



DEFOAMER PRODUCT GUIDE

Defoaming

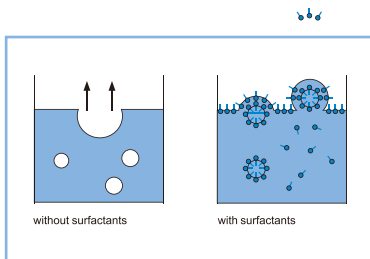
Defoaming

During the production and application of paint systems, foam is an undesired side-effect of mixing, usually slowing production and making it difficult to fill vessels with the correct amount of paint, in addition to causing surface defects such as craters and weak points in the dried film.

What is Foam?

Foam can be described as a stable dispersion of gas bubbles in a liquid medium.

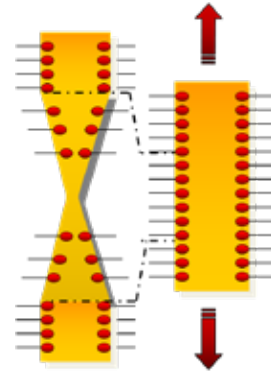
In pure liquids, foam is not stable. Foam is only stable in systems containing surfactants - like substances such as wetting agents, or certain surface control additives needed to improve important properties of the paint; surface active materials tend to migrate to the air/liquid interface of the paint, thereby reducing the surface tension.



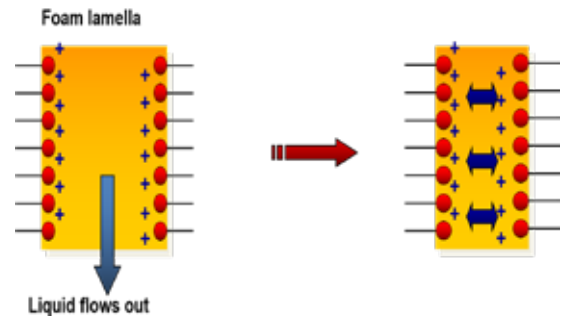
Foam originates at various stages of production, such as pumping, stirring, dispersing, and also the application of a liquid paint, through the entrapment of air bubbles. The air-liquid interface of these bubbles is surrounded by the surface-active materials in the paint. Due to the bubbles' low density, they rise to the surface in low-viscosity paints. As the bubbles rise, smaller bubbles can combine to form larger bubbles which rise faster. At the surface, the bubbles accumulate and deform both the surface of the paint and themselves. The air cannot escape because a lamella is formed which is stabilized by the presence of surfactants. Without surfactants, drainage of the liquid would cause thinning of the lamella until breakage occurred.

However, the presence of surfactants prevent lamella thinning by

- counterflow of liquid due to a surface tension difference, as result of interface stretching, called the Marangoni effect.



- repulsion by the surfactants at the interfaces, through steric and electrostatic mechanisms. These stabilizing effects result in elasticity of the lamella, preventing them from reaching a critical thickness of ca. 10 nm, which is the criterion for lamella breakage.



Mode of action

To eliminate the foam defoamers and air release agents do need to fulfil certain conditions:

- **Low surface tension** so that it can be concentrate on the boundary layer fluid/air or gas and then penetrate in the foam, weaken and burst the foam and can also be uniformly dispersed through in the formulation
- **Capacity to spread** over the foam bubbles when the paint system is spayed on the substrate. In this way the defoamer will cover the whole applied surface

- **Insoluble in the medium** for a long time. This will ensure the long term stability of the defoamer

But the selection of the defoamer remains to be critical. when for your systems a defoamer will be selected what is too incompatible it will cause other defects to your systems what is unwanted. These defects can be eg. like craters, causing turbidity or loss of gloss, orange peel and many others. Due to many variety of resins and coatings systems one defoamer can't be optimal for all formulations and need to be optimized and selected per systems.

In for defoamers we can make a difference between macro-foam and micro-foam. Macro-foam is foam what appears at the surface of your system. Micro-foam is entrated foam into your system what can't rise fast enough to the surface to be destroyed. for both different defoamers are required. When having micro-foam there is a high need for air-release agents who can coagelate micro bubble to bigger bubbles so the rise faster to the surface. This is decribed by the Stokes law:

$$V \sim \frac{r^2}{\eta}$$

It describes the speed of the air bubble is related to the diameter of your air bubble divided by the viscosity of your system. In simple words: the bigger the air bubble the faster it will rise to the surface.

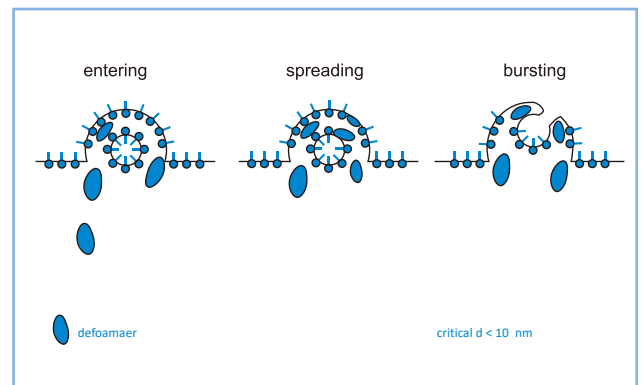
Micro-foam defoaming properties can be enhanced by selecting defoamers who may conatin hydrophobic particles or polyurea.

How do Defoamers work?

To eliminate foam, these stabilizing effects must be avoided using defoamer(s), which should have one or more of the following properties:

- foam destruction to eliminate existing foam
- foam prevention to avoid formation of foam
- air release to assist an air bubble's to rise to the surface

Defoamers act mainly in the stabilized lamella. Therefore it must be insoluble in the paint system, mobile so that it can enter in the lamella and spread at the interface to dis- place the surfactants. The defoamer must have a lower surface tension than the surfactant, leading to an opposite Marangoni effect, i.e. fast thinning and collapse of the lamella.



Choosing a Defoamer

Possible chemical entities for defoamers are molecules with a low surface tension such as silicone and mineral oils, fatty acid and fluorocarbons. To increase the defoaming efficiency, solid particles with a low surface tension can be included, such as hydrophobic silica and metallic soaps. These materials can be incorporated in carriers such as water or organic solvents to promote addition and enable faster distribution of the active substance in the liquid paint. 100% active defoamers are suitable for systems subjected to shear stresses such as grinding, ensuring their distribution and activity as a defoamer.

Different defoamers for different systems:



For solvent-based and solvent-free systems

polysiloxanes, polyacrylates and polyolefins are effective, because these types of systems already have a low surface tension. Pure polydimethylsiloxanes can also be used but are critical in terms of their compatibility due to side-effects such as cratering. The best balance between compatibility and incompatibility is achieved through organically-modified polysiloxanes. Modification with fluorine gives even lower surface tensions.

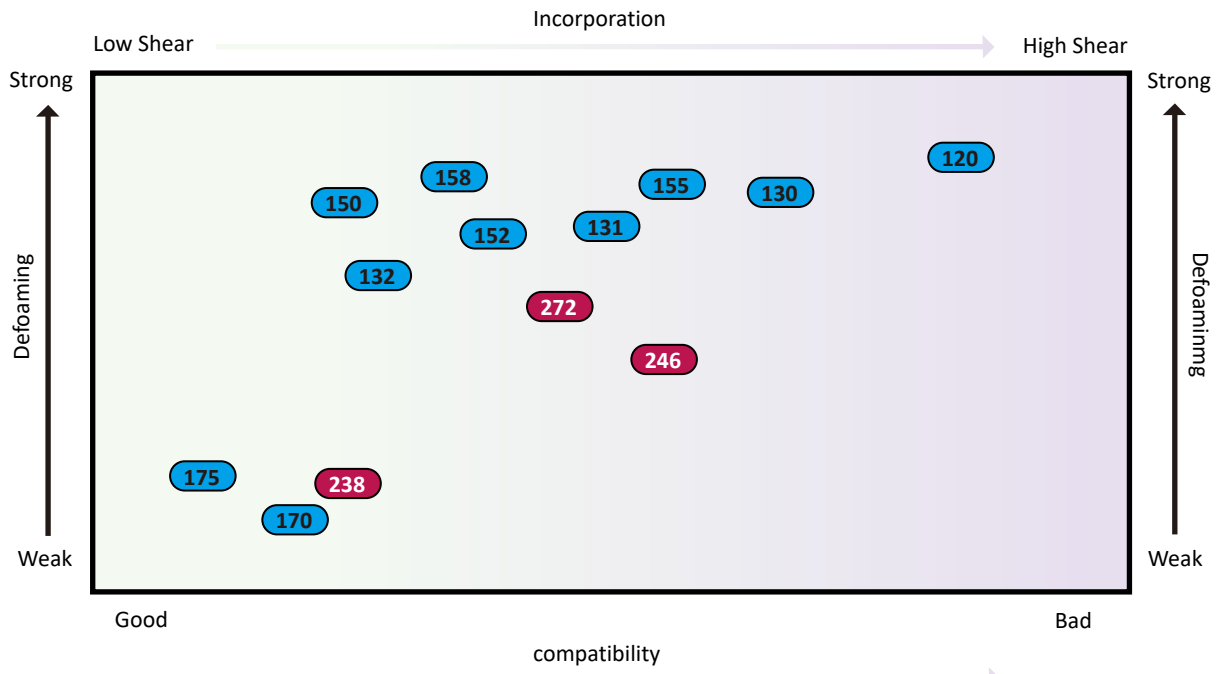
For water-based systems

a wider range of chemical structures can be used due to the generally higher surface tension of these systems; here mineral oil types and silicones are highly effective.

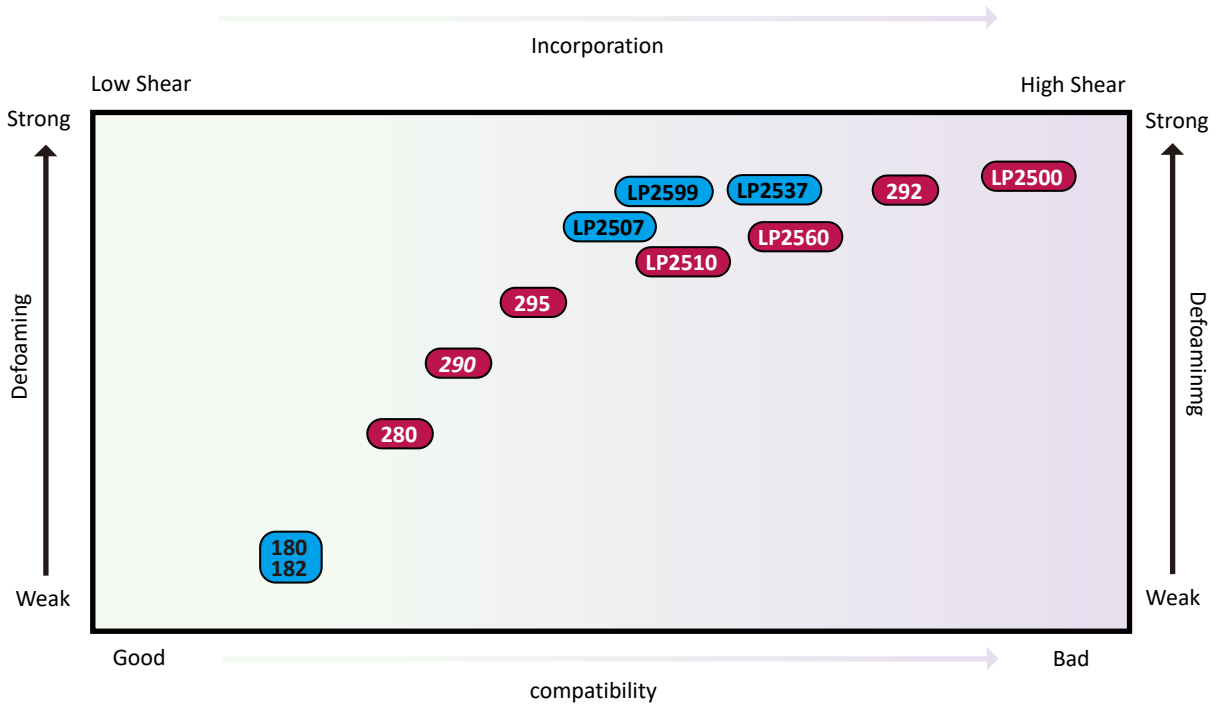
An important point to consider is the incorporation of the defoamer in the paint system. The defoamer is not soluble in the system, so a good distribution of the active sub-stance is necessary. This should be controlled by the mixing speed and time, otherwise craters can be formed and/or loss of defoaming efficiency is observed.

 Silicone free
  Silicone

Solvent Based



Water Based





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