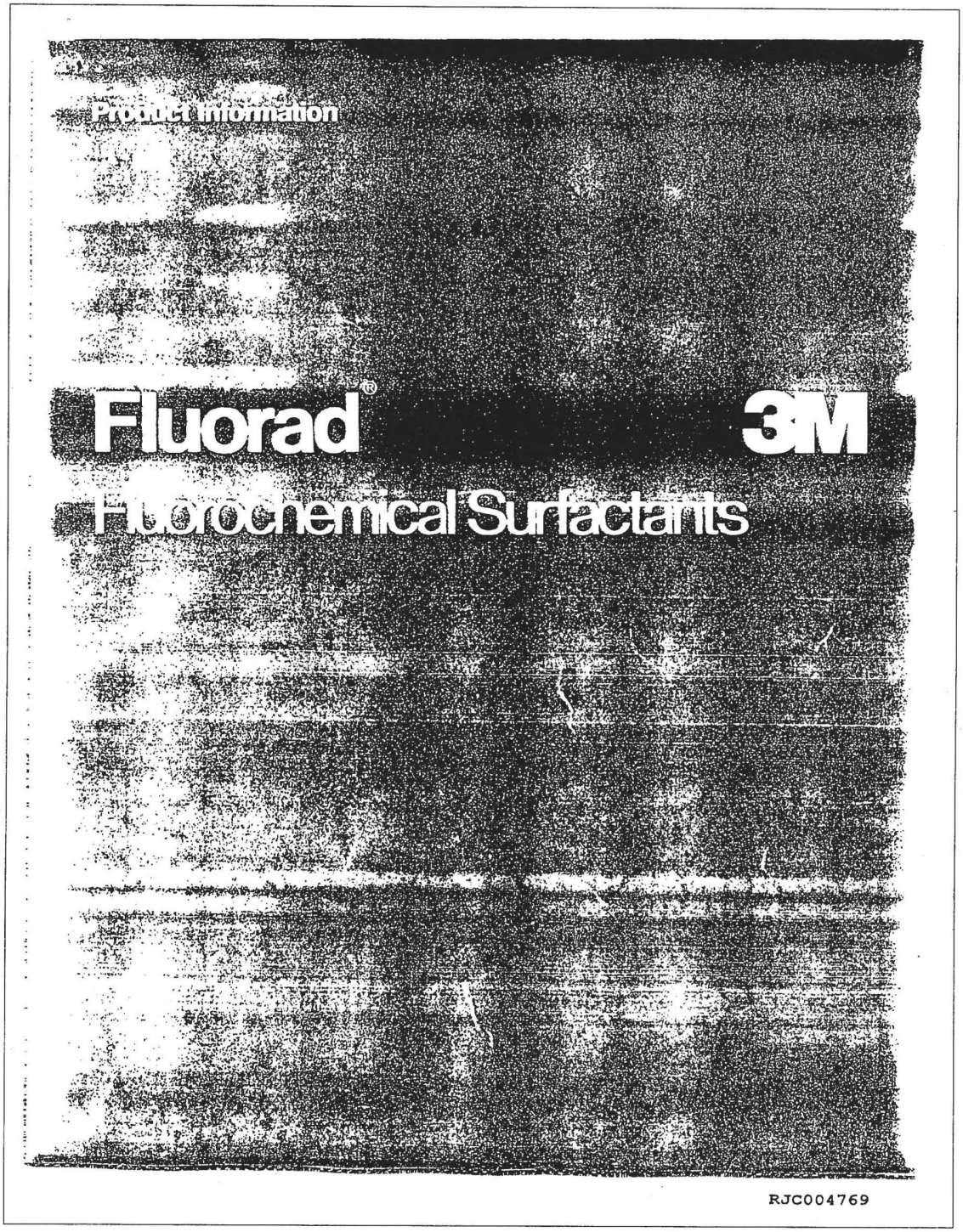


Exhibit
1328
State of Minnesota v. 3M Co.,
Court File No. 27-CV-10-28862

STATE_07543930

1328.0001

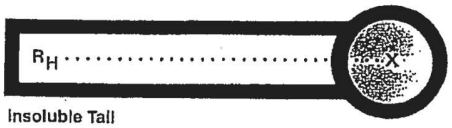
What is a surfactant?

The term "surfactant" is a contraction of "surface active agent", and refers to any material which is capable of reducing the surface energy of a liquid at relatively low concentrations. Generally, such a compound consists of an organic compound having an insoluble moiety (which is inherently insoluble in the liquid in which it is useful) combined with a solubilizing group.

Such surfactants can be divided into three major chemical classes, hydrocarbons, silicones and fluorochemicals. This classification describes the "tail" portion of the surfactant molecule. In regard to their relative ability to reduce surface tension in water based systems, the general trend is that fluorochemicals are more effective than silicones, which in turn are more effective than hydrocarbons. Each class has its own utility and ultimately the decision as to which one or ones to use is determined by the level of performance needed. If more than one material proves effective, cost-effectiveness parameters are usually used as the selection basis.

What are "Fluorad" Fluorochemical Surfactants?

A conventional hydrocarbon surfactant generally may be represented as:



Insoluble Tail

Hydrophilic Group

where R_H....represents the hydrocarbon "tail" and ....X represents a solubilizing group.

In a similar fashion, "Fluorad" Fluorochemical Surfactants can typically be described by the following chemical structure:

Insoluble Tail

Hydrophilic Group

where the R_F....portion is the stable fluorocarbon tail, and ....X represents a solubilizing group. It is this unique fluorochemical "tail", modified in length and structure to meet end use needs, which provides the exceptional resistance to thermal and chemical attack characteristic of the "Fluorad" Surfactants. This fluorochemical portion of each "Fluorad" Surfactant is basically responsible for its capability to dramatically reduce surface tension, as well as being the major difference between these materials and conventional surfactants.

The solubilizing group.....X is commonly water soluble, but can be designed to be oil soluble for use in nonaqueous systems.

The nature of this group varies among the "Fluorad" Surfactants. By altering it, "Fluorad" Surfactants have been prepared which are extremely surface active in a number of environments, including many systems which would degrade hydrocarbon or silicone surfactants.

Insoluble Tail

Organophilic Group

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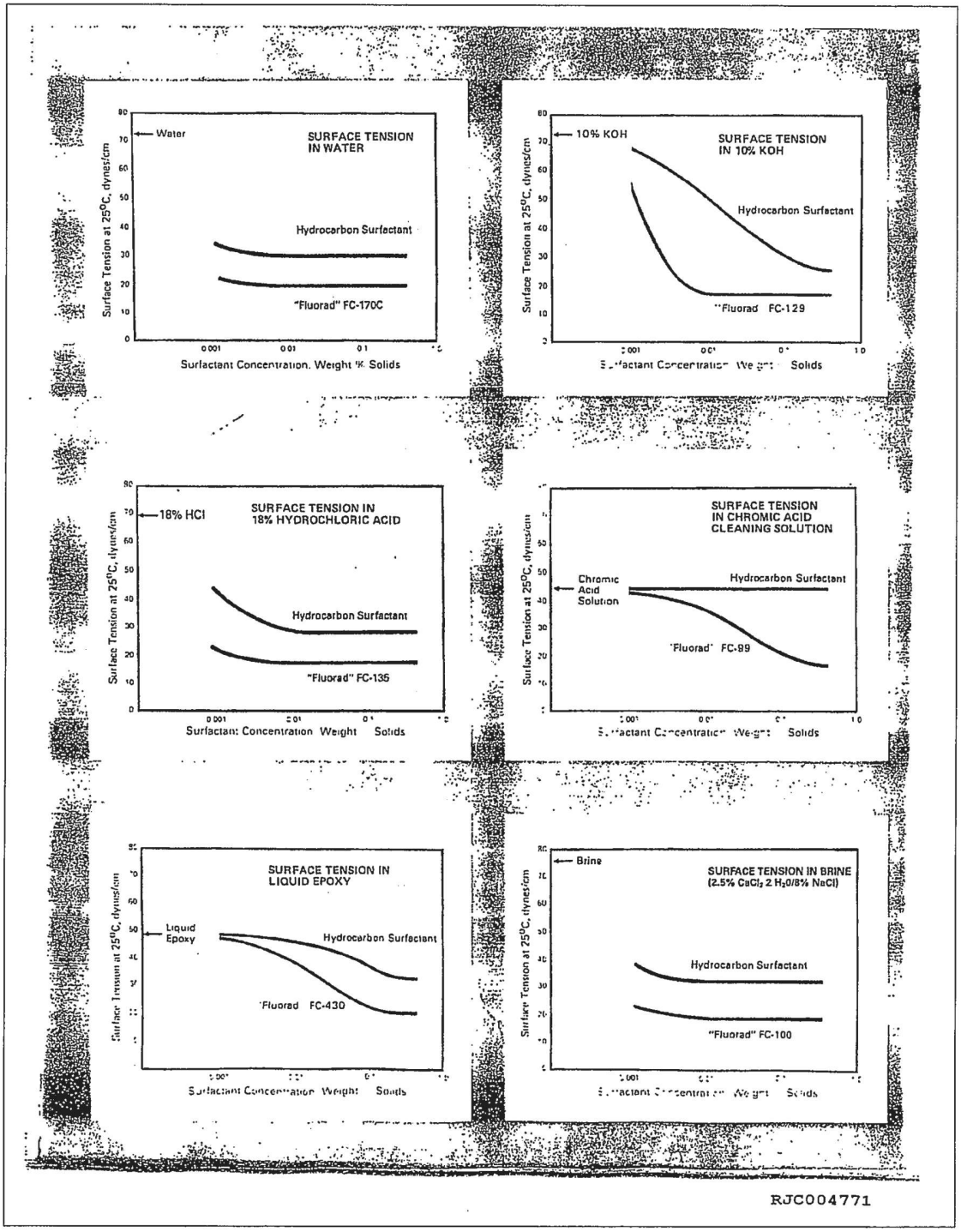

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Low surface tension, low concentrations and stability

"Fluorad" Fluorochemical Surfactants differ greatly from conventional hydrocarbon and silicone surfactants. In most systems they are far more efficient in reducing surface tension to levels that are unreachable with these other types. In some aqueous systems, surface tensions as low as 15 to 16 dynes/cm can be attained. The "Fluorad" Surfactants normally produce these extremely low values at concentrations as low as 100 parts per million, or less. Equally important is the fact that certain of these fluorochemical surface active agents are stable and effective in many extremely hostile environments, including strongly acidic, strongly alkaline and even strongly oxidizing systems.

Features of "Fluorad" Surfactants

The principle features of "Fluorad" Surfactants have been discussed previously. These may be summarized as the ability to reduce surface tensions to extremely low levels, chemical and thermal stability, and effectiveness at low concentrations.

SURFACE ACTIVITY

AQUEOUS SYSTEMS
Some of these surfactants can lower surface tension to less than 16 dynes/cm and function at low concentrations. They are effective in dramatically reducing surface tension in a wide variety of aqueous media, including acidic and basic systems.

NON AQUEOUS SYSTEMS
"Fluorad" Surfactants have been developed which uniquely reduce surface tensions of many organic media to about 20 dynes/cm, including solvents such as esters, alcohols and ethers and resin systems including epoxies, polyesters, urethanes and acrylics.

WETTING
Reduced surface tensions result in the ability to improve the wetting of a variety of materials, including such hard to wet surfaces as plastics and oily metals.

LEVELING
Emulsion coatings applied to difficult to wet surfaces can show greatly improved leveling with the addition of small quantities of these materials.

FOAMING
Stable foams can be produced in hostile media such as chromic acid or sodium hydroxide, where conventional surface active agents would be destroyed.

EMULSIFICATION
While generally not effective as emulsifiers in water-organic systems, these materials can be quite efficient emulsifiers in specialty applications, where fluorinated materials comprise either the continuous or the dispersed phase.

STABILITY

CHEMICAL
Some of these surface active agents are stable in such rigorous environments as hot chromic acid, anhydrous hydrazine, hot concentrated sulfuric acid, hot concentrated hydrofluoric acid and hot concentrated sodium hydroxide solutions.

THERMAL
While all of these materials have very good stability at moderate temperatures, a few can withstand temperatures in excess of 600°F in air.

LOW CONCENTRATION

ECONOMICAL
These materials are normally effective at extremely low concentrations, and often are utilized at concentrations of 100 parts per million active solids or less.

"Fluorad" Surfactants for nonaqueous systems

The family of "Fluorad" Surfactants includes a unique class of materials which can effectively reduce surface tension and interfacial tension in non-aqueous systems. The use of this new generation of fluorochemical surfactants in coating resins and solvent systems can produce the following advantages:

IMPROVEMENT IN FLOW AND LEVELING
ELIMINATION OF FISH EYES AND CRATERS
PREVENTION OF CRAWLING AND EDGE BUILD UP
IMPROVEMENT IN PIGMENT DISPERSION
REDUCTION OF PINHOLES

Use levels vary in organic systems between 0.05% and 1.0%.

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Some typical "Fluorad" Surfactant application areas

Application Area	FC-93	FC-95 and FC-98	FC-99	FC-100	FC-120	FC-129	FC-135	FC-143	FC-170-C	FC-171	FC-430	FC-431	FC-740
Floor Polish Emulsions					■	■	■		■				
Electrolytic Conversion Coatings		■	■										
Photographic Processes						■	■	■					
Fluoropolymer Emulsions								■					
Specialty Inks									■		■		
Water Based Coatings						■	■				■		
Solvent Based Coatings											■	■	
Plating Bath Antimist		■	■										
Electronic Etch Baths	■								■	■			
Corrosion Inhibitors							■						
Soldering Systems								■			■	■	
Alkaline Cleaners						■							
Plastic Preplate Etchants		■	■										
Refractory Processes									■				
Leak Detector Solutions						■	■						
Foaming Hydrocarbons													■

■ = Usually effective □ = Sometimes effective

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"Fluorad" Surfactants in combination with conventional wetting agents

Many applications involve more than just air-liquid interfaces where surface tension alone might be important. More often liquid-liquid or solid-liquid systems are encountered. In these cases, interfacial tension, as well as surface tension, plays a significant role in the wetting or leveling process. Quite often in these cases, a combination of "Fluorad" Surfactant plus a suitable hydrocarbon surfactant can produce a degree of wetting which cannot be accomplished by either type alone. Normally, in such a combination, it is the "Fluorad" Surfactant which reduces the surface tension, while the hydrocarbon material aids in the reduction of the interfacial tension. The net result can be a system that easily wets and spreads on otherwise hard to wet surfaces.

What reduced surface tension really means

The reduction of surface tension can produce an improvement in many important liquid system properties, especially in the case of the very low values attainable through the use of "Fluorad" Surfactants. Some of the possible results and benefits of successfully modifying liquid properties through dramatically reduced surface tension may include:

IMPROVED WETTING
Generally speedier and more effective cleaning operations can result from low surface tension cleaning solutions.

BETTER SPREADING
Low surface tension in combination with low interfacial tension affects spontaneous spreading of a liquid over various surfaces. This is important in reducing pinholes, craters, and edge crawling of coatings applied to unclean surfaces.

IMPROVED FOAM GENERATION
Gaseous corrosive mists being evolved from chemical solutions in certain industrial operations can be blanketed by a dense, stable foam formed on the solution surface which prevents escape of such mists into the surroundings.

REDUCED WATER SPOTTING
Because of reduced droplet formation, the need for distilled or deionized water in rinsing operations may be eliminated.

SMALLER GAS BUBBLES
These smaller gas bubbles produces at the surface of metal during chemical etching will have less tendency to adhere, grow and cause surface imperfections.

SMALLER DROP FORMATION
Smaller drops are desired in fine aerosol mists.

BETTER LIQUID PENETRATION
The force required to cause liquids to move through small pore spaces can be greatly reduced.

IMPROVED FILM UNIFORMITY
Smoother, more even films are produced from polishes, finishes and coatings.

Technical information and services

Local "Fluorad" Surfactant sales representatives are equipped with extensive technical data and experience to help you solve your surfactant problems. Backing them up is a modern technical service laboratory. Contact your representative today at the 3M Commercial Chemicals Division branch office nearest you. They are listed on the back page.

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"Fluorad" Fluorochemical Surfactants

PRODUCT NUMBER	TYPE	DESCRIPTION	COMMENTS
FC-93	Anionic	Ammonium perfluoroalkyl sulfonates	Excellent chemical and thermal stability. Active in acidic and alkaline systems.
FC-95 and FC-98	Anionic	Potassium perfluoroalkyl sulfonates	Outstanding chemical and thermal stability, especially in acidic and oxidizing systems.
FC-99	Anionic	Amine perfluoroalkyl sulfonates	Outstanding surface activity in acidic and oxidizing systems. Chemically stable with excellent water solubility.
FC-100	Amphoteric	Fluorinated alkyl amphoteric mixtures	Outstanding surface activity and solubility in strong electrolyte systems such as brines.
FC-120	Anionic	Ammonium perfluoroalkyl sulfonates	Superior leveling agent for water-based acrylic emulsions.
FC-129	Anionic	Potassium fluorinated alkyl carboxylates	Excellent leveling agent in alkaline systems. Good foamer.
FC-135	Cationic	Fluorinated alkyl quaternary ammonium iodides	Outstanding activity in acid solutions. Excellent in basic and neutral solutions.
FC-143	Anionic	Ammonium perfluoroalkyl carboxylates	Effective emulsifier for fluorocarbon polymer systems. Excellent chemical stability.
FC-170-C	Nonionic	Fluorinated alkyl polyoxyethylene ethanols	Excellent activity in neutral and acid solutions.
FC-171	Nonionic	Fluorinated alkyl alkoxylate	Excellent activity in neutral, alkaline, and acidic aqueous solutions.
FC-430	Nonionic	Fluorinated alkyl esters	Active in organic polymer coatings. Effective in many water-reducible systems.
FC-431	Nonionic	Fluorinated alkyl esters	Active in organic polymer coatings. Effective in some water reducible systems.
FC-740	Nonionic	Fluorinated alkyl esters	Active in low polarity organic solvents. Foams hydrocarbon liquids.

RJC004775

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