

Be Clean, Look Clean

Stepan's Low Film/Streak Technology

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Overview

- Market Needs and Trends
- Background: Why Low Film/Streak (LFS)?
- Role of Surface Free Energy (SFE)
- Role of Soil, Wetting and Surface Types
- LFS Performance Overview
- LFS Fundamentals
- Discussion, Q&A

Identifying Market Need

Desire for Cleaning Ingredients with Multi-Functionality

- Excellent cleaning performance
- Visibly clean surface
- Useful in household care, industrial and institutional cleaning, vehicle care, truck wash, etc.
- Useful on glass, ceramic, vinyl, metal, etc.

Market Trends



Hard Surface Cleaning Product Introductions 2015 - 2019

26% of HSC products had “shine” or “streak” on label in relation to performance claims

94% growth in those claims

Highest growth in:

- Bath, Shower, Tile Care
- Metal Cleaners
- Floor Care
- Furniture Care
- All-Purpose/Multi-Purpose Surface Care

Be Clean, Look Clean

Cleaning a surface is more than just lifting the dirt.

- If the cleaning process leaves behind soil, the surface will not **Be Clean**
- If the cleaner leaves a visible residue, the surface will not **Look Clean**



This is a polished vinyl tile that is “clean,” but with visible residue left from the cleaning solution.

Why LFS? Watch These Cleaners in Action

Ceramic

Typical Nonionic
Surfactant



Stepan's LFS
Technology



All-Purpose Cleaners consisting of 1 wt% of the corresponding nonionic surfactant, C9-11 6EO (left) and BIO-SOFT® LFS-04 (right) in deionized water

Why LFS? Watch These Cleaners in Action

Acrylic Polished VCT

Typical Sugar-Based
Surfactant



Stepan's LFS
Technology



All-Purpose Cleaners consisting of 1 wt% of the corresponding nonionic surfactant, alkyl polyglycoside (left) and BIO-SOFT LFS-04 (right) in deionized water

Why Low Film/Streak?

Cleaners should remove soils and not leave a visible residue behind

Property	Alcohol Ethoxylates	Alkyl Polyglycosides
Activity	90-100%	50%
Leave Film-Free and Streak-Free Surface	X	✓
Degreasing	✓	X

Are there any 90-100% active alcohol alkoxylates that can clean and not leave a visible residue?



Time For Some Science ...

Role of Surface Free Energy in Cleaning & LFS

Glass	Ceramic	Finished Oak	Engineered Laminate	Acrylic Polished VCT	Luxury Vinyl Tile (LVT)	Polypropylene	Sealed Granite
70.9	68.8	64.8	51.6	40.8	37.7	32.9	29.4

(SFE in units of mN/m)

First requirement: cleaner must wet the surface

- Necessary for cleaning
- Spreads residues over larger area to dry
- Some surfaces wet easily
- Others are very difficult to wet

Ceramic



Sealed Granite

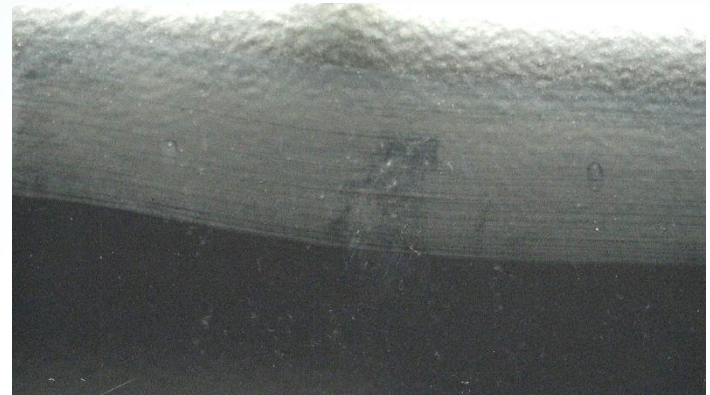


There is More to Film/Streak than Effective Wetting

Even when a cleaner wets a surface well ...



Car Panel – Wet with cleaner
(1 wt% C10 Guerbet 8EO)



Car Panel – After cleaner dries
(1 wt% C10 Guerbet 8EO)

... it does not guarantee a film/streak-free result.

Soil Removal and Film/Streak Combined

Soil can lower the SFE of a surface (*water doesn't spread well on oil*)

Good cleaning is the first step:

- Surfactants penetrate, emulsify and remove soil

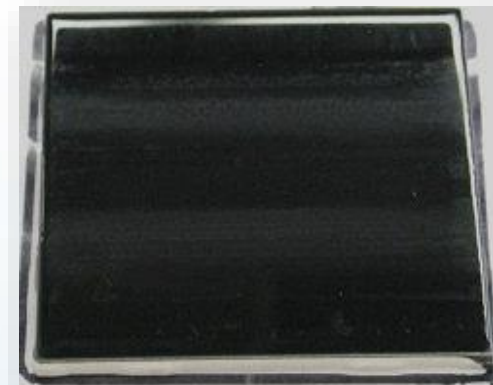
Improved appearance is the second step:

- Does the soil re-deposit?
- Does the cleaner leave its own residue?

Average Cleaning, Poor Film/Streak



Average Cleaning, Good Film/Streak

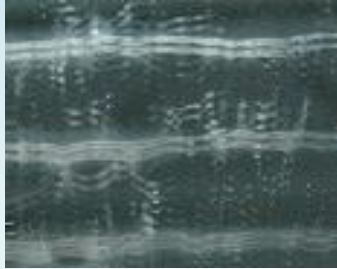


Gardner Scrub Test with ASTM Soil, No Rinse

Film/Streak Across Surface Types

Surfaces are not all equal: some show film/streak more than others

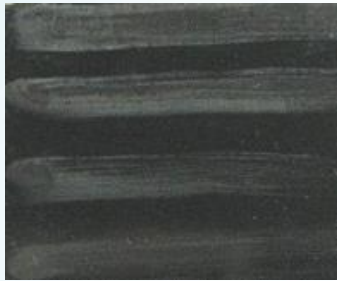
**Glass
Mirror**



Car Panel



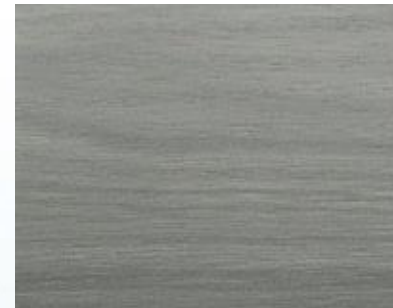
**Ceramic
Tile**



**Acrylic
Polished
VCT**



**Luxury
Vinyl
Tile**



Solving the Problem: Development of LFS

With Stepan's expansion of our alkoxylate platform, R&D set out to work on this problem:

- Conducted extensive research across many classes of nonionic surfactants
- Identified the origin of the problem
- Developed a solution

Property	Alcohol Ethoxylates	Alkyl Polyglycosides	BIO-SOFT LFS-Series
Activity	90-100%	50%	90-100%
Leave Film-Free and Streak-Free Surface	X	✓	✓
Degreasing	✓	X	✓

Introducing: BIO-SOFT LFS-04 and BIO-SOFT LFS-07

BIO-SOFT LFS-04

Average soil loads, best film/streak on glossy/glass surfaces and high-dilution applications

BIO-SOFT LFS-07

Heavier soil loads, great for low film/streak, fast-break foam

- ✓ Patent-Pending
WO2020018356
- ✓ 90-100% Active
- ✓ Easy-to-Handle Liquids
- ✓ Dilutable
- ✓ Low Foam or Fast Break
- ✓ Cost-Effective
Performance
- ✓ Versatile, Multi-Surface
Performance
- ✓ Greasy Soil Remover

Typical Properties

Tradename	Appearance at 25°C	Cloud Point (°C)	Pour Point (°C)	Surface Tension at CMC (mN/m)	pH (1% in DI water)	Ross-Miles 0.1% aqueous		Draves Wetting at 25°C, 1% aqueous, seconds
						Initial, cm	5 min, cm	
BIO-SOFT LFS-04	Clear Liquid	45.5	18	27.3	10.5	8.7	8.2	15.5
BIO-SOFT LFS-07	Clear Liquid	33.5	-15	27.1	10.5	7.9	3.3	4.3

Measurement of Film/Streak

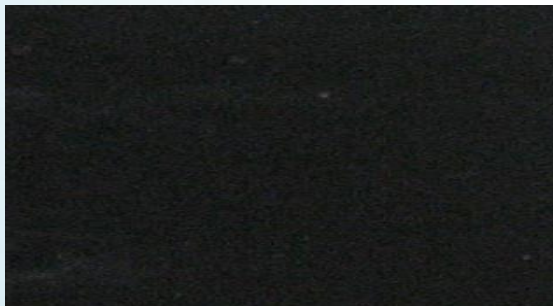
BIO-SOFT LFS-04 on
Acrylic Polished VCT = 0.8



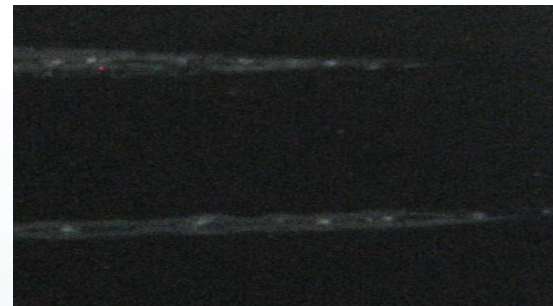
Decyl/Undecyl Glucoside on
Acrylic Polished VCT = 2.4



BIO-SOFT LFS-04 on
Glossy Ceramic = 0.7



Guerbet Alcohol Ethoxylate
on Glossy Ceramic = 4.8



0

Visibly poor film/streak begins at about 2 and above

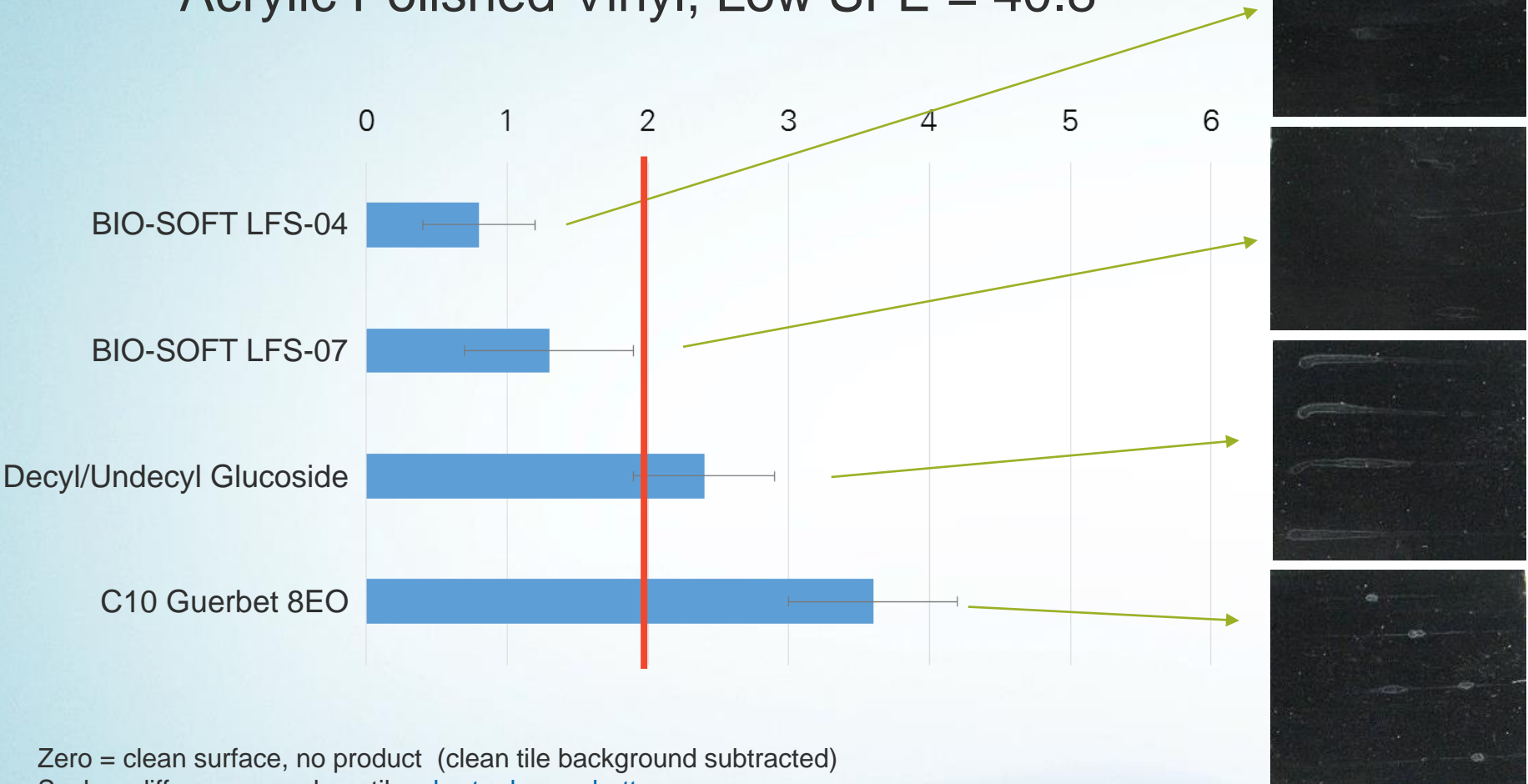
Zero is best
(most like clean surface)

Scale = difference vs. clean tile

The top end is
unbounded

BIO-SOFT LFS-Series Performance vs. Alternative Nonionics

Acrylic Polished Vinyl, Low SFE = 40.8



BIO-SOFT LFS-Series Performance vs. Alternative Nonionics

Ceramic, High SFE = 68.8



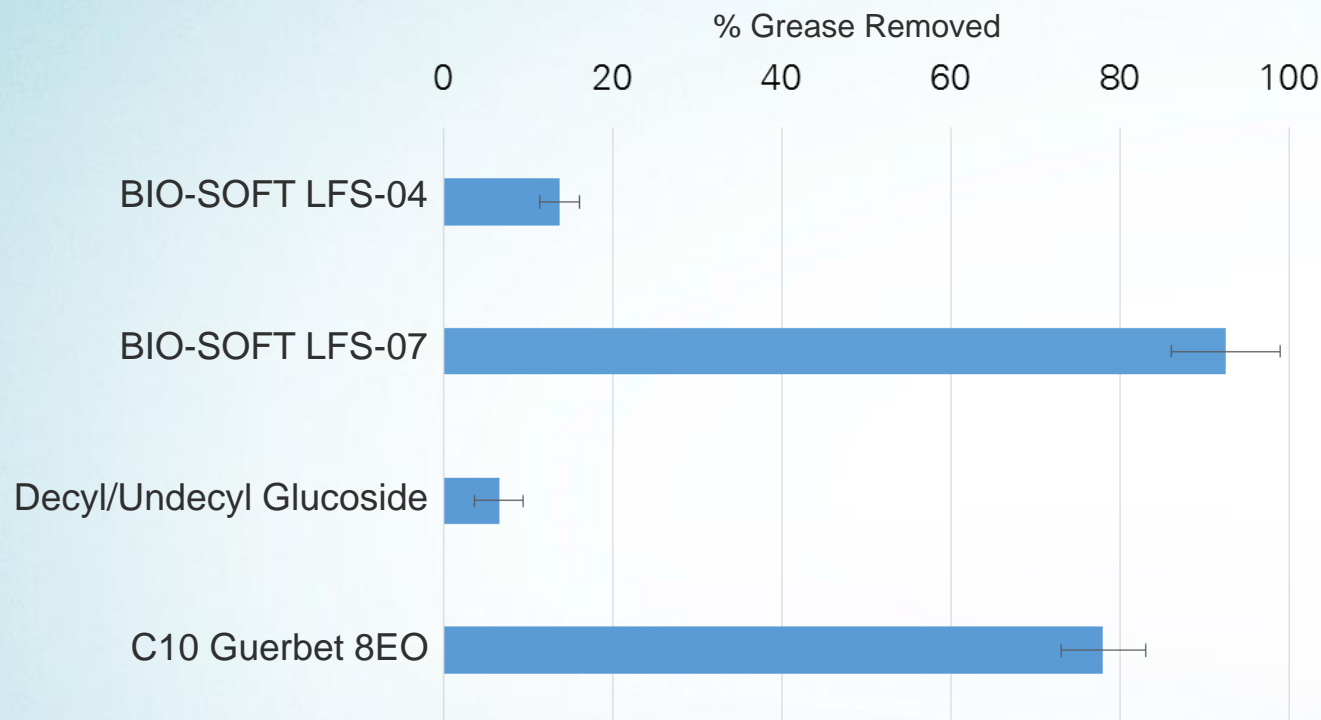
Zero = clean surface, no product (clean tile background subtracted)

Scale = difference vs. clean tile; **shorter bars = better**

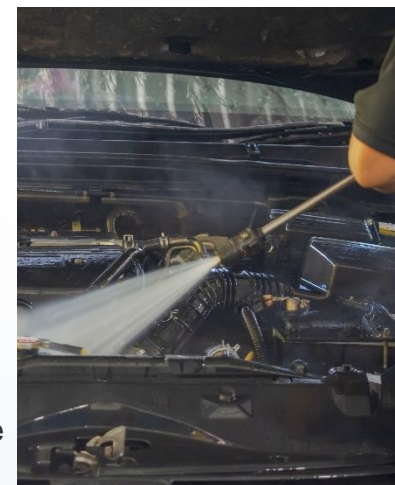
Relates to intensity = how noticeable film/streak is

BIO-SOFT LFS-Series Cleaning Performance

Immersion Degreasing of Tough Grease



***BIO-SOFT LFS-07
is the best option
for heavy duty
degreasing.***

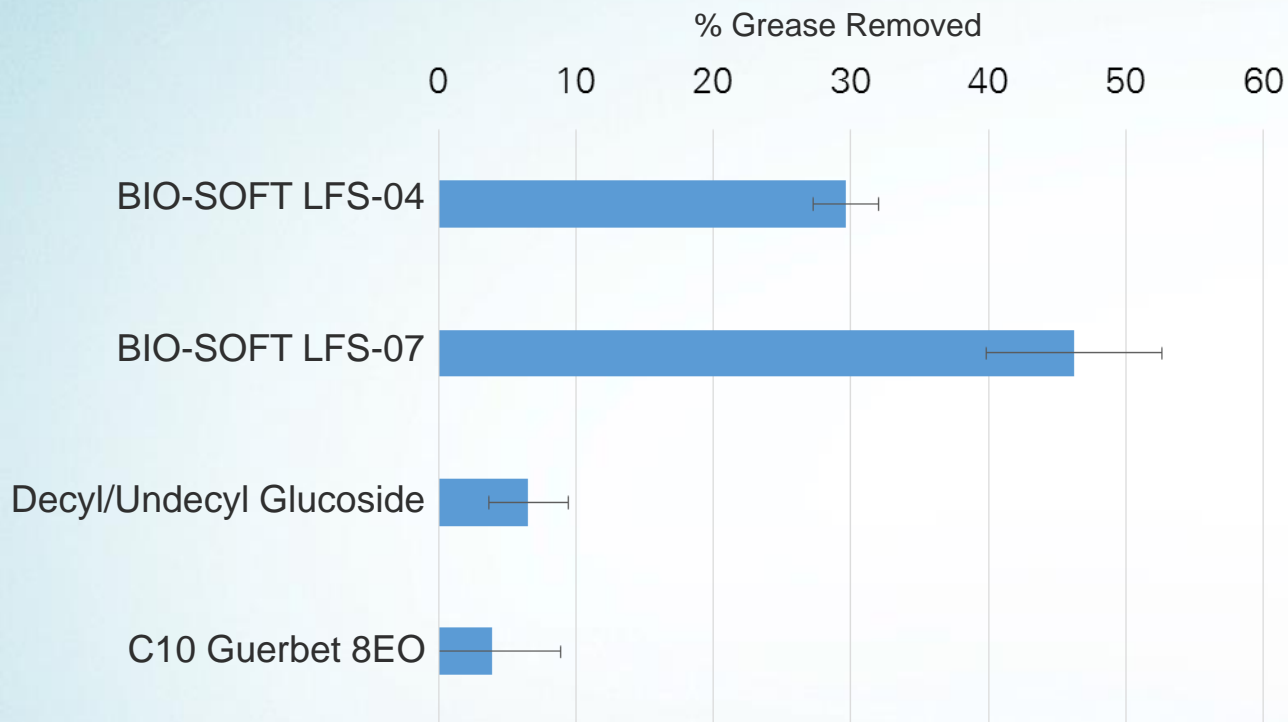


Cleaning formula: 1 wt% surfactant + 1 wt% potassium hydroxide (45%) + 1 wt% sodium metasilicate

BIO-SOFT LFS-04 is not designed for industrial greases such as Lithium Complex Grease.

BIO-SOFT LFS-Series Cleaning Performance

Immersion Degreasing of Cooking Shortening



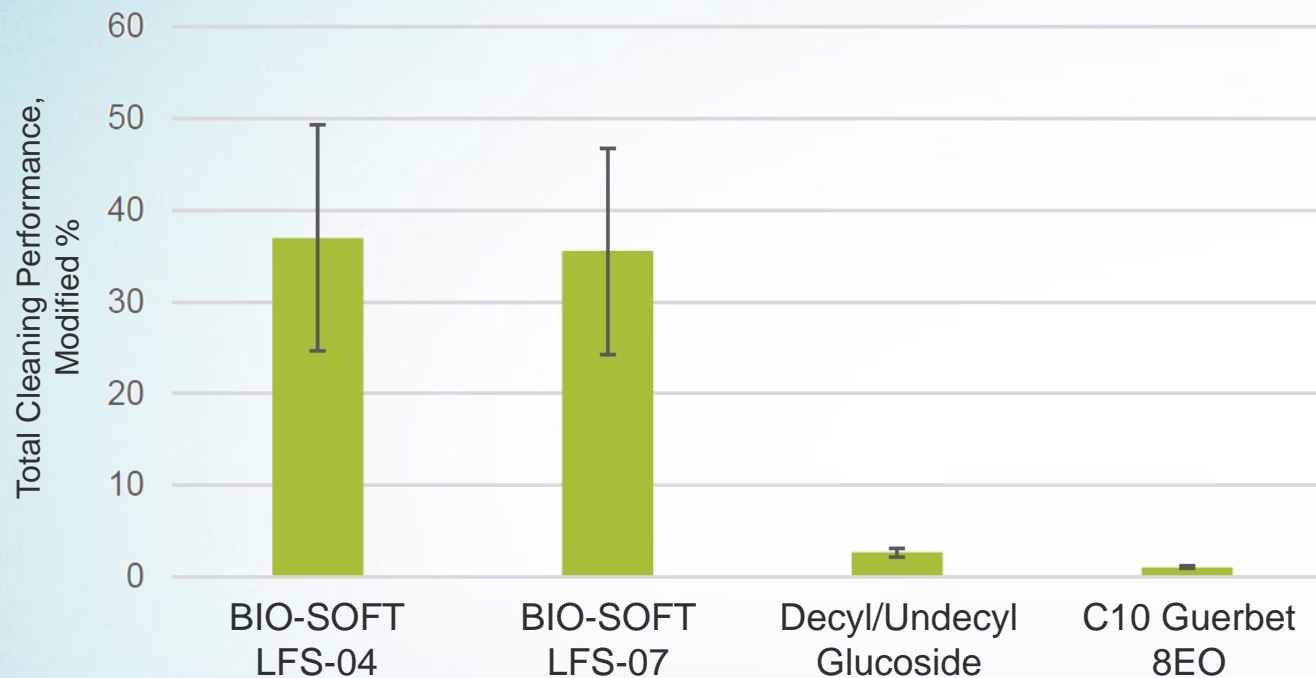
BIO-SOFT LFS-04 & BIO-SOFT LFS-07 are superior.

Cleaning formula: 0.2 wt% surfactant in deionized water



Total Cleaning Performance

Cooking Shortening on Acrylic Polished Vinyl



BIO-SOFT LFS-04 & BIO-SOFT LFS-07 are superior.



Total cleaning performance is equal to percent soil removal divided by film/streak score.

Formulation Guidance

All Exterior Vehicle Spray and Wipe Cleaner (Formulation No. 1321)

Ingredient	% by Weight
Deionized Water	99.54
AMPHOSOL® CS-50	0.28
BIO-SOFT LFS-07	0.10
Propylene Glycol n-Butyl Ether	0.08
Preservative, Fragrance, Dye	q.s.



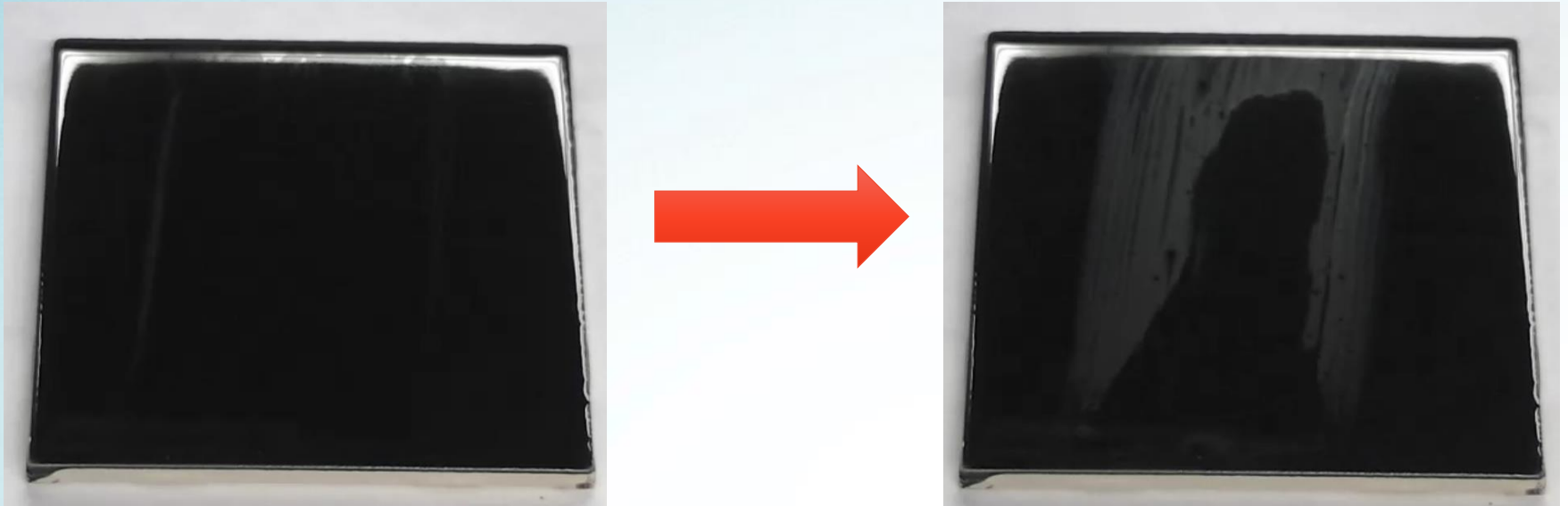
Glass Cleaner Concentrate (Formulation No. 1319)

Multipurpose Cleaner Concentrate (Formulation No. 1320)

Stainless Steel Cleaner and Polish (Formulation No. 1322)

Visit ulprospector.com for starter formulation details.

Stepan LFS: How Does It Work? Origin of Film/Streak

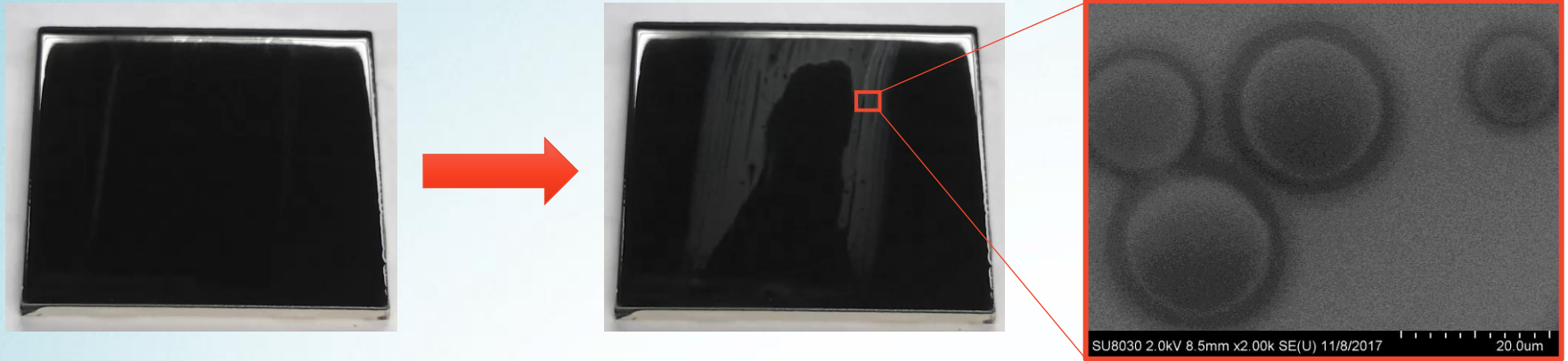


- Wet to Dry => Phase Inversion
- From 90+% water to < 10% water

Wet: Water continuous, surfactant hydrophobic tails internal


Dry: Hydrophobe continuous, water/hydrophilic headgroups internal

Stepan LFS: How Does It Work? Origin of Film/Streak



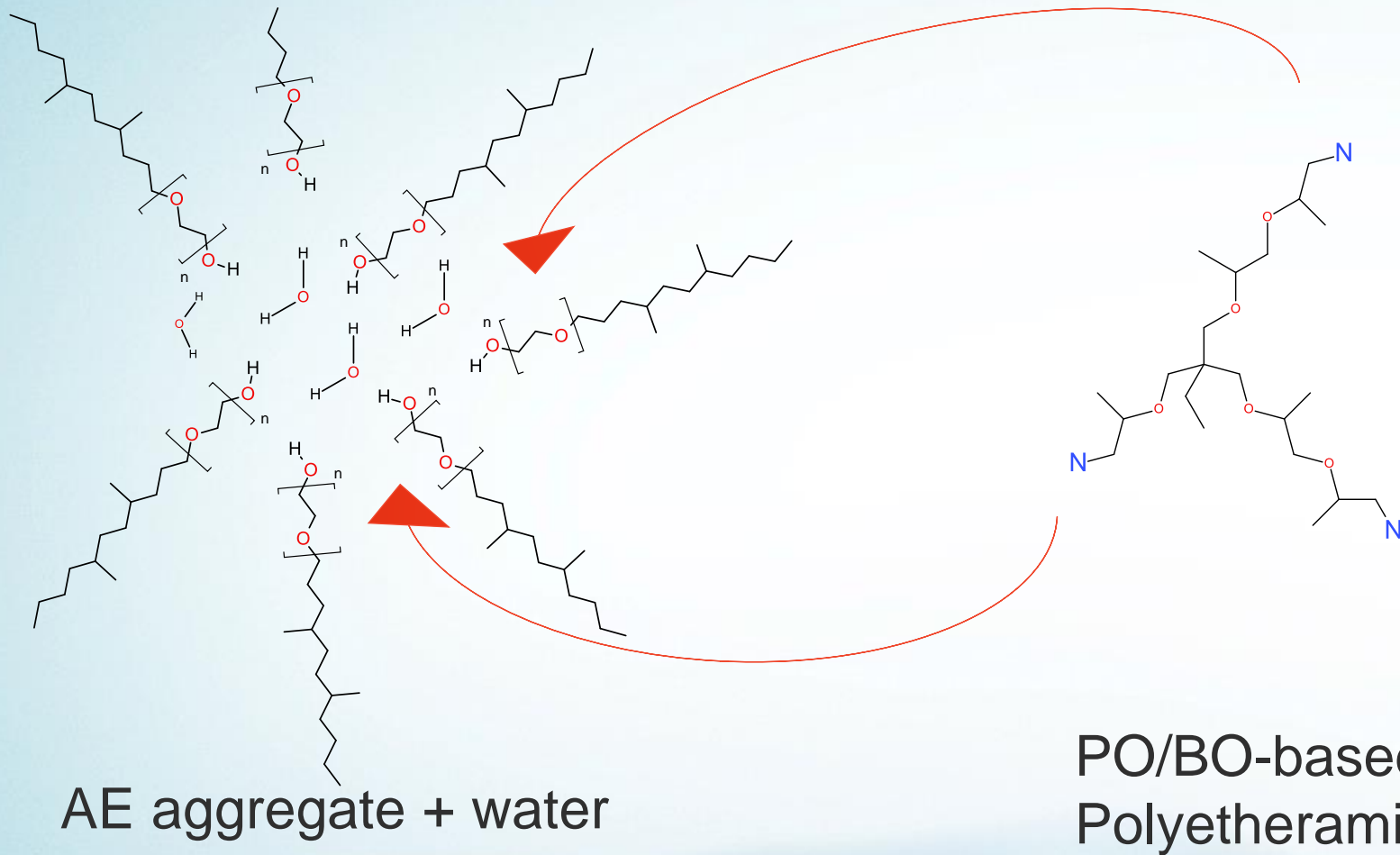
SEM (NUANCE center, Northwestern University) reveals micron-size droplets of nonionic surfactant on pristine surface

Micron-scale de-wetting of nonionic surfactant

- Hydrophobic liquid  Hydrophilic ceramic/glass surface
- Forms discrete droplets across surface
- Droplets act as a “fog” and scatter reflected light
- Origin of film/streak from alcohol ethoxylate surfactants

Stepan LFS: How Does It Work? Solving the Problem

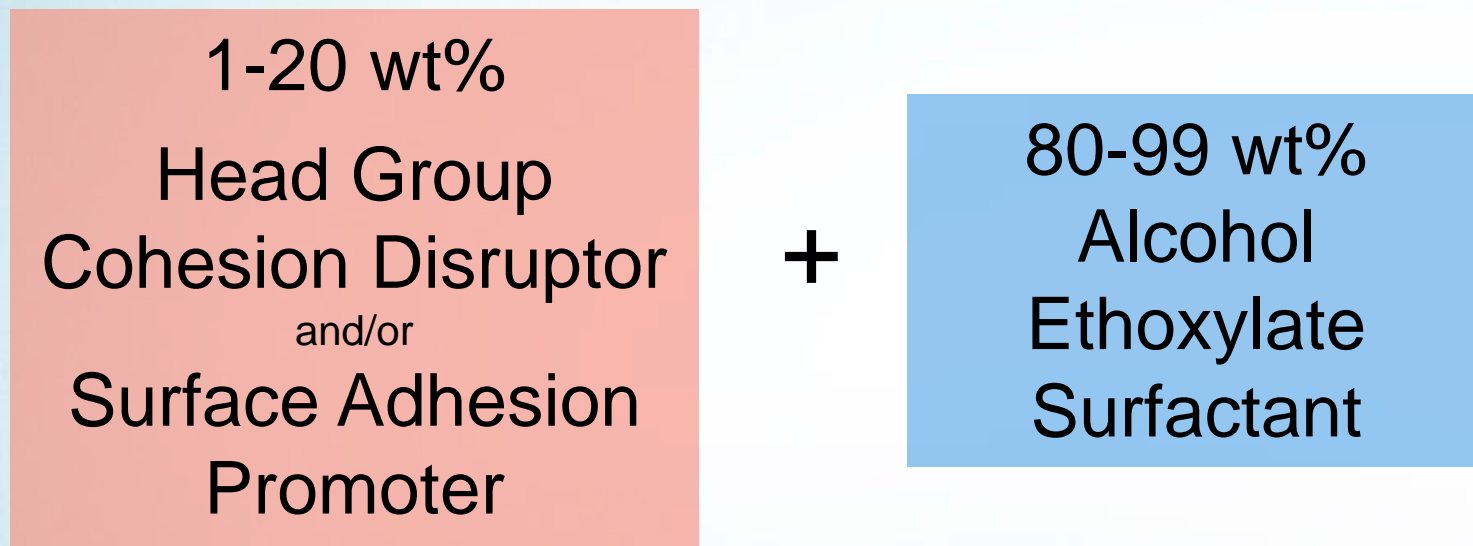
Additive to Alter Phase Behavior During Drying Process



Stepan LFS: How Does It Work? Solving the Problem

Many possible options: 1. General Blend Principle


Advantages: Choice of Nonionic Surfactant, Already Registered



Use all nonionic components for stable high active blends

Multi-Surface and Multi-Purpose Solutions


Performance		BIO-SOFT LFS-04	BIO-SOFT LFS-07	Alcohol Ethoxylates	Alkyl Polyglycosides
Film/Streak	Acrylic Polished Vinyl	✓	✓	X	X
	Ceramic	✓	✓	X	✓
Cleaning	Tough Grease	X	✓	✓	X
	Cooking Shortening	✓	✓	X	X
Total Cleaning Performance		✓	✓	X	X

 Samples (0)

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BIO-SOFT® LFS-07

Company: [Stepan Company](#)

Tags: 

DOCUMENTS

 [BIO-SOFT® LFS-07 Datasheet](#)

 [MSDS / SDS](#)

FORMULATIONS


[All Exterior Vehicle Spray and Wipe Cleaner \(Formulation #1321\)](#)

[Low Film / Streak Multipurpose Concentrate \(Formulation #1320\)](#)

[Stainless Steel Cleaner and Polish \(Formulation #1322\)](#)

BIO-SOFT® LFS-07 is a proprietary nonionic surfactant technology for hard surface cleaners where low film/streak and heavy-duty cleaning performance are important. It can enable a single cleaner


 REQUEST A SAMPLE

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BIO-SOFT® LFS-04

Company: [Stepan Company](#)

Tags: 

DOCUMENTS


 [BIO-SOFT® LFS-04 Datasheet](#)

FORMULATIONS

[Low Film / Streak Glass Cleaner Concentrate \(Formulation #1319\)](#)

BIO-SOFT® LFS-04 is a proprietary nonionic surfactant technology for hard surface cleaning where low film/streak performance is important, such as glass and floor cleaners. With a very low critical micelle concentration (CMC), it is useful for concentrates with high dilution rates, and may also be used for ready-to-use (RTU) cleaners.

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