



delta

little makes difference

• **DELTA SC®**
Surface Control Additives

• **MORDRY®**
Driers

• **DELTA FC®**
Foam Control Additives

• **DELTA DC®**
Dispersion Control Additives

• **DELTA S®**
MORDRY®
Specialty Additives

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Delta in Brief

About Us

Delta Specialties is a specialized multinational company serving the market with optimized solutions in multiple industries namely coatings, graphic arts and plastics industries. The core business arms are the driers and additives offered with consistent quality to more than 30 countries serving local, regional, and multinational base of clients around the GLOBE.

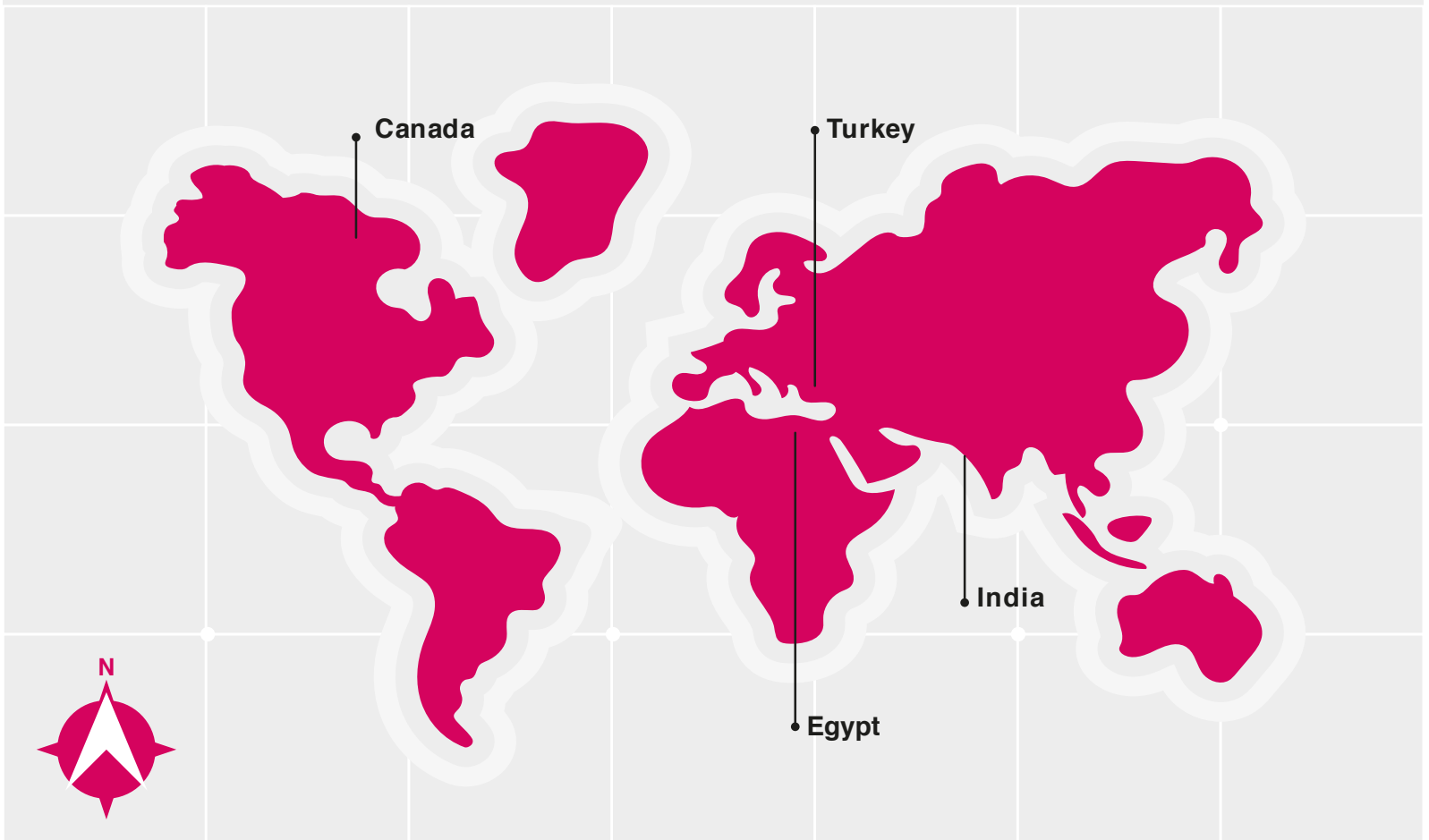
Having been in the market for over 15 years, Delta is currently operating with offices in Canada, India, Turkey and Egypt.

Our technical department holds the key for the continuous success of the company. The Research & Development labs together with the Technical Service & Application labs work very closely in testing existing products for new applications and developing new products according to the customers' demand.

Our business model is built around serving our customers in an industry that revolves around technology and innovation, but above all positive impact. From the huge change little additives can bring to your performance comes our belief that **little makes difference**.



Delta...Your Global Reliable Partner for Additive Solutions



Delta in Brief

Core Values

Honesty is our guiding principle; it reflects on our integrity with all stakeholders while bringing a high sense of trust to our markets and community at large.



RESPECT



DEVELOPMENT

Our deep belief in developing people and solutions reflects on our ability to successfully develop markets and business.

Our entrepreneurial acumen supports our forthcoming vision; adapting to market changes and responding with high flexibility.

AGILITY

PARTNERSHIP

We deal with business as humans; we understand their challenges and we cherish a partnership relation led by our devoted passionate team.

We are proactive and courageous; we take calculated risk trusting an empowered team enjoying self-realization and achieving outstanding performance.

BOLDNESS



Delta in Brief

Brand Promise

Optimized Solution-Based Portfolio

Understanding our customers' needs is key to adopt the most relevant solutions that fit their requirements and provide them with better product performance. We will be the ultimate choice contributing value for money partnership.

Reliable Partnership

Trust is a pillar formulating our relationship with our stakeholders. We will always deliver on promise to assure a partnership relation with all our stakeholders around the globe.

Human-to-Human Service

Empathy is in the heart of the way we deliver service; we will always deliver a close and personal relationship all backed up with responsive technical support and on- time & budget delivery.

Sustainable Impact

We work with impact, and we promise to embed sustainable development and support our customers aiming at more environmental friendly solutions.



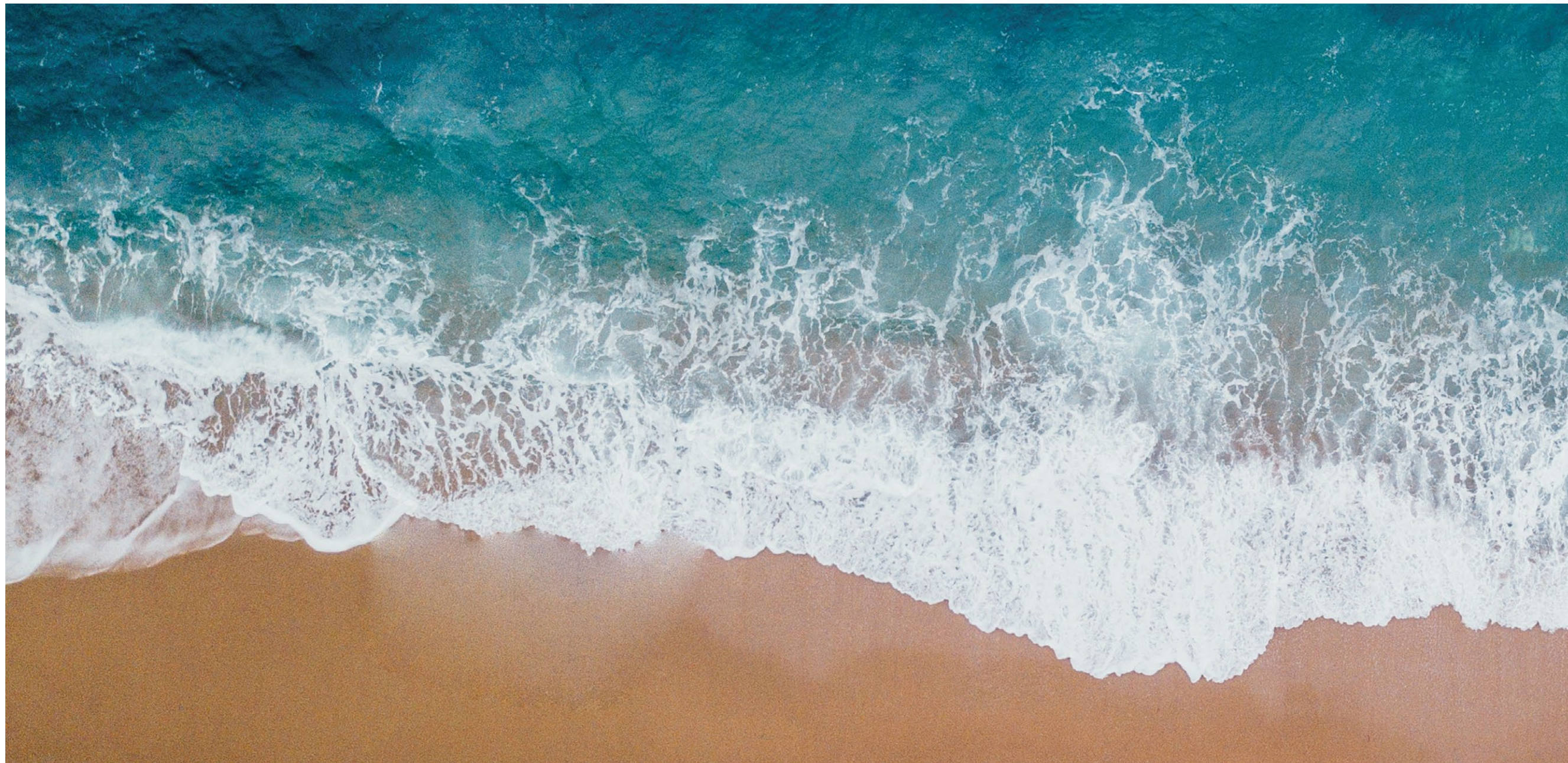


Foam Control Additives

Air can be incorporated into a coating by mixing during the polymer/pigment grinding and let-down steps, by pumping during package filling...etc.

Effective foam control additives are beneficial in preventing or reducing many common coating problems such as viscosity increase and loss of mechanical shearing power during milling, volume increase during the letdown and mixing steps...etc.

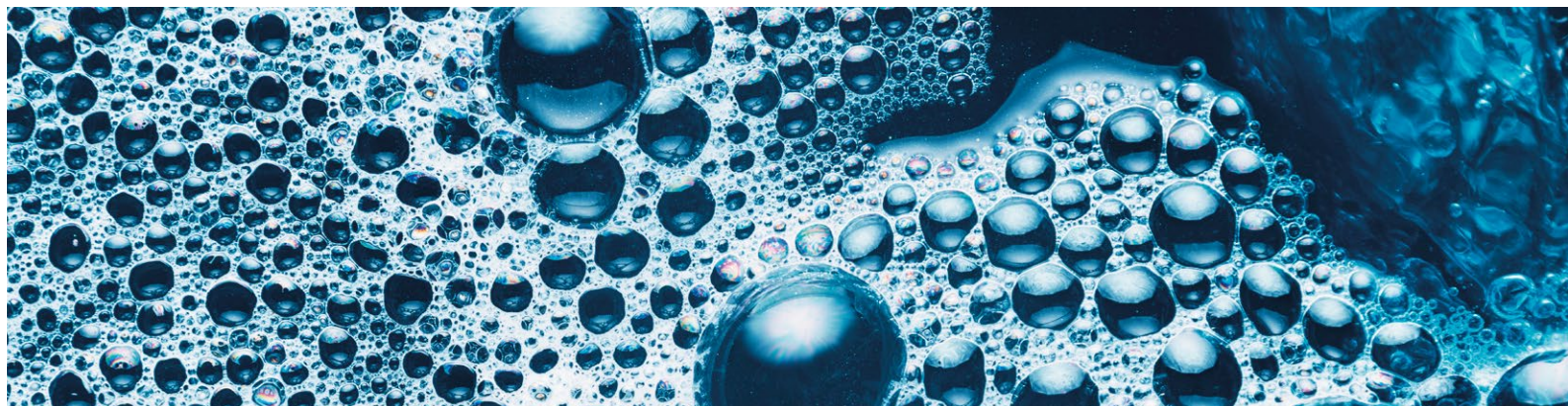
Delta Specialties offer a comprehensive range of foam control additives (silicone-free and silicone-based) to help you get rid of foam and achieve foam-free formulations in coatings, printing inks, adhesives and plastics (composite).



Composition of a Foam Control Additive

Typical foam control additives consist of the following components:

- Carrier fluids: They act to transfer the generally hydrophobic active substance uniformly into the hydrophilic medium. Typical carrier fluids include aliphatic and aromatic mineral oils, solvent blends, and water in the case of pre-emulsified defoamers.
- Surface active agents: They bring the active substance to the air interface and into contact with the stabilized foam structure. These substances work by having a general incompatibility with the formulation and disrupt the spreading mechanism for stabilizing foam.
- The most often used substances showing incompatible spreading include fatty acid esters and amides, glycols, silicones, and modified silicones.
- Active substances: They adsorb surfactant ingredients present in the formulation and destabilize foam. Hydrophobic particles such as metal soaps, waxes and hydrophobic fumed silica are adsorption compounds for foam destruction.



Choosing a Foam Control Additive

For solvent-based and solvent-free systems, polysiloxanes, polyacrylates and polyolefins are effective.

Pure polysiloxanes are also suitable but critical in terms of their compatibility, which can cause cratering. The best balance between compatibility and incompatibility is achieved through organically-modified polysiloxanes.

Modification of the polysiloxane backbone with fluorine results in the so-called fluoro-silicones known for their very low surface tension and strong defoaming properties.

For waterborne systems, a wider range of chemical structures can be used due to the generally higher surface tension of these systems.

Foam control additives for waterborne systems can generally be based upon:

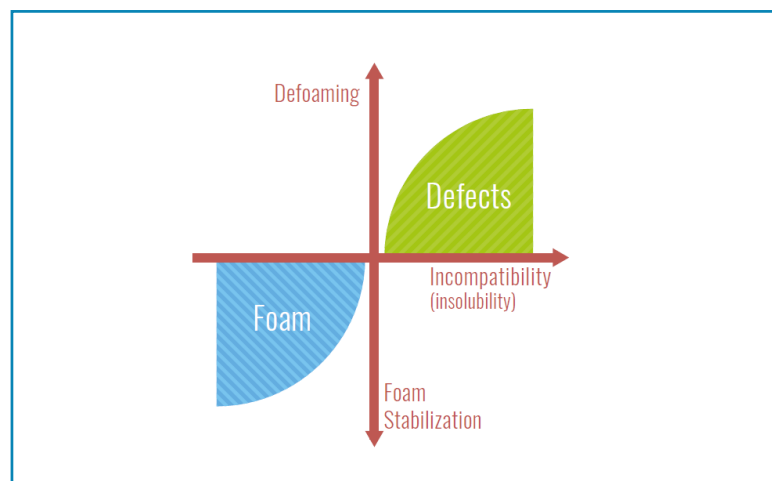
- Mineral oil: As opposed to solvent-based systems, the spreading of mineral oils in water-based systems is sufficient to act as a foam control additive. In the presence of hydrophobic particles, the mineral oil acts in addition as carrier for these particles.
- Silicone: Both dimethylpolysiloxanes and modified polysiloxanes can be used as foam control agents in water-based systems.

An important point to consider is the incorporation of the foam control additive in the paint system. Since they are not soluble in the system, a good distribution of the active substance is necessary. This can be controlled by the mixing speed and time, otherwise craters can be formed or loss of defoaming efficiency is observed.

Since the performance of a foam control additive is difficult to predict due to the variety of raw materials used in a paint formulation and the application method, evaluation of your own system is indispensable.

The stirring or shaking tests are based on the incorporation of air in a system. After this air incorporation, the samples can be analysed on weight or volume. The foam reduction over time of these stirred or shaken samples can also be observed. These tests give the effectiveness of the foam control additive during the manufacturing process.

The roll test can be used to control the foam behaviour during the application of the paint. After application of the paint with a roller on a testpaper, the wet and dry film is analyzed on surface defects.



Foam Control Additives

- Highly Recommended
- Potentially Suitable

- **Highly Recommended**
- **Potentially Suitable**

[illegible]

02

Surface Control Additives

The surface of coating (coating could mean paint, ink or composite) is exposed to "the outside world" and has to withstand some severe circumstances which may lead to a fast degradation of the system itself.

In most cases, superior surface properties cannot be achieved without the addition of surface control additives that alter the surface properties of the coating.

Depending on the kind of additive used, properties such as mar, slip and scratch resistance, abrasion resistance, anti-blocking ...etc can be altered.

Delta Specialties offer a variety of surface control additives suitable for water and solvent-based systems.



Surface Defects

Defects of wet and consequent dry coating films affecting coating appearance and sometimes performance are:

- Benard cells: Hexagonal cells with marked centers produced by circulation in the film caused by gradients of concentration, density and/or temperature.
- Floating: Benard cell circulation influences color shade and appearance; observed as mottled, blotchy, or streaked appearance of a paint film.
- Flooding: Surface color is uniform but different to the original one caused by uneven distribution of pigments in the film during drying.
- Craters: Small bowl-shaped depressions often having drops or bands of material at their centers and raised circular edges in a coating film. Caused by contaminants of lower surface tension.
- Orange peel: Surface bumpiness or waviness that looks like the skin of an orange. It is often caused by poor levelling and is a common defect in both spray and roll-applied coatings.
- Picture framing (edge crawling): De-wetting of the applied coating and the appearance of fat edges or picture framing around the edges of a panel or metal part. It is generally caused by increase of surface tension on the edge during drying. Low viscosity increases this phenomenon.
- Fish eyes: Crater-like holes whose centers consist of a uniform flat painted region, surrounded by a depression, followed by a ridge of paint. They are caused by un-dispersed fluid globules in the paint or by airborne droplets (silicones, water, dried soap, dust, wax, and oil) deposited on the painted surface. Large fish eyes can be found individually and small ones are often found in small densely packed clusters.
- Crawling: De-wetting of the applied film from the substrate due to surface tension differentials.
- Telegraphing: Flow of paint induced by temperature gradients or contaminant of the substrate surface.



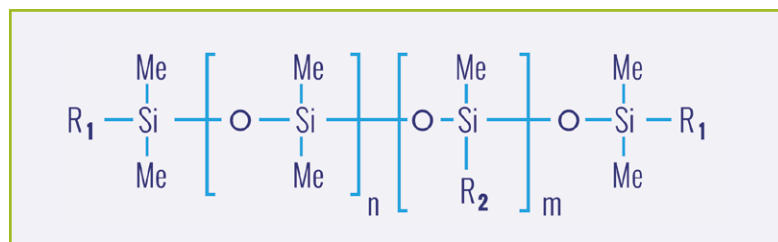
Choosing a Surface Control Additive

Surface control additives are silicones, polyacrylates or perfluoro surfactants.

Polysiloxanes (silicones) have a very high surface activity and therefore are often used as surface control additives. Commercial silicone-based surface control additives are modified by polyethers, polyesters or alkyl side groups to improve recoatability and inter-coat adhesion. Modification parameters are silicone content, molecular weight, and modification degree.

Dimethylpolysiloxanes (PDMS) are used for different purposes depending on their degree of polymerization. Low molecular weight products are used as levelling agents.

Increasing the molecular weight creates a higher degree of incompatibility with the coating medium and can generate a defoaming action.



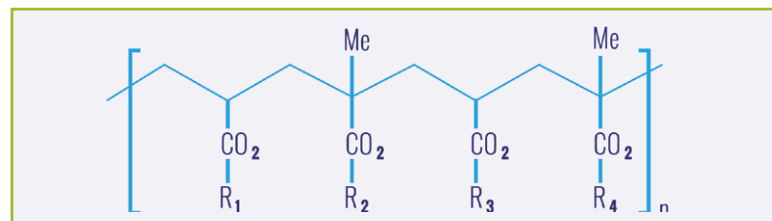
These products can be used to create a strong cratering tendency, a so-called hammer-tone effect. However, in most cases, recoatability is a problem with this product group and methylalkyl polysiloxanes are superior in this respect.

Polyether-modified siloxanes can be tailored to certain coating types and are superior to the dimethylpolysiloxanes. However, in certain applications, hydrolytic stability may be a problem. Self-condensation of hydroxyl functional polysiloxane can give rise to the formation of incompatible products with a strong tendency for cratering.

Polyester-modified siloxanes exhibit a higher stability against thermal degradation and improvements in compatibility. These products provide long-term slip and water repellency.

Homo and copolymers based on (meth)acrylic monomers are well known polyacrylate surface control additives. In some cases, they are incompatible in the paint system, which leads to the development of haze in clear-coats. This problem can be solved by choosing an acrylic leveling agent with lower molecular weight and improved compatibility. Gloss levels in solid colors are normally not affected by the incompatibility.

In addition to their positive impact on flow and leveling, acrylic homo- and co-polymers are effective as air-release agents. Since they are not reducing the surface tension of the coating to the extent of silicone-based products, the wetting of substrate surfaces is improved (substrate wetting).



Perfluoro-modified surface control additives are the most effective compounds to decrease surface tension, however, recoatability and foam stabilization and cratering may occur. These undesired side-effects depend very much on the system parameters that have to be optimized and adjusted to gain optimum results. Controlling the parameters of molecular weight, polarity, degree of fluorine modification, curing conditions, and additive concentration in the formulation must be evaluated carefully.

Surface Control Additives

● Highly Recommended

● Potentially Suitable

Product Name	Chemical Type	Active Ingredients %	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		
DELTA SC® 2030	Silicone-based	52		●	●	●	●		●	●	●	●	●	●	●		●		●			●	●	●	●	●	●	●	●		●				●				
DELTA SC® 2031	Silicone-based	52.5		●	●	●	●		●	●	●	●	●	●	●		●															●	●						
DELTA SC® 2033	Silicone-based	15		●	●	●		●	●	●	●	●	●	●	●	●	●																●						
DELTA SC® 2034	Silicone-based	52.5			●	●	●	●	●			●	●	●	●	●	●	●	●		●					●	●	●	●	●			●						
DELTA SC® 2035	Silicone-based	52.5			●											●		●								●	●	●	●	●			●						
DELTA SC® 2211	Silicone-based	>98		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●		●	●	●	●	●	●	●	●			●	●					
DELTA SC® 2212	Silicone-based	>98		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●												●	●					
DELTA SC® 2230	Silicone-based	>98		●	●	●	●		●	●	●	●	●	●	●	●	●		●						●	●	●					●	●						
DELTA SC® 2231	Silicone-based	>98		●	●	●	●		●	●	●	●	●	●	●		●															●	●						
DELTA SC® 2239	Silicone-based	>98		●		●		●	●	●			●		●	●	●	●																			●		
DELTA SC® 2284	Silicone-based	>98			●	●	●				●		●		●	●	●	●																					
DELTA SC® 2580	Silicone-based	>98																																	●				
DELTA SC® 2777	Polyacrylate-based	70		●	●	●	●	●	●	●	●	●	●		●	●		●	●														●						
DELTA SC® 2780	Polyacrylate-based	50		●	●	●	●	●	●	●	●	●	●		●	●		●	●														●						