

Fluorosurfactants

Highly Effective Wetting Additives

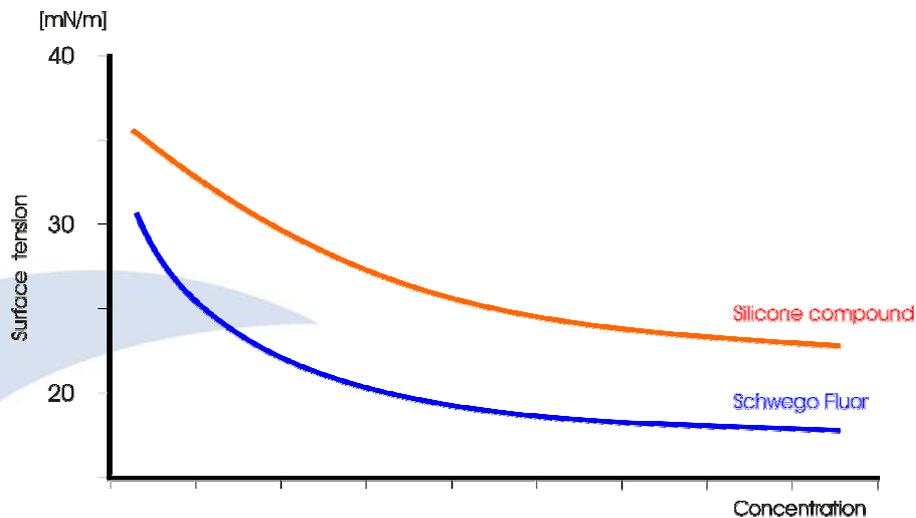
In paint systems fluorinated compounds are used for a wide variety of applications. They enhance important properties as wetting, especially substrate wetting, and flow.

In addition to silicone-containing additives fluorsurfactants are used in the coatings industry as wetting additives. With the aid of fluorsurfactants significantly lower surface tensions than that resulting from silicon additives can be achieved.

For a liquid to be able to spread and wet the surface of a solid, the surface tension of the liquid must be lower than that of the solid.

The following table shows a comparison of surface tension of several substrates, measured in mN/m:

Glass:	73
Steel:	43 - 46
PVC:	39 - 42
Polystyrene:	36 - 42
Polyethylene:	32 - 39
Polypropylene:	28
PTFE:	19



As the graph shows fluorsurfactants help to reduce surface tension below 20 mN/m so that surfaces of very low surface tensions can be wetted. Certain substrates can only be wetted with the aid of fluorsurfactants. If especially high standards with regard to wetting and adhesion are required fluorsurfactants will be indispensable.

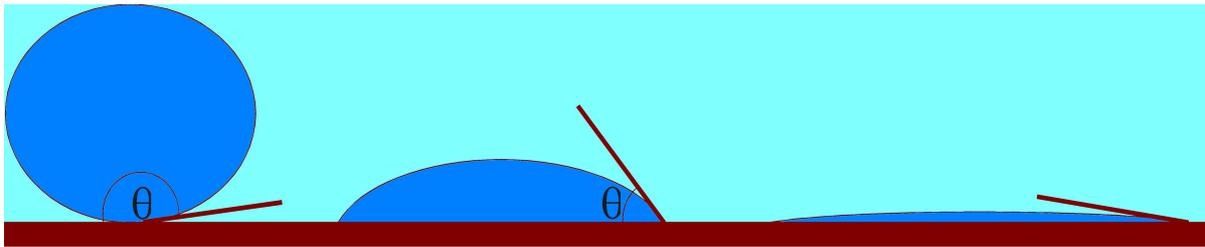
The required quantities are significantly lower than those of silicone additives. As evident in the chart above needful reductions of surface tension can be achieved with dosages as low as 0.01 %. The addition amounts are smaller than the amounts to be used of silicone additives. The optimal dosage mainly depends on the kind of system.

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Furthermore, it is an advantage that fluoro compounds - in opposite to those based on silicones - do not cause surface defects. In practice pinholes, craters etc. appear only if the dosage used is too high. Because of the very good interfacial activity the amounts of incorporation are so small that there is no measurable influence on the other properties of the systems. However the addition amounts of silicones may be high enough to create surface defects. Silicone compounds can negatively influence the recoatability of a system. Fluorosurfactants are additives that can be used universally and without problems - they show their effectiveness in virtually all usual systems.

Some customers criticise the tendency of this kind of additives to foam. It is right that fluorosurfactants in general do not help avoid foam - they stabilise foam. This means that in most cases they do not create foam but they stabilise the present foam. If in a specific formulation foam occurs, the principle "much helps much" is applied and so the dosage of the additive is higher than recommended by the producer, just to be on the safe side. The cause of the problem can be one drop too much, as the substance is highly effective with regard to interfacial activity.

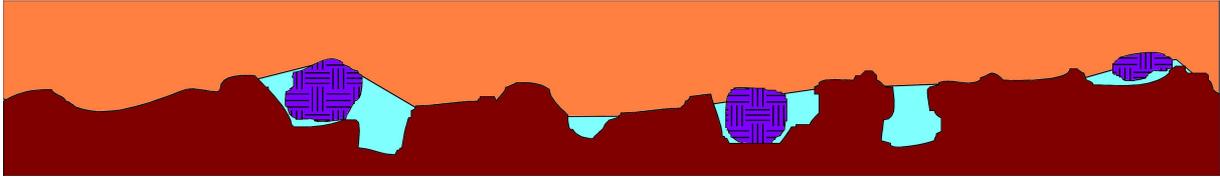
Therefore, it is absolutely essential, to find out the smallest amount of addition that just allows the desired effect to occur. Predilution is advised, because homogeneous distribution is necessary. In fact, it can be shown that a product of a small active content (a thinned product) can be more effective than one having a higher active content. The reason is that a product with a small active content can be better and more homogeneously distributed in practice and local over-dosage can be avoided. Fluorosurfactants cause an improved adhesion on the surface because of the reduction of the surface tension. The smaller the contact angle of a liquid on a solid surface the better is the wetting.



[Fig. 1] – Contact angle θ

The resulting adhesion improvement is of pure physical nature - there is no chemical reaction with the surface. On the molecular level the contact between coating and surface is optimised. The higher the contact space the better is the adhesion. By the optimal surface wetting that fills all hollow spaces in the surface and by the so-called micro-chemical connection a better adhesion of the coating on the surface is achieved (see arrow in the figure below).

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[Fig. 2] - Wetting without fluorosurfactant



[Fig. 3] - Wetting with fluorosurfactant

SCHWEGO® fluor 6536, SCHWEGO® fluor 6543 and SCHWEGO® fluor EL 2422 are universally non-ionic surfactants which provide excellent wetting in nearly all systems. They are also used as co-dispersants and belong to the [chemical](#) class of flour alkylalkoxylates.

All three products can be used for solvent borne and also for water-based systems. Typical application fields are:

- wetting of non-polar substrates
- wetting additive for pigment pastes
- removal of floating and flooding effects
- prevention of cratering
- avoiding of poorly coated edges

Because of the chemical resistance they are suitable for high temperature systems and also for very acid and alkaline systems.

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