for the most part on dipole-dipole and van der Waals interactions. From a chemical point of view, a distinction can be made between two main groups: the modified polyurethanes and the large group of polyacrylics.

Although the high-molecular weight additives have been developed specifically for organic pigments, this concept also applies to inorganic pigments. However, there are also disadvantages to modern dispersing agents, for in some cases, the high molecular weight is associated with limited binder compatibility. Furthermore, the required dosages of high-molecular weight wetting and dispersing additives are usually considerably higher than with the low-molecular weight grades.

Our range of **Borchi® Gen** wetting and dispersing additives includes both low-molecular weight and high- molecular weight products, providing optimal solutions for every field of application and every kind of pigment.

Currently, our **Borchi® Gen** family of products contains about one and a half dozen coordinated products for the waterborne and solvent borne segments.



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Borchi® Gen 0851 is a high-molecular weight polyurethane block polymer. It shows outstanding results with organic and carbon black pigments in high- performance waterborne applications. Additionally, it is highly efficient in dispersing and stabilizing perylene pigments with regard to tinting strength and stability. The product is free of VOC.

Borchi® Gen1750 is a polyurethane based polymer that is specially designed for transparent iron oxide pigments in waterborne formulations. This product is compatible with alkyd emulsions, straight acrylics and polyol emulsions. **Borchi® Gen1750** provides high tinting strength and superior transparency.

Borchi® Gen AP is a nonionic polymer wetting and dispersing agent for waterborne systems. It is highly efficient for the stabilization of inorganic pigments. When used with Borchi® Gen 12, it is suitable for pigment concentrates. Due to its acidic character (pH 1 - 2), it should be neutralized with ammonia or an amine before use in waterborne binders that are sensitive against acids.

Borchi® Gen ND is used predominantly as a wetting and dispersing agent in solvent borne and solvent-free industrial coatings. However, due to its 100 % active substance content, it is also suitable for waterborne systems. Because of its anionic structure, it is especially suitable for the dispersion of inorganic pigments. Apart from that, **Borchi® Gen ND** has a significant brightening effect in white and clearcoats containing a colored metal drier. In two-pack polyurethane systems, the addition of **Borchi® Gen ND** can be used to control pot life.

Borchi® Gen 0650 is an amine neutralized phosphoric acid ester. It is recommended for universal, waterborne and solvent borne pigment concentrates. It has excellent wetting characteristics and facilitates the dispersion of inorganic pigments and surface treated organic pigments at a small dosage. It also can be used as a post additive in order to improve rub out and stability.

Borchi® Gen 0451 is a solvent-free wetting and dispersing agent. Although it has a high molecular weight, the additive is free-flowing and contains excellent wetting and dispersing properties. Because of its universal solubility and binder compatibility, it can be used in most coating systems, including radiation-curing UV systems. Furthermore, it is ideal for the formulation of pigment pastes, especially with carbon blacks and organic pigments.

Borchi® Gen 1451 is a modified polyurethane, specifically designed for dispersing organic pigments and carbon blacks in high performance automotive and industrial coatings.

Borchi® Gen 1452 is a modified polyurethane, specifically designed for dispersing organic pigments as well as carbon blacks for pigment concentrates.

The development of **Borchi® Gen 0755** was aimed at applications in middle and low polarity areas. It is a modification of Borchi® Gen 0451 with improved compatibility in solvent borne and waterborne coatings, inks and common universal grinding resins. It is, therefore, a primary recommendation for carbon black, organic and inorganic pigments.

Borchi® Gen 12 is an environmentally friendly, VOC- and APEO-free wetting and dispersing additive developed from renewable raw materials. It has an active ingredient content of 100 percent. **Borchi® Gen 12** is suitable for waterborne and solvent borne systems and guarantees outstanding film flexibility. This additive is OH-functional. When dispersing inorganic pigments, especially in the case of pigment pastes, we recommend using this product in combination with Borchi® Gen ND (ratio 3:1) or Borchi® Gen AP (ratio 4:1).

Borchi® Gen 1251 is based on a high molecular polyurethane block polymer with outstanding wetting and dispersing properties for high-grade solvent borne applications (e.g. automotive OEM and refinishing coatings). **Borchi® Gen 1251** contains 85% of the active polymer dissolved in methoxypropyl acetate. It is highly effective in the milling of carbon blacks and organic pigments, where a significant lowering of the grinding viscosity allows the production of highly concentrated pigment pastes.

Borchi® Gen 1051 is a high-molecular weight dispersing additive for solvent borne systems. It is a solution of a polyurethane-based block copolymer in a special, nonaromatic solvent mixture. Its main application is in high-grade, two-component industrial coatings, including automotive refinishing and OEM coatings. Optimal compatibility is provided when used in medium-polar binder systems.

Borchi® Gen 1757 is a VOC-free wetting and dispersing agent designed for inorganic bismuth vanadate pigments in water-based coatings. It provides vibrant color, superior opacity and a combination of various principles of pigment stabilization.

Borchi® Gen 911 is a solvent borne dispersing resin especially recommended for conventional alkyd resin-based coatings. It contains an active ingredient combination that not only guarantees excellent wetting and dispersing properties, but also effective stabilization of the pigments. It prevents both reagglomeration of the dispersed pigments and the formation of hard sediment.

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