



KAM Kimya

Engineered Solutions

SPECIALTY ADDITIVES

PRODUCT GUIDE

Issue 3/2023

**Additives for Coatings, Printing Inks,
Composite, Adhesives and Sealants**

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Welcome

In search of the right partner? Here we are...

When a team of experts gets together, it delivers engineered solutions, state-of-the-art product development, a high level day-to-day technical service and customer specific product solutions. Our company was founded in 2020 by people who have been in the chemical industry for nearly 3 decades. Though young, our company can provide service innovation and develop products that can meet your most demanding requirements.

Expertise

At the top with our know-how in the sector...

We can follow your projects from the drawing table to the first operation. We can indeed develop individual concepts for the optimum use of specialty additives, ensure the smooth realization in your business operations and help you compete in a tough and aggressive competitive environment.

Ambition

We intend to be the leader in what we do...

We manufacture a wide range of specialty additives specifically developed for applications in coatings, printing inks, plastics (Thermosetting and thermoplastic resins), polyurethane foams, paper and adhesives. We also produce a number of high value chemicals for special applications.

We like "green" and we do what we can to deliver "green" solutions.

Partnership

We are dynamic and reliable; and we aspire to a long-standing partnership...

We are a dynamic and reliable company that aims to deliver high quality products and engineered solutions. Lasting business partnerships with our valued customers through service innovation and proactive thinking matter a lot to us. We work as partners with our customers to "Engineered Solutions" that meet their most demanding requirements.

We are a privately owned company located in the Industrial zone of Kilis, in the south of Turkey.

Our office and production site are located in Kilis area, near Gaziantep international airport.



We position ourselves as being an innovative company with R&D, Technical Service and Application laboratories to be the departments which hold the key to the continuing success of our young company.



Our mission and objectives:

We want to be your partner in specialty additives by strengthening your market position through innovation, technology and service.

We intend to achieve this by creating a partnership with:

- Our Customers by cooperating in finding solutions and sharing technical experiences
- Our Suppliers by asking them to help us optimize our service and product quality
- Our Employees by offering them a healthy working environment and opportunities for development and growth
- Local and International Institutions with a view to expanding our range of green chemicals and less or/and non-polluting products.

Specialty additives are indispensable ingredients of each and every formulation. They are used in tiny amounts to help modify the performance spectrum of coatings, Inks and plastics systems.

Manufacturing processes are also optimized by the addition of specialty additives.

The coatings, inks and plastics industries are among the main consumers of specialty additives.

Yet with exploration technology oil/gas, the manufacture of care products, the production of adhesives and sealants, and construction chemistry, too, specialty additives improve the product characteristics and production processes.

We offer a broad range of specialty additives for the formulation of coatings, inks and plastics.

Our portfolio includes low/no VOC technologies for solvent-based, solvent-free, water-based, high solids and energy curable systems in both existing and emerging markets:

- Architectural-decorative Paints
- Automotive and Transportation Coatings
- Wood and Furniture Coatings
- Coil Coatings
- Floor Coatings
- General Industrial Coatings
- Printing Inks
- Adhesives and Sealants
- PVC Compounds and Plastics
- Polyurethane Foams
- Marine and Protective Coatings
- SMC and BMC (Thermosets)
- Construction Chemicals

Specialty additives enhance performance by reducing foam formation, improving flow and levelling, increasing slip and scratch resistance, improving pigment dispersibility and modifying rheological properties.

KAM-FCA[®], KAM-SCA[®], KAM-DCA[®] and KAM-RCA[®] Additive families serve, respectively, the following applications:

- Foam Control Additives
- Surface Control Additives
- Dispersion Control Additives
- Rheology Control Additives

A foam control additive is used to reduce or eliminate foam in a coating or coating constituent. The terms 'defoamer' and 'antifoaming' agent are often used interchangeably. In fact, they are not quite the same.

A defoamer is a surface-active agent that stops the foam and breaks the bubble once it has been formed. It is a bubble breaker.

An antifoaming agent prevents the formation of foam so it never forms.

The term "foam control additive" is a more appropriate term to use.

There is a difference between macrofoam and microfoam. Macrofoam is located mostly on the coating surface and is surrounded by a duplex film with two liquid/air interfaces (double layer), whereas microfoam occurs inside of a coating film (air entrapment) and is characterized by a single liquid/air interface. These two types of foam also differentiate defoamers from deaerators.

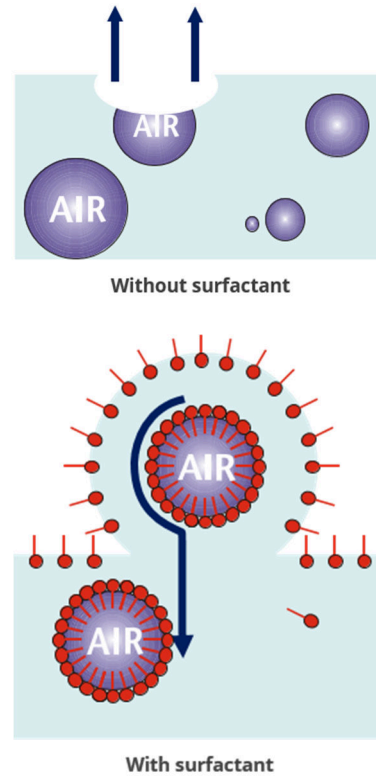
Defoamers are mostly effective against macrofoam, whereas deaerators suppress microfoam.

Both kinds of foam impair the surface optics of the coating and cause surface irregularities, as well as reduce gloss and transparency. Microfoam also adversely affects the coating's protective properties because the effective film thickness is reduced and pinholes can form from the micro bubbles.

The function of defoamers is based on disturbance of the double layer of the macrofoam lamella. Substances with very low surface tension are used as they are not wetted by the foam bubble.

Foam-stabilizing substances move away from the defoamer droplet, which finally causes collapse of the bubble. Surfactants are often used with defoamers to improve the spreading of the

defoamer droplet on the bubble surface.



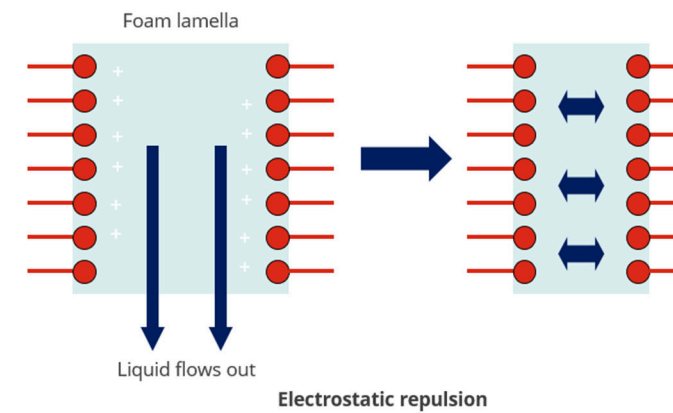
In surfactant-free solutions, these bubbles will move up to the surface because of their lower density. At the surface, formation of a so-called lamella takes place, the gas bubble still containing a layer of liquid on the outside. The liquid in the lamella flows down and then out. The size of the lamella gets smaller while the thickness of the liquid layer around the gas bubble is reduced. Ordinarily, the lamella will burst at a thickness of approximately 10 nm. This process is called drainage effect and in pure water, will occur instantaneously.

In the case of a system containing a surfactant characterized by the presence of hydrophobic and hydrophilic molecular subgroups, air in bubbles are stabilized by a double layer of surfactants.

Foam builds up due to the fact that the hydrophobic subgroups orient themselves towards the air whereas hydrophilic groups are directed towards the liquid phase thereby reducing surface tension.

Foam is stabilized by different mechanisms via action of surfactants:

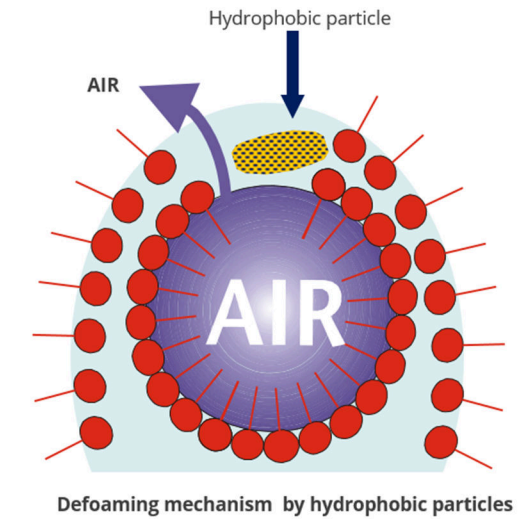
- The formed lamella is much thinner compared to that in pure liquids. The liquid cannot flow out and drain as quickly.
- The presence of ionic surfactant molecules at the surface creates electrostatic repulsion.
- The foam lamella exhibits a higher elasticity due to a stretching effect caused by the presence of surfactant molecules.



Defoaming mechanism:

- Finely dispersed foam control additive droplets penetrate into the foam lamella and spread itself out into the shape of a duplex film. This leads to an increase of surface tension causing the lamella to break.
- The "droplet" penetrates the lamella and forms a mixed monomolecular film there, leading to a lower cohesion compared to the previously existing one and causes lamella to break.
- In case of foam control additives containing hydrophobic particles like silicas: Hydrophobic particles reach the surface of lamella and on the top of the lamella they adsorb surfactant molecules. The lamella is deprived of the surfactants and breaks.

Excellent foam control additives are characterized by high incompatibility, high spreading activity, low surface tension and for further enhancement, the content of hydrophobic particles.



According to the described defoaming mechanism, a typical foam control additive consists of carrier fluids (A), surfactants (B) and active substances (C).

(A) act to transfer the generally hydrophobic active substance uniformly into the hydrophilic medium. Typical carrier fluids include aliphatic and aromatic mineral oils, solvent blends, water, etc.

(B) bring the active substance to the air interface and into contact with the stabilized foam structure. These substances (Fatty acid esters, amides, polyalkylated glycols, etc.) work by having a general incompatibility with the formulation and disrupt the spreading mechanism for stabilizing foam.

(C) adsorb surfactant ingredients present in the formulation and destabilize foam. Hydrophobic particles like metal soaps, waxes, hydrophobic fumed silica are adsorption compounds for foam destruction.

A foam control additive with a high degree of incompatibility and therefore, high defoaming activity should be introduced into the system under sufficiently high shear to render good mixing. Otherwise, side effects like cratering or haze may appear in the dried films.

A more compatible grade can be added at the let-down process or as a post-addition.

Trade name	Description/Composition	Dosage %	Solids %	Features & benefits	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 melamine	Chlorinated rubber	Solvent-based epoxy	Solvent-free epoxy	Nitrocellulose	Unsaturated polyester	Silicon resin	Vinyl copolymer	Acrylic emulsion	Acrylic water-reducible	Alkyd emulsion	Alkyd melamine	Alkyd water-reducible	Epoxy	Polyester melamine	Polyurethane emulsion	2K polyurethane	UV Curable	Packaging inks (Gravure/Flexo/Screen)	Water-based inks	Ambient Curing Systems	SMC/BMC	PVC (Plastisols/Compounds)	Thermoplastics	PUR Foams	Water-based	Solvent-based	Solvent-free & Reactive					
					Solvent-based Coating										Water-based Coating										Ink	Composite			A & S*																
KAM-FCA 20	Solution of defoaming substances, silicone-free	0.1-0.7 upon total formulation	-	No negative influence on inter-coat adhesion/Universal for pigmented systems	●	●	●	●	●	●					●		●	●												●	●	●									●				
KAM-FCA 22	Solution of defoaming substances, containing silicone	0.2-1.0 upon total formulation	-	Polyurethane curtain coatings and stoving enamels		●	●			●	●	●	●		●	●																													
KAM-FCA 26	Solution of defoaming substances, containing silicone	0.1-1.0 upon total formulation	-	Printing inks based on acetate-reduced nitrocellulose. PVB and PU inks				●									●													●															
KAM-FCA 40	Solution of defoaming substances, containing silicone	0.1-0.7 upon total formulation	-	Industrial coatings including airless spary applications/highest compatibility	●	●	●	●	●			●	●	●	●	●	●	●	●	●	●									●															
KAM-FCA 521	Foam-destroying polysiloxanes emulsified in water	0.05-1.0 upon total formulation	-	High-gloss and satin-gloss systems. Suitable for resin-free grinds																			●	●	●	●	●	●	●	●		●										●			
KAM-FCA 550	Modified polydimethyl siloxane	0.1-0.5 upon total formulation	-	Grinding stage for pigment concentrates/Long-term stability																				●	●				●													●			
KAM-FCA 561	Foam-destroying polysiloxanes emulsified in water	0.05-1.0 upon total formulation	-	Defoams particularly high-gloss and satin-gloss systems, even in airless application.																		●	●	●	●	●	●	●	●	●	●		●									●			
KAM-FCA 564	Polysiloxanes and hydrophobic solids in polyglycol	0.1-1.0 upon total formulation	-	All purpose/Suitable in PVC range of 0 to 25. Suitable for resin-free grinds																			●	●	●	●	●	●	●	●		●										●			
KAM-FCA 568	Polysiloxanes and hydrophobic solids in polyglycol	0.1-1.0 upon total formulation	-	High-gloss systems/Suitable in PVC range of 0 to 25																			●	●	●	●	●	●	●	●		●										●			
KAM-FCA 593	Fine dispersion of foam-destroying hydrophobic solids in mineral oil	0.2-0.5 upon total formulation	-	Prevents air entrainment during manufacture and application of water-based paints and adhesives																			●	●	●	●	●	●	●	●		●										●			
KAM-FCA 720	Solution of defoaming substances, silicone-free	0.1-1.0 upon total formulation	-	Unstaturated polyesters/epoxy and polyurethane coatings											●	●		●												●	●		●	●	●	●	●				●	●			
KAM-FCA 722	Solution of defoaming substances, containing silicone	0.3-1.5 upon total formulation	-	Solvent-free epoxy and polyurethane systems											●																		●	●	●							●	●		

* Adhesives and Sealants

● Suitable/Recommended

● Potentially suitable

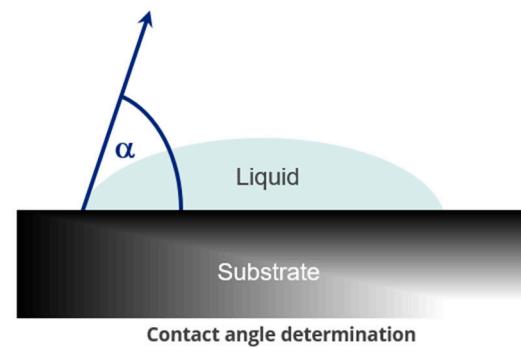
Superior surface properties can not be achieved without the addition of surface control additives that alter the surface properties of the coating, ink and plastic films. Depending on the kind of additive used, the following properties can be improved:

- **Slip** (commonly named lubricity) represents the ability of two surfaces to glide over each other without causing any mechanical damage. Good slip properties require that the slip additive concentrate to the surface during and immediately after application and curing.
- **Abrasion** is a phenomenon caused by the mechanical action of rubbing, scraping or erosion. Since it is intimately related to scratch and slip, it is not surprising that many slip additives also function as mar and abrasion resistance additives.
- **Mar, scratch and metal marking** are the damages on the surface of a coating from surface abrasion, typically sliding objects, fingernails, etc.
- Anti-blocking** defines a non-stick condition between two surfaces or the resistance to adhesion between two surfaces under the influence of temperature, relative humidity or even pressure.
- **Levelling** is the ability of a liquid to go from irregular liquid film to a level film (during curing/drying).



Wetting, by itself, generally means the spreading of one substance, usually a liquid, over a substrate, such as a solid. Wetting is normally a surface tension-driven spreading that happens when a liquid or gas of lower surface tension is in contact with a surface, such as a liquid or solid, of higher surface tension.

When spreading occurs, the angle between spreading layer and the non-wetted substrate is zero. This is called contact angle (α).



Surface control additives are silicones, polyacrylates or perfluoro surfactants.

Polysiloxanes (Siloxanes) have a very high surface activity and therefore are often used as surface control additives. They are generally 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.

Polyacrylates (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. In addition to their positive impact on flow and leveling, polyacrylates are effective as air-release agents.

Perfluoro surfactants (Perfluoroalkyls) 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 to gain optimum

results. Controlling the parameters of molecular weight, polarity, degree of fluorine modification, and additive concentration in the formulation must be evaluated carefully.

Surface defects that can be overcome by using surface control additives:

Crawling and De-wetting

Tendency of a wet paint film to recede from certain areas of a painted surface leaving them apparently uncoated. It is caused by an incompatible film on the surface or a substrate with too low surface tension (e.g. plastic).

Cratering

Formation of small bowl-shaped depressions in a coating film.

Fish Eyes

Crater-like holes.

Orange Peel

A surface bumpiness or waviness that resembles the skin of an orange.

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.

Pinholes

Channels resulting from slow rising air bubbles that cannot flow together and form pinholes.

Bénard cells and Silking

Polygonal (hexagonal) cell patterns, micro-separation of pigments in the film due to surface tension gradients.

Air draft sensitivity

Loss of wetting in local regions of higher surface tension caused by irregular evaporation of solvent due to air flow (ventilation or forced drying).

Roller and Brush marks

Strikes left after application of the paint by a brush or roller.

Blistering

Bubbles resulting from localized loss of adhesion, and lifting of the paint film from the underlying surface.

Respective properties and characteristics of surface control additives are described in detail in below tables:

	Perfluoroalkyls	Siloxanes	Polyacrylates
Low	→	Surface tension	→ High
Low	→	Addition level	→ High
High	←	Price level	← Low
Many	←	Side effects	← Few

Chemistry	Type of Modification	Surface tension	Foaming/defoaming	Levelling	Substrate wetting	Inter-coat adhesion	Anti-cratering	Slip
		0=No reduction-5=Strong reduction	F=Foaming/D=Defoaming	0=No levelling-5=Strong levelling	0=No sub. wetting-5=Strong sub. wetting	0=No affected-5=Strongly affected	0=No anti-cratering-5=Strong anti-cratering	0=No slip-5=Strong slip
Polysiloxanes	Pure polydimethylsiloxane	4	D	4	2	5	5	5
	Polyether-modified	4	F	4	4	2	5	3
	Alkyl-modified	3	D	4	4	5	4	4
Polyacrylates	Unmodified	2	D	4	1	0	1	0
	Perfluoro-modified	4	D	4	4	0	3	0
Perfluoro surfactants		5	F	0	4	0	5	0

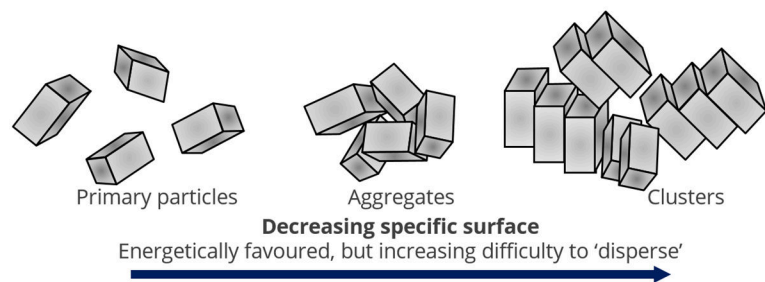
Protective and decorative properties are important performance issues of coating, ink and composite systems. Many are produced as solid colors with excellent hiding power to fulfill esthetic requirements. With increasing complexity and a large number of solid ingredients introduced in the liquid formulation, there is a corresponding increase in the problems to overcome.

The addition of dispersion control additives can provide solutions to many of these problems.

The dispersing of solid pigments and fillers into the liquid phase of binder solutions is an important step in production influencing optical properties such as gloss, color strength, and hiding power.

Dispersion control additives are used to improve and accelerate the dispersion process and to stabilize the dispersion during storage.

In the production of pigments, finely dispersed primary particles are formed. During the purification and drying process, primary particles come together and form pigment clusters or agglomerates. These clusters are in their lowest thermodynamic state, that is, the most stable physical state for the pigment.



During the grinding process, these clusters can be broken down to the level of primary particles. The grinding process in the liquid phase consists of three processes:

- Breaking up the pigment clusters (Normally accomplished by mechanical energy-Grinding)
- Wetting of the pigment surface (Involving the displacement of air and other adsorbents on

particles in the pigment cluster-Wetting)

■ Stabilization of the homogeneous distribution (Dispersing)

Once dispersed, primary particles have a tendency to re-agglomerate. This process is called 'flocculation'. The grinding process can be regarded as a de-flocculation process .

Flocculation is the association of pigment particles, which have been dispersed in a liquid medium, and is the result of forces of attraction (e.g. van der Waals) between the particles. Flocculation reduces the size of the phase boundary between pigment and dispersion medium leading to reduced color strength and brightness in the finished film.

The task for the formulator is to stabilize the de-flocculated state of the pigment in the formulation.

Two main stabilization mechanisms can be distinguished:

Electrostatic stabilization

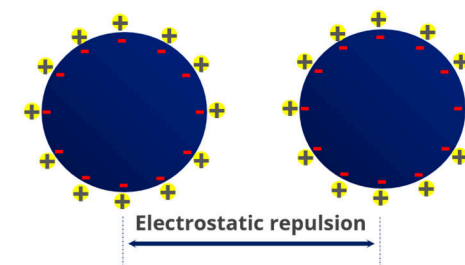
Electrostatic stabilization takes place when particles bear the same electrical surface charges and as a result, repulsion occurs. The charge around the particle is arranged into a double layer in which each layer possesses an equal charge.

When two particles approach one another, their charged double layers overlap and repulsion takes place.

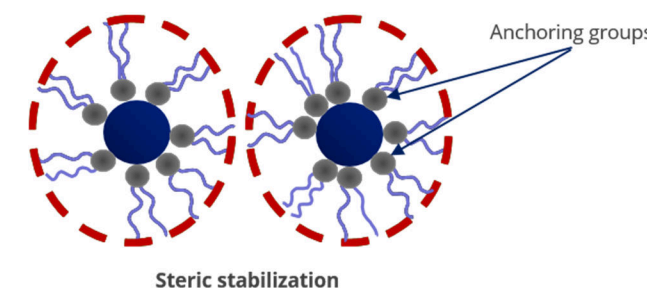
Steric stabilization

Steric stabilization is brought about by adsorbed polymers. Polymers must strongly adsorb on the pigment surface by appropriate functional groups (Anchoring groups) and must have sufficiently long chain segments (barrier groups) which readily dissolve in the dispersion medium (organic solvents or water), a process that leads to widening of polymer chains.

This stabilization is dependant upon the structure and dimensions of the adsorbed polymer layer.



The polymer can adsorb onto the particle through so-called 'anchoring groups', which have strong affinity toward the particle surface. The remainder of the polymer can be seen as dissolved and can extend into the resin medium. These extended parts of the stabilizing polymer are the first point of contact between two approaching particles.



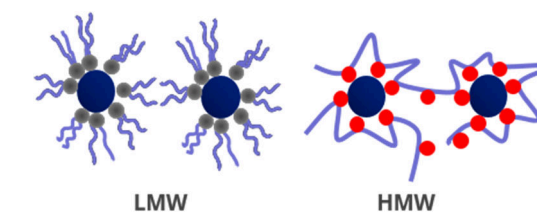
We offer two types of dispersion control additives:

Low molecular weight (LMW)

- 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
- They reduce liquid surface tension & interfacial tension solid/liquid
- Good for wetting and reduction of dispersing time
- They have generally good compatibility to all kinds of resin systems
- They reduce flooding and floating tendencies and exhibit anti-settling properties

High molecular weight (HMW)

- 5,000 g/mol < Molecular weight < 35,000 g/mol
- They are built of branched or long linear molecules, which in general have a PU, polyacrylate, polyester or block copolymer 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
- 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 (Multi-adsorption) on the surface via the anchoring groups assuring an efficient steric hindrance between the solid particles by keeping them apart.



To achieve the best de-flocculation/stability effect of pigment dispersions, one must consider the compatibility of the dispersion control additive with the vehicle, quantity of the dispersion control additive in relation to pigment and 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 let-down vehicle in the ratio 90:10. This test, however, is not indicative of the effectiveness of the dispersion control additive. It can only predict possible deficiencies in de-flocculation performances (loss of gloss) and, in the case of mixed pigments, the risk for floatation.

Rheology control additives effect changes in viscosity over a specific range of shear rate, and this leads to non-Newtonian flow.

In contrast, thickeners effect an increase in viscosity over the whole range of shear rate by increasing only the viscosity of the liquid phase (liquid phase thickeners).

Figure (A) shows Newtonian flow in which the viscosity does not depend on the shear rate (viscosity is constant).

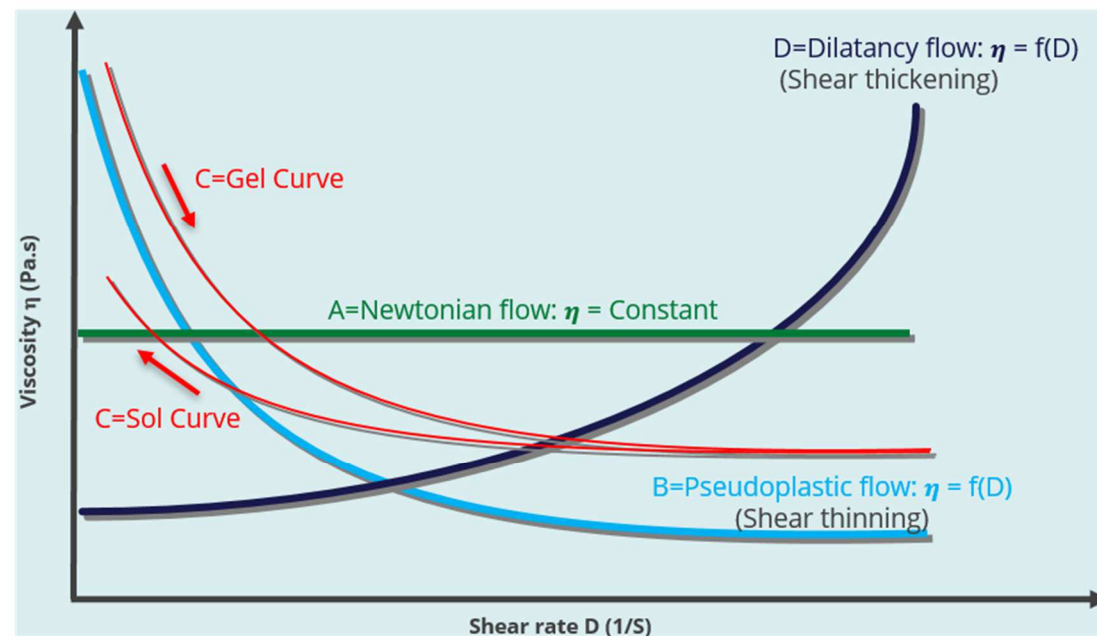
As an example of non-Newtonian Flow , Figure (B)

is the degree of thixotropy.

Unlike shear thinning, which is time-independent, thixotropy is time-dependent.

Rheology modifiers can become active at different shear rates encountered during manufacture or application of the paint.

At rest, many rheological additives build up a 3-D network (gel) in paints (clear or pigmented solvent- or water-based systems). During shearing (e.g. stirring), this network is broken temporarily (sol) but



Viscosity curves and thixotropic flow

shows shear thinning (pseudoplasticity), in which the viscosity decreases with increase in shear rate.

Another example of non-Newtonian flow that is important in coatings technology is thixotropy like in Figure C, in which, again, the viscosity decreases with increase in shear rate (gel curve) and increases with decrease in shear rate (sol curve), but not to the same extent as in the case of the gel curve.

If the system is allowed to stand for some time, it returns to its initial viscosity. The greater the difference between the sol and gel curves, the greater

re-forms fairly rapidly at rest (reversible sol-gel transition).

In order to influence the rheology of liquid systems, use is made predominantly in the industry of silicas, organically modified bentonites, hydrogenated castor oil, polyamide waxes, etc.

A disadvantage of these substances is that they are usually dry solids which have to be incorporated into the liquid system in a form in which they are compounded by means of solvents, with shearing forces, to form a semi-finished

product or by means of careful temperature control.

The other drawback is that they lead to haziness and turbidity in clear and unpigmented systems.

KAM Kimya offers rheology control additives based on urea.

On being admixed to liquid systems, these additives precipitate in the form of very tiny needle-shaped crystals, generating a 3-D rheologically active network structure. The resulting thixotropic flow behavior is highly suited for preventing sedimentation and increasing the anti-sagging properties without impairing leveling.

The other advantage of these types of rheology modifiers is that they can be incorporated into liquid systems without undergoing a chemical reaction. However, intensive stirring is required, as otherwise specks can form.

KAM-RCA 410 & KAM-RCA 410A

KAM-RCA 410 and KAM-RCA 410A are liquid rheology control additives for medium-polarity solvent-based and solvent-free coating systems as well as PVC-based plastisols and ambient-curing resin systems.

KAM-RCA 410 contains N-Methylpyrrolidon (NMP) as a carrier and KAM-RCA 410A is the NPM-free version of KAM-RCA 410.

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The technical information and specifications contained in this brochure are based on careful investigations and given to the best of our knowledge. Nevertheless, circumstances under which the product is used in practice are subject to many variations.