



The miracles of science™

DuPont™ Zonyl®
Fluorosurfactants
for Electronics Applications



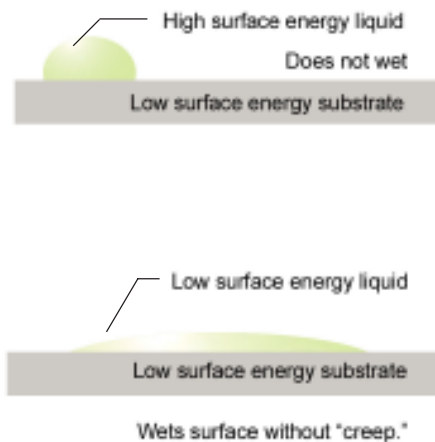
DuPont™ Zonyl® Fluorosurfactants are useful additives in electronics cleaners and polishes, and their low surface energy can give novel release properties.

Solder flux, cleaners, strippers and etch baths all function through creation of a thin film that thoroughly wets a substrate. To effectively wet a substrate the surface energy of the formulation must be lower than the surface energy of the substrate. Zonyl® fluorosurfactants are capable of creating solutions with surface energies as low as 18 dynes/cm (see chart below for wetting of typical surfaces).

Zonyl® offers unparalleled wetting and leveling power in both water- and solvent-borne formulations, and will remain effective in acidic and strongly basic formulations. Their effectiveness is achieved at extremely low concentrations. In cleaning applications, this facet of their function translates as the ability to clean difficult-to-wet surfaces, yet leave little residue. As a plating bath aid, Zonyl® can provide excellent wetting or water break characteristics.

Depending on the choice of surfactant, the presence of an adsorbed layer of fluorosurfactant can dramatically affect surfaces that have been treated with Zonyl® products, giving soil repellency benefits. This function is important in many formulations that provide protection for surfaces. (See Figure 1.)

Figure 1. Schematic for Wetting.

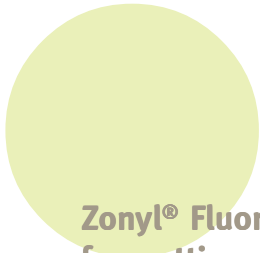


In most formulations Zonyl® is used in addition to conventional surfactants where it can lower the total cost of the surfactant addition and provide better performance as well. Typical formulations utilizing Zonyl® are able to reduce the loading of the conventional surfactant while creating an even lower surface tension of the formulated product.

Benefits of Zonyl® Fluorosurfactants

- Reduce surface tension
- Help wetting a variety of substrate materials
- Lower dragout in bath applications
- Provide water-break in rinsing applications
- Prevent surface defects
- Promote flow and leveling
- Avoid air entrainment in baking applications
- Help the film formation of polymer emulsions
- Maintain recoatability and water-resistance

Substrate	Typical Surface Energies, dyne/cm
Polyurethane	43
Alkyd	38
Polyethylene	31
Paraffin	26
Silicone	24
Teflon®	18



Zonyl® Fluorosurfactants for wetting

Fluorosurfactants are effective wetting agents in situations where conventional surfactants fail. These include strongly alkaline or acid media. In applications such as soldering flux, fluorinated surfactants function well as low-foaming wetting agents.

Zonyl® Fluorosurfactants for coatings

Fluorosurfactants impart self-leveling properties for even coating thickness. Fluorosurfactants also improve wetting and leveling in photoresist and conformal coatings.

Zonyl® Fluorosurfactants for foam

Amphoteric fluorinated surfactants, such as Zonyl® FS-500 are foaming agents in aqueous media. On the other hand, nonionics, such as Zonyl® FSH and Zonyl® FSO are low foaming surfactants.

Zonyl® Fluorosurfactants for water break

Fluorinated surfactants facilitate wetting of hard surfaces and aid cleaning of low-energy surfaces such as polyethylene. They also promote rapid runoff of rinse solutions.

Evaluation Guidelines

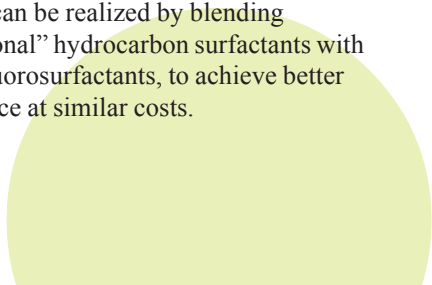
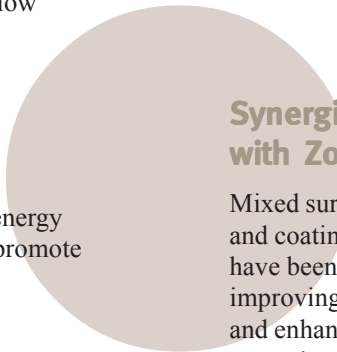
The best way to test Zonyl® fluorosurfactants is to screen several over a range of concentrations. For most electronics applications 0.01%, 0.05% and 0.1% solids on weight of the formulated system is recommended.

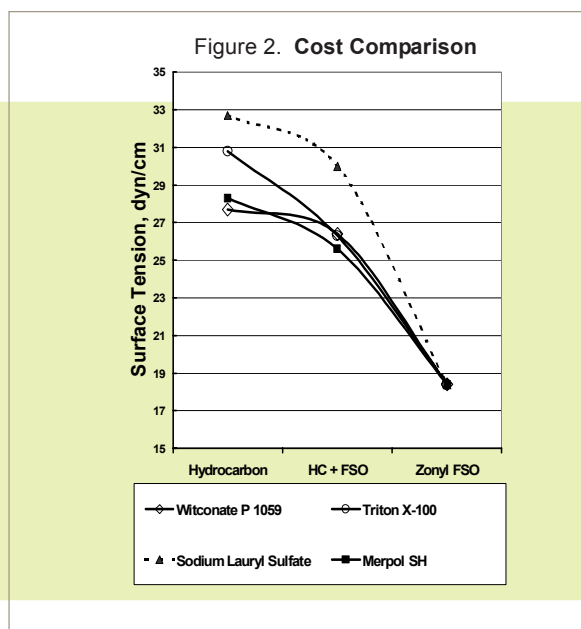
Fluorosurfactants Applications Guide

Application	Function	Zonyl®	
Soldering flux	Wetting	1033D	
	Low Foamer	FSH	
		1033D	
Zinc battery scale inhibitor	Wetting	FSO	
	Plating bath aid	Wetting	FSN
Water break		FSJ	
FSP			
Photoresist stripper	Wetting	FSN-100	
	Low Foamer	FSO-100	
		FSH	
Surface cleaning	Wetting	FSP	
		FSJ	
		FSH	
Post CMP	Water break	FSJ	
	Polishing slurry	FSP	
Metal etching chemicals	Wetting	FSN	
	Nitric acid	Wetting	1033D
	Sulfuric acid	Wetting	FS 500
	Hydrochloric acid	Wetting	FS 510
Electroplating	Low Foamer	FSA	
	Low Foamer	1033D	

Synergies in formulation with Zonyl® Fluorosurfactants

Mixed surfactant systems are useful in cleaning and coating formulations and impressive gains have been made in the areas of reducing foam, improving dynamic surface tension performance, and enhancing ‘fluorine efficiency’. In many cases, improved performance (cost and/or function) can be realized by blending “conventional” hydrocarbon surfactants with Zonyl® Fluorosurfactants, to achieve better performance at similar costs.





formulations using Zonyl® are able to reduce the loading of the conventional (silicone or hydrocarbon) surfactants, while creating an even lower surface tension in the formulated product. **Figure 2** shows that a mixture of a fluorinated surfactant with a hydrocarbon surfactant can give greater wetting power at equivalent cost (all cases are at 2¢ of surfactant per pound of formulated product). **Figure 2** below shows mixed Zonyl® and hydrocarbon surfactants achieve lower surface tension than the same cost level of hydrocarbon surfactant alone. For example, when using Triton X-100, a hydrocarbon surfactant, at an addition rate of 2¢ per formulated pound of product the surface tension is 31 dyn/cm. When 1¢ of the Triton was removed and 1¢ of Zonyl® FSO was substituted in the mixture, the surface tension was reduced to 26 dyn/cm. For the same formulated cost, a surface tension reduction of 4 dyn/cm was achieved using Zonyl® FSO in the mixture with the hydrocarbon surfactant!

Synergy and cost to formulation

In most formulations, Zonyl® fluorosurfactants are used in combination with conventional surfactants. This can lower the total cost of the surfactant package and provide better performance as well. Typical

Concentrates

The ability of Zonyl® to perform at very low concentration opens possibilities for the formulation of concentrates that can be diluted as much as 100:1. This can be a great asset in designing systems for electronics applications.

Personal Safety, First Aid and Storage and Handling: See the Material Safety Data Sheet (MSDS) for product-specific information.

Ordering Information - Product, Literature or Samples: To order a product sample or literature, call DuPont Chemical Solutions Enterprise Telecontact Center at **866-828-7009**. In Canada, call: **800-263-5924**. To order commercial quantities of any of these products, call the Customer Service Center at **800-441-9140**.

Technical Assistance: For assistance in evaluating these products in your application, please call the DuPont technical service experts: **866-828-7009**. You may also Email us directly at: zonyl@usa.dupont.com Most of our literature is available on the website: www.dupont.com/zonyl

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