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3D inkjet using Dynol™ 800

Additives for inkjet inks

Fast additives to improve **wetting, dispersing**, **stabilising** and **defoaming**

At this moment inkjet is by far the most promising printing technology. Inkjet printing is suitable for a diverse range of substrates:

Paper • Textile • Plastics • Metal • Ceramics • Electronics

Compared to other ink technologies, inkjet gives product designers and manufacturers new possibilities in personalisation, speed, flexibility and variability.

However, as inkjet is a non-contact and very fast printing technology, it presents ink formulators with completely new challenges – especially in terms of **wetting**, **dispersing**, **stabilising** and **defoaming**.

No matter wether **water-based**, **solvent-based** or **UV systems** – we offer the right additives to address:

- surface wetting issues
- pigment and dye agglomeration
- foam stabilisation
- jetting issues
- rheology issues
- stability issues
- plastic swelling.

Wetting

Compared to other common surfactants (siloxane- or polyacrylic-based), **Surfynol®** and **Dynol™** wetting agents are unique.

Their **Gemini structure** *(see Figure 1)* leads to the reduced formation of micelles, resulting in a very dynamic surface tension reduction – both of which are very important for inkjet applications.

Benefits of Gemini wetting agents include:

- quick and efficient dynamic surface tension reduction
- non-ionic structure
- non-micellar behaviour
- deaerating and defoaming
- tolerance towards a very broad pH range.

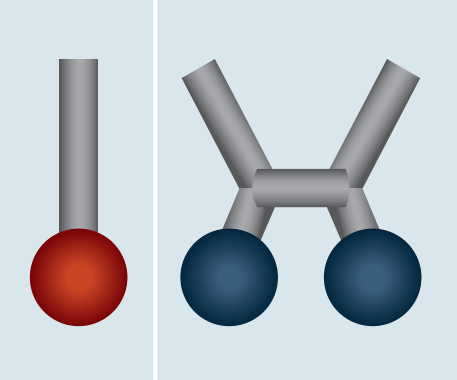


Figure 1: A comparison of a traditional surfactant and a Gemini surfactant

Surface tension vs. bubble frequency

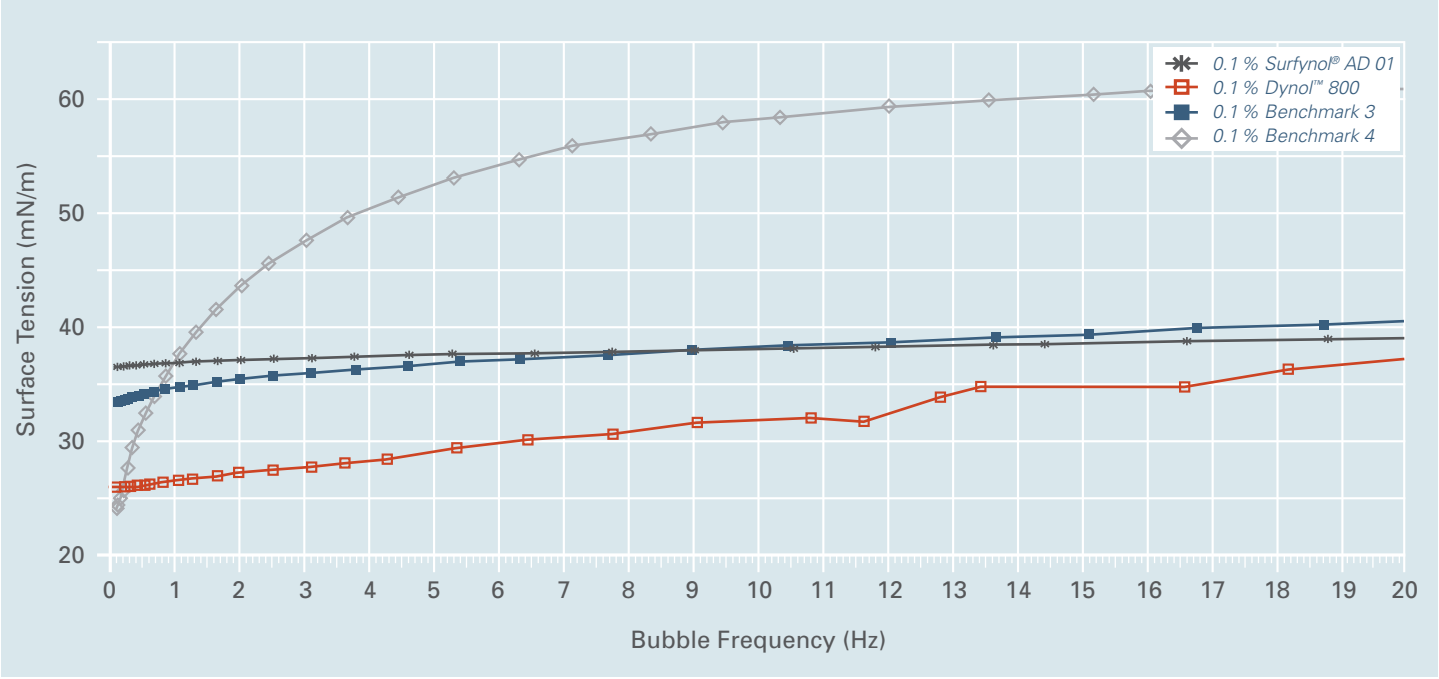


Figure 2: A comparison of the dynamic surface tension of Dynol™ 800 and Surfynol® AD-01 with competitor's first choices (see also Figure 4)

In terms of dynamic surface tension reduction, Gemini surfactants outperform the standard surfactants on the market. *Figure 2* illustrates the difference in properties between Dynol™ 800/Surfynol® AD-01 and two commonly used benchmark products, which are often the first recommendation.

Depending on your substrate, Dynol™ and Surfynol® additives will give you the following advantages:

- wetting of very low energy/ difficult to wet substrates
- jetting
- depth of penetration
- spreading/pinning
- drying.

Dispersing/stabilising

Pigment-based systems

In pigment-based systems, having the ideal dispersion and stabilisation of pigments is the key to an optimum colour and viscosity stability.

ZetaSperse® dispersants encompass a range of products developed to provide effective primary stabilisation of pigments.

The choice of additive depends on the pigments used. First recommendations are listed here.

ZetaSperse® 3600 and ZetaSperse® 3800 are multipurpose additives suitable for most pigments and dyes.

Pigment dispersants

PBk 7	ZetaSperse® 3800 or 3600
PW 6	ZetaSperse® 1200 or 3600
PB 15:3	ZetaSperse® 3600 or 3700
PR 122	ZetaSperse® 2500 or 3400
PV 19	ZetaSperse® 2500 or 3400
PY 74	ZetaSperse® 3600 or 3700
PY 155	ZetaSperse® 3600 or 3700

Dye-based systems

We offer a range of additives for dye-based inks, too. Depending on your system, several combinations will help you with:

- wetting and dispersing of dyes
- preventing agglomeration of dyes
- improving ink stability.

Sublimation/disperse dyes

Dispersion and stabilisation	ZetaSperse® 3600 ZetaSperse® 2500
Stabilisation	ZetaSperse® 179
Wetting	Surfynol® 2502 Dynol™ 800

Reactive/acid dyes

Stabilisation	ZetaSperse® 179 Carbowet® GA-211
Wetting	Surfynol® 2502 Dynol™ 800

Secondary stabilisation

Secondary stabilisers are recommended when stability is a parameter that has to be improved. The ZetaSperse® 179 can be used in conjunction with the polymeric dispersants mentioned above. It is a non-ionic low molecular weight dispersant (500-2500 Da) that will boost ink stability and colour.

Figure 3 shows how small dispersants will prevent destabilisation. When stabilised systems are mixed, a re-equilibration of dispersing additives occurs. As a consequence most colourants flocculate, which leads to rheology, stability and printability issues *(a)*.

Secondary stabilisers quickly distribute to new formed surfaces to prevent flocculation *(b)*.

Dispersants prevent colourant destabilisation

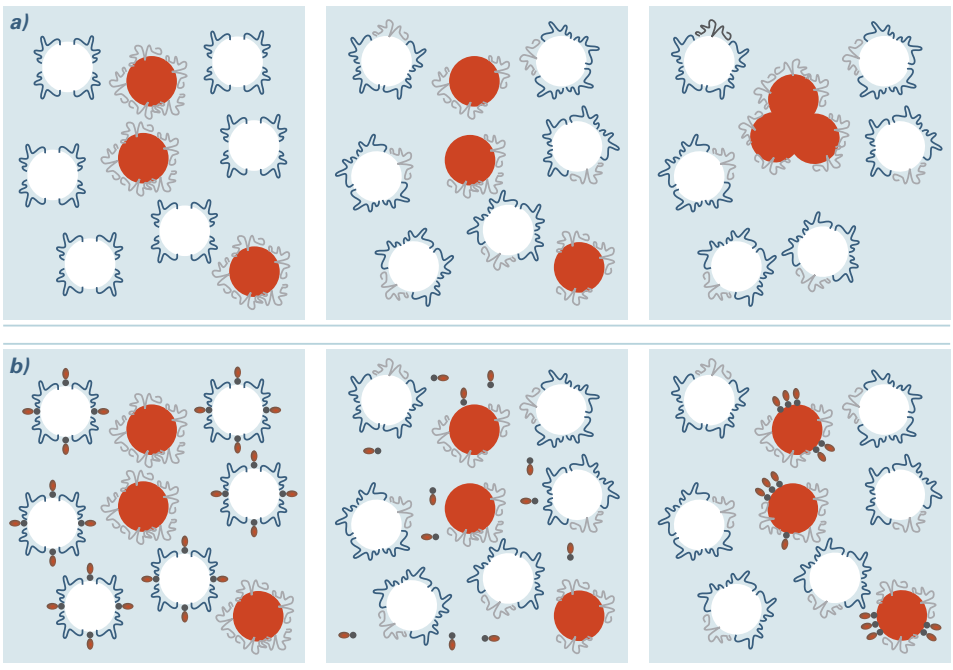


Figure 3: Dispersants prevent colourant destabilisation

Defoaming

The first step in preventing foam is the use of **non-foaming additives**. *Figure 4* shows the influence of surfactants on foaming behaviour.

Traditional defoamers (organic oil- and silicone-based) are predominantly available under the name of **Airase®**. Usually strong defoamers are used in pigment grind formulations.

As these products have to work via balanced film incompatibility, they can have an adverse effect on ink stability, jetting, wetting properties or long-term foam control.

One attractive option is the use of defoamer class called **Molecular Defoamers** *(see Figure 5)* under the brand name **Surfynol®**. These products contain no solids and are silicone-, silica- and oil-free.

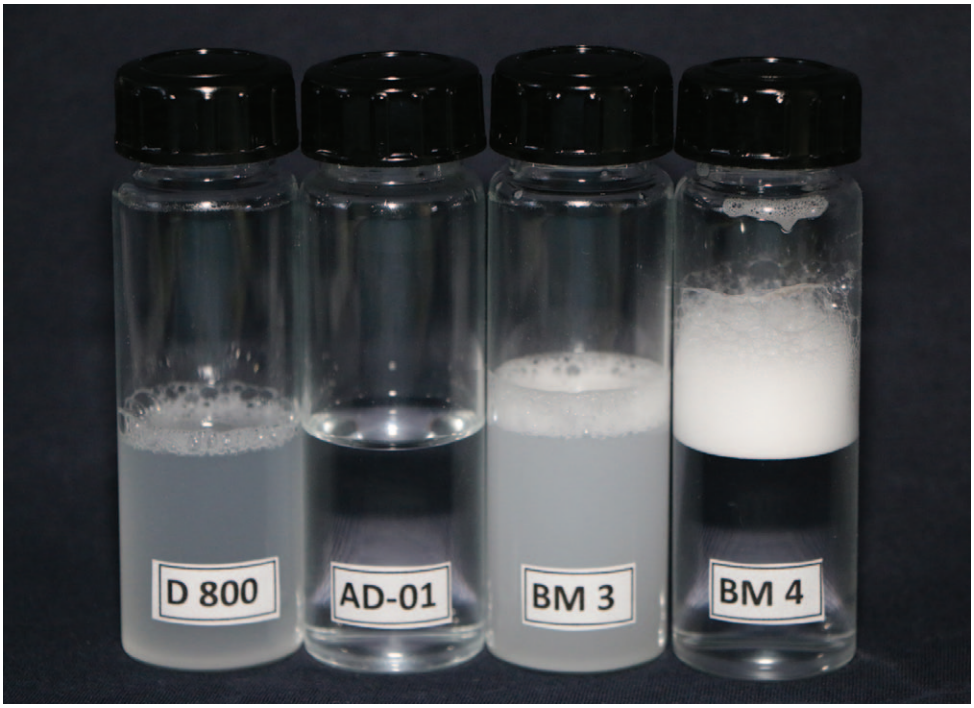


Figure 4: Dynol™ 800 and Surfynol® AD-01 compared with competitor´s first choices

Non-foaming wetting agents:

- Surfynol® 107L
- Surfynol® AD-01
- Surfynol® 2502
- Dynol™ 360
- Dynol™ 800

Traditional defoamers:

- Airase® 4500
- Airase® 5300
- Airase® 5400
- Airase® 8070

Molecular Defoamers:

- Surfynol® AD-01
- Surfynol® 107L
- Surfynol® MD-20
- Surfynol® DF-110D (very suitable for pigment and dye preparation)

Defoaming with Molecular Defoamers

Molecular Defoamers displace foam-stabilising surfactants but are unable to stabilise the bubble wall

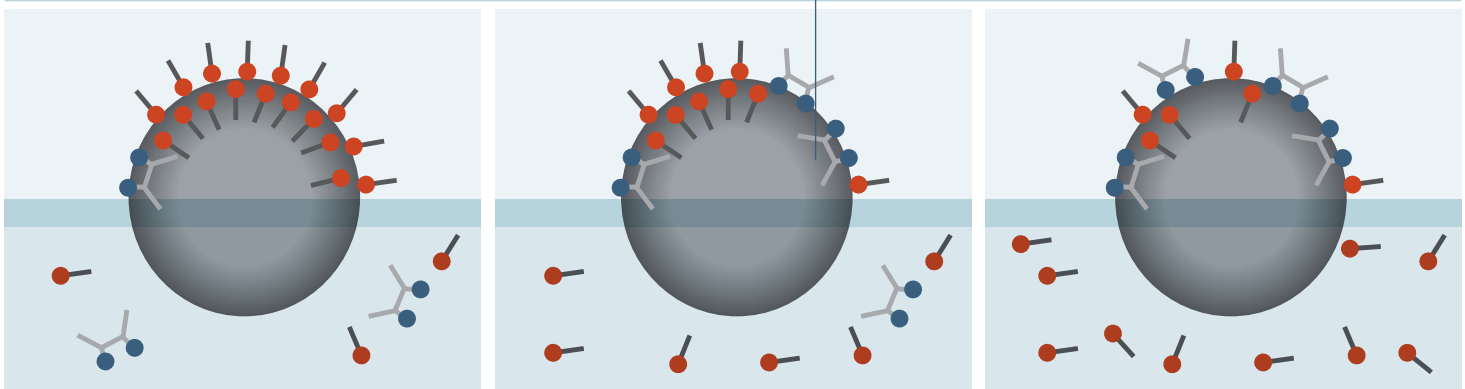
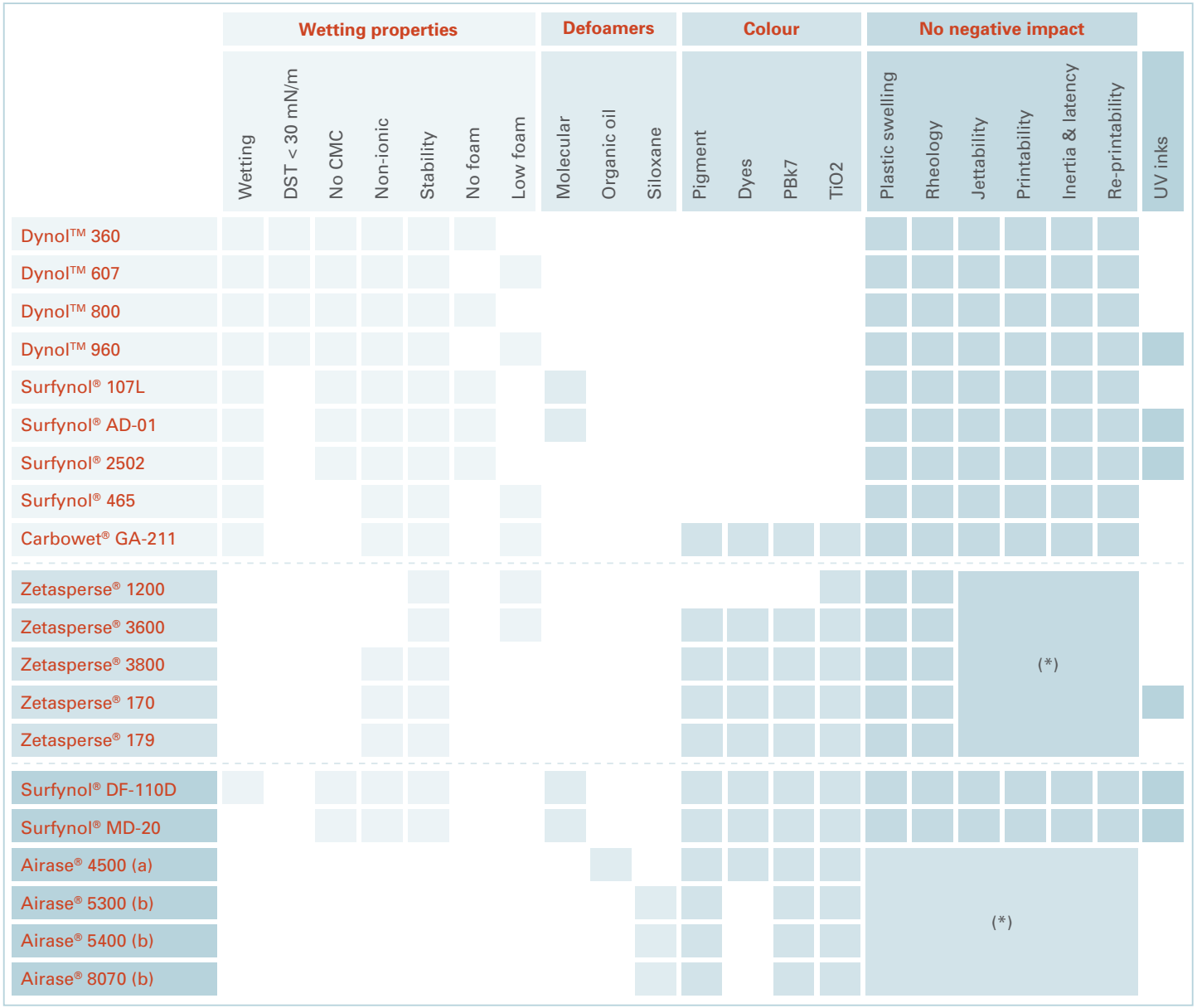


Figure 5: Mechanism behind Molecular Defoaming

Additives for inkjet inks: water-based, solvent-based and UV systems



(a) Mineral oil-free, (b) Ethoxylated siloxanes, no solids and silicone-free, (*) Depending on ink formulation, production method and other additives. Above recommendations are based on current successes, final recommendation will be based on ink type, issue at hand and substrates used.

Food contact

There is a growing market awareness regarding the safety of food and substances in contact with food, including packaging materials as well as cutlery, processing appliances and containers.

Most additives recommended for inkjet have the required food contact approvals, for example:

- Swiss Ordinance Annex 10, May 1st 2017
- PIM EU 10/2011
- German BfR XXXVI 1/2/3, July 1st 2016
- FDA 21CFR 175.105, and others.

Contact Biesterfeld for the complete list with grades and food contact regulatory details.

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