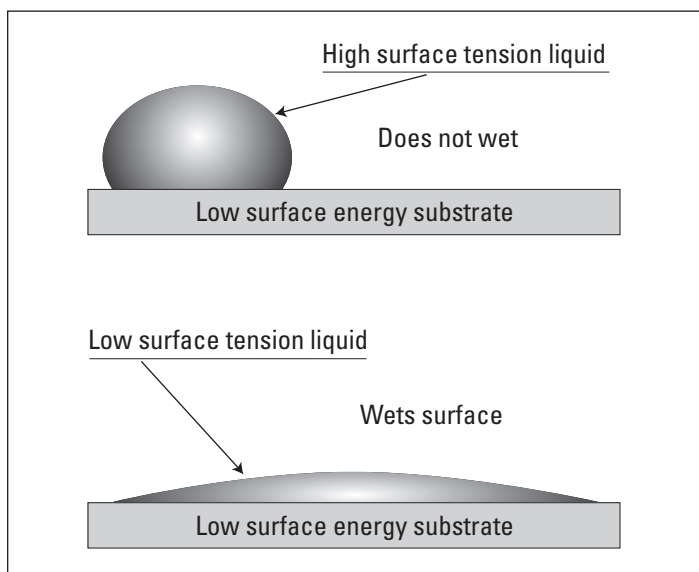


DuPont™ Zonyl®

FLUROSURFACTANTS FOR INDUSTRIAL AND INSTITUTIONAL APPLICATIONS

DuPont™ Zonyl® fluorosurfactants are cost-effective additives in cleaners, polishes/waxes, and coatings, which all function through the 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 polishes/waxes, protectants and cleaning solutions with surface energies as low as 18 dyn/cm (see **Figure 1** for example wetting of typical surfaces).

Figure 1. Schematic for Wetting



Substrate	Typical Surface Energies, dyn/cm
Polyurethane	43
Alkyd	38
Polyethylene	31
Paraffin	26
Silicone	24
Teflon®	19

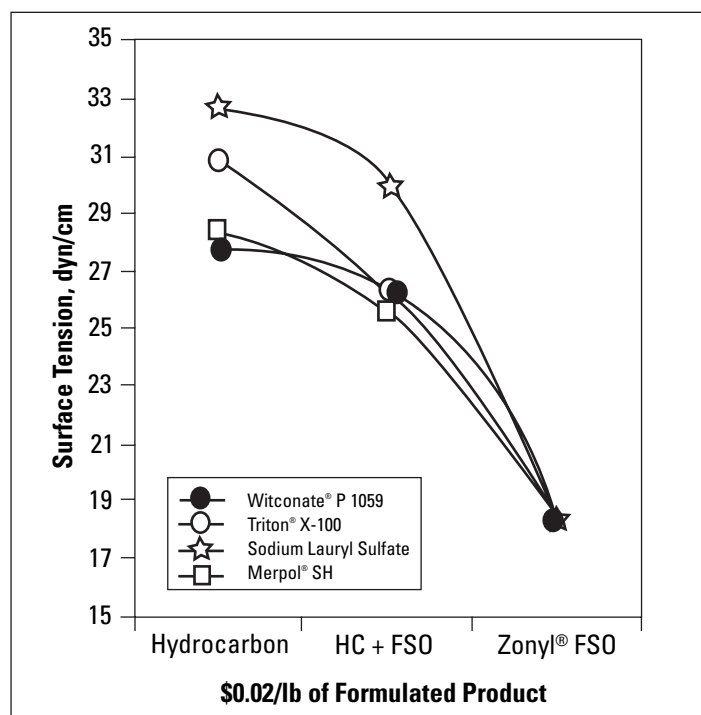
Zonyl® offers unparalleled wetting and leveling power in both water- and solvent-borne formulations, even at extremely low concentrations. In cleaning applications, this function translates as the ability to clean difficult-to-wet surfaces, yet leave little residue. In polishes and waxes, Zonyl® also gives excellent leveling and rewet characteristics, enhances gloss and enables multi-coat applications. Outstanding repellency and surface protection is delivered by Zonyl® products on porous surfaces such as stone and tile as well as carpets.

Cost Synergies in Formulating with Zonyl®

In most formulations, Zonyl® fluorosurfactants are used in combination with conventional surfactants to reduce the amount of surfactant used, lower the total cost of the formulation, and provide better performance. Typical formulations utilizing Zonyl® are able to reduce the loading of conventional surfactant while creating an even lower surface tension of the formulated product.

Mixed surfactant systems are possible in cleaning and coating formulations, and impressive gains have been made in the areas of reducing foam and improving dynamic surface tension

Figure 2. Cost vs. Performance Comparison



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reduction. In many cases, improved performance (cost and/or function) can be realized by blending 'conventional' hydrocarbon surfactants with Zonyl® fluorosurfactants. As shown in **Figure 2**, a mixture of fluorinated surfactant with a hydrocarbon surfactant can give greater wetting power at equivalent cost.

Concentrates

Zonyl® grades perform at very low concentrations, which allows for developing concentrates that can be diluted as much as 100:1. This is a great asset in designing cleaning systems for industrial and institutional applications where large volumes of formulations are often required.

Zonyl® Fluorosurfactants in Cleaners for Glass or other Hard Surfaces

The key to good performance on glass and hard surface applications is wetting power at low concentrations. Because low surface tension is realized with a small amount (e.g., 200 ppm) of fluorosurfactant there is less residue on evaporation and the

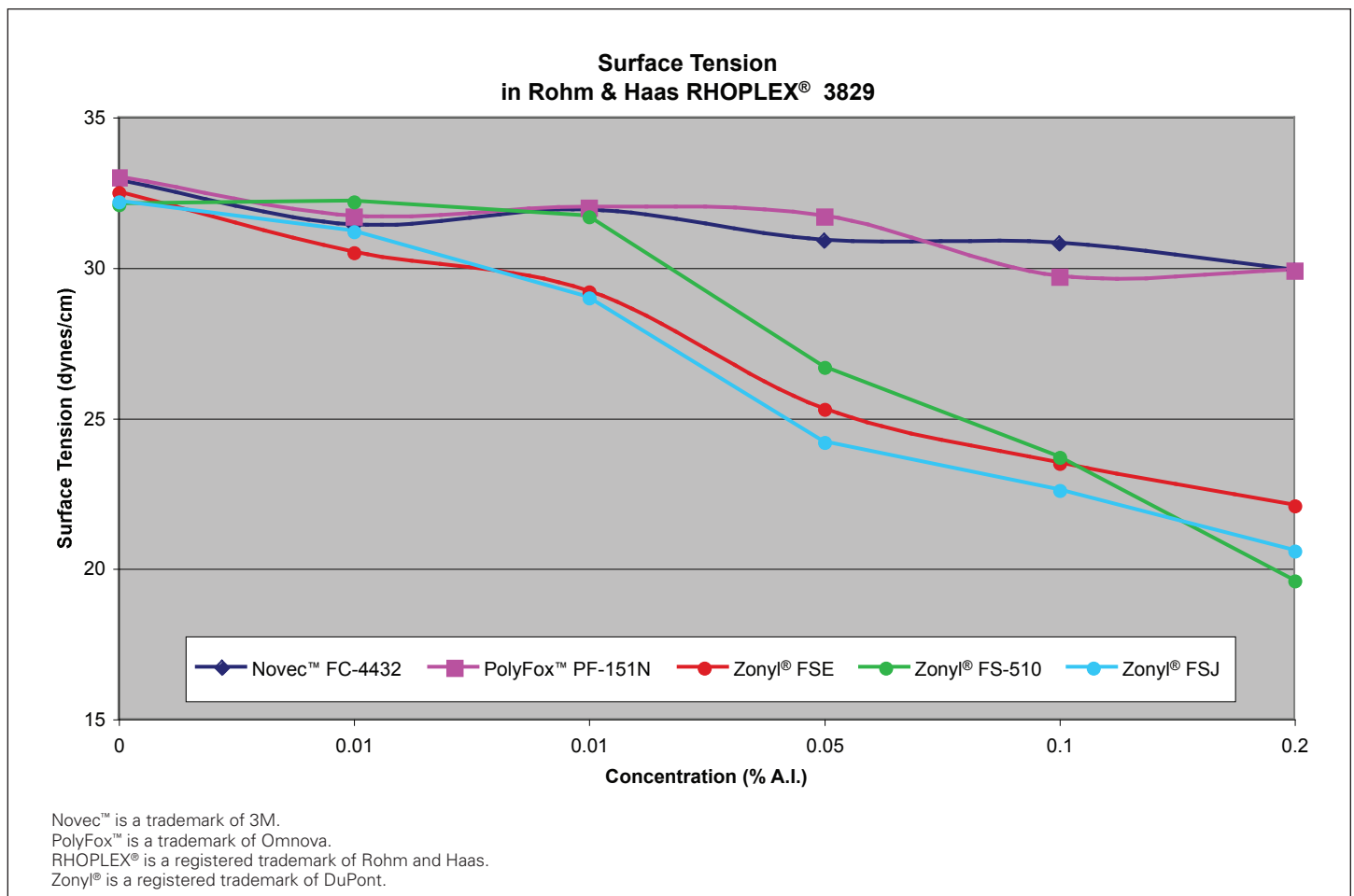
residual film is thinner. This results in faster drying times as well as less haze and streaking. Zonyl® FSH, a nonionic surfactant, will leave an invisible absorbed monolayer that encourages rewet of the surface. This will decrease the tendency of the surface to 'fog' in high humidity environments, a major benefit in glass cleaners. Zonyl® FSA offers good scale removal and wetting properties.

For metal, polymeric, or ceramic surfaces it is often desirable to create a surface that repels water or oily soils. In this application, Zonyl® FS-610 is recommended. This product is more strongly adsorbed on those surfaces and gives protection against resoiling, while still being very effective at low concentrations.

When foam is used to promote adhesion of the active cleaning ingredient on the surface, Zonyl® grades such as FS-500 and FS-510 are best at creating stable foam for these applications. For specific features and applications of the various Zonyl® products, refer to the Application Guide on page 3 of this bulletin.

Recommended products: Zonyl® FSH and FS-610

Zonyl® Fluorosurfactants were tested against competitive fluorosurfactants in Rohm and Haas RHOPLEX® 3829 floor finish formulation. The Zonyl® surfactants consistently show lower surface tensions than the competitive fluorosurfactants demonstrating their cost effectiveness in formulations.



Fluorosurfactants Applications Guide

Zonyl®/Features	FSH	FS-300	FSA	FSJ	FS-610	1033-D	FS-500	FS-510
Waxes and Polishes								
Leveling/gloss	X		◆	◆	◆		X	X
Aqueous strippers	◆	O			X	X		
Cleaners								
Wetting	◆	O	X	X	X	X		
Antifog	◆	O						
Antistatic	X	X	O			◆		
Oxidizing cleaners	O					◆		
Flash corrosion inhibitor	O	O	O		◆			
Scale removal		O	◆		X	X		
Alkaline cleaners	◆	O	O		X			
Glass cleaners	◆	O	X	O	X		X	
VOC free		X			X	X		
Aqueous foamers		X				X	◆	X

X = Frequently functional

◆ = Most common in use

O = Occasionally functional

Note: Zonyl® FSA, FS-300 and FSE meet the definition of “ultimately biodegradable” as defined by Regulation 648/2004/EC on detergents. These Zonyl® products were tested by OECD 301B or 67/548/EEC Annex V.C.4-C method and found to meet the 60% or greater biodegradability criteria in 28 days and can therefore be considered as ultimately biodegradable. Zonyl® FSE can be substituted for Zonyl® FS-610 in applications where compliance with the European directives are desired.

Floor Polishes/Waxes and Strippers

When a cleaner or polish/wax is spread on a substrate, two new interfaces are created 1) the interface between the liquid layer and the substrate (flooring, in this case), and 2) the upper (and visible) surface of the coating. In polishes and waxes, Zonyl® fluorosurfactants provide wetting power to give a uniform film on the substrate. Furthermore, they improve gloss and rewet characteristics on the upper surface, permitting multi-coat application without haze.

Zonyl® fluorosurfactants are widely used in this application and are recommended by nearly every resin manufacturer. At the low concentrations used (typically 200 ppm or less), they do not interfere with the hydrocarbon surfactants that are added to emulsify resins and waxes in the formulation, and minimal foaming is observed. Zonyl® FSH, FSJ, FSA and FS-610 are the most common grades for this use.

In ‘strippers’ for floor polish removal systems, the chemical stability (i.e., resistance to alkali) of Zonyl® surfactants is an important performance attribute. Good performance depends on

the ability of the stripper to completely wet and penetrate the layer(s) of old polish/wax, so that they can be separated from the substrate to provide a surface ready for refinish. These surfaces can be difficult to wet and Zonyl® products eliminate this concern. In stripper formulations, Zonyl® fluorosurfactants work with the detergency of hydrocarbon surfactants (which emulsify the old finish to guard against redeposition) to give superior performance.

Recommended product: Zonyl® FSH and FS-610

Delivering Repellency and Protecting Surfaces

The presence of an adsorbed layer of fluorosurfactant can dramatically affect surfaces that have been treated with Zonyl® products as well as giving soil repellency benefits, depending on the choice of surfactants. This function is important in many formulations that provide protection for surfaces such as carpets or porous surfaces like stone and tile.

Carpet Care Products

Zonyl® products are an important ingredient in the performance of extraction cleaner, lane cleaner and spot remover formulations. In addition to wetting the fibers of the substrate to lift off soil, they have an added capability of altering the receptivity of the cleaned surface to resoiling, especially dry and oily soils. Choosing the correct amount and type of Zonyl® can tailor the individual formulation so that the area that has been cleaned soils at the same rate as the surrounding carpet. For more information on Zonyl® grades for carpet care products, visit www.dupont.com/teflon/carpetprotector/tech.info

Porous Surface Protection

DuPont has extended fluorosurfactant technology to develop a family of products for use in the protection and maintenance of porous surfaces. Zonyl® fluoroadditives give outstanding stain protection of porous mineral based surfaces such as marble, unglazed tile, and grout. Zonyl® 8740 and 9027 can be diluted in water to create penetrating sealers for natural stone (e.g., limestone, granite), porous tile, grout, and masonry. Zonyl® 225 can be diluted in solvents for surface protection. These products provide oil- and water-repellent treatments that resist staining without changing the natural appearance of the substrate. For more information on Zonyl® products for stone and tile, visit www.dupont.com/zonyl/pdf/stone_tilecolor.pdf

Personal Safety, First Aid, Storage and Handling

See the Material Data Sheet (MSDS) for product-specific information. These can be downloaded from the Zonyl® web site: www.dupont.com/zonyl or by contacting DuPont.

Technical Assistance

DuPont offers technical assistance to help assess the right Zonyl® grade for your specific application. To contact a DuPont Technical Service Specialist, call toll-free at 1-866-828-7009, within the United States, or contact your local DuPont representative outside the U.S.

Order Information for Product, Literature or Samples

To place an order for DuPont™ Zonyl® fluorosurfactants, call DuPont Chemical Solutions Customer Service toll free at 1-800-441-9140. For additional literature or to evaluate a product sample, call toll free at 1-866-828-7009. For locations outside the United States, contact the local DuPont representative in your country.

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