



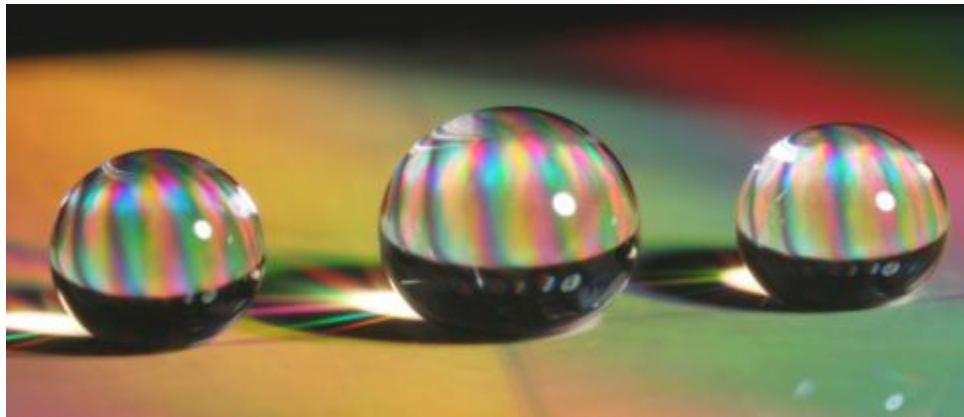
**Chemguard is Preparing for a Future Without
C8-2 Telomer Based Surfactants**

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Reebok Seminar, July 7/8, 2009

Will Removing All C8-2 Telomer Based Surfactants From Foam Agents Have Negative Consequences? Maybe!

Paper and textile sizing agents having C8-2 Telomer tails provide strong Oil repellency (fuel shedding) properties.



Similarly, Fluorosurfactants having C8-2 Telomer tails impart fuel shedding properties to foam extinguishing products, thereby lowering fuel pickup to the foam.

FluoroProteins get this property from FS-220B (95% C8-2 telomer)

Will Removing All C8-2 Telomer Based Surfactants From Foam Agents Have Negative Consequences?

Small quantities of C8-2 Telomer based surfactants:

- Improve low energy bubble formation (ie. Sprinklers).
- Improve flame resistance of bubbles.
- Improve hot solvent resistance of bubbles.
- Increase bubble wall thickness.
- Increase drain time.
- Reduce fuel pickup.

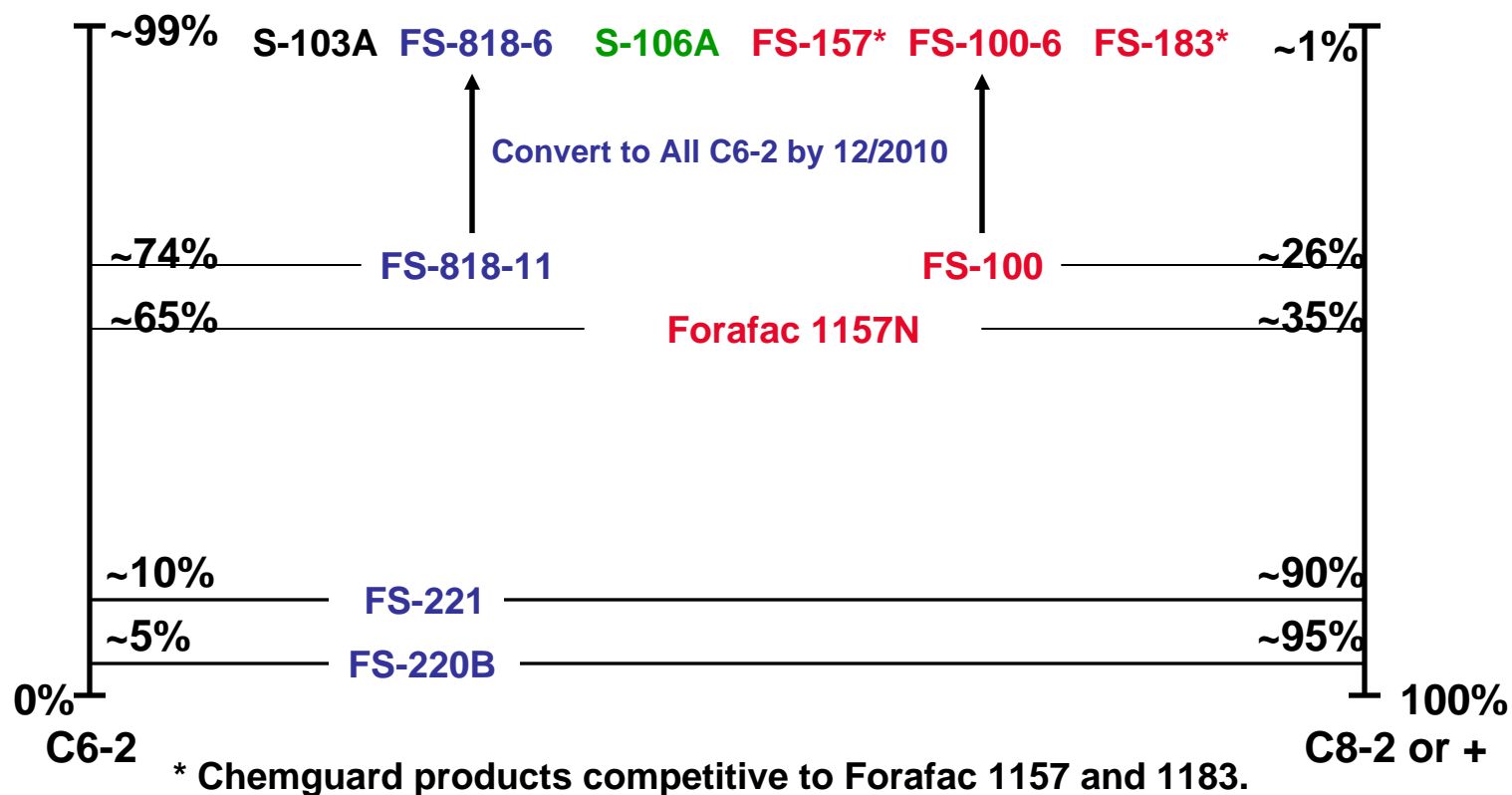
**We should assume that there will be consequences!
...And be proactive to them!**

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Many Fluorosurfactants are Already Available as C6-2 Telomers But Important C8-2 Telomer Based Products Remain

Color Scheme: Black = anionic, green = cationic,
red = amphoteric, blue = nonionic



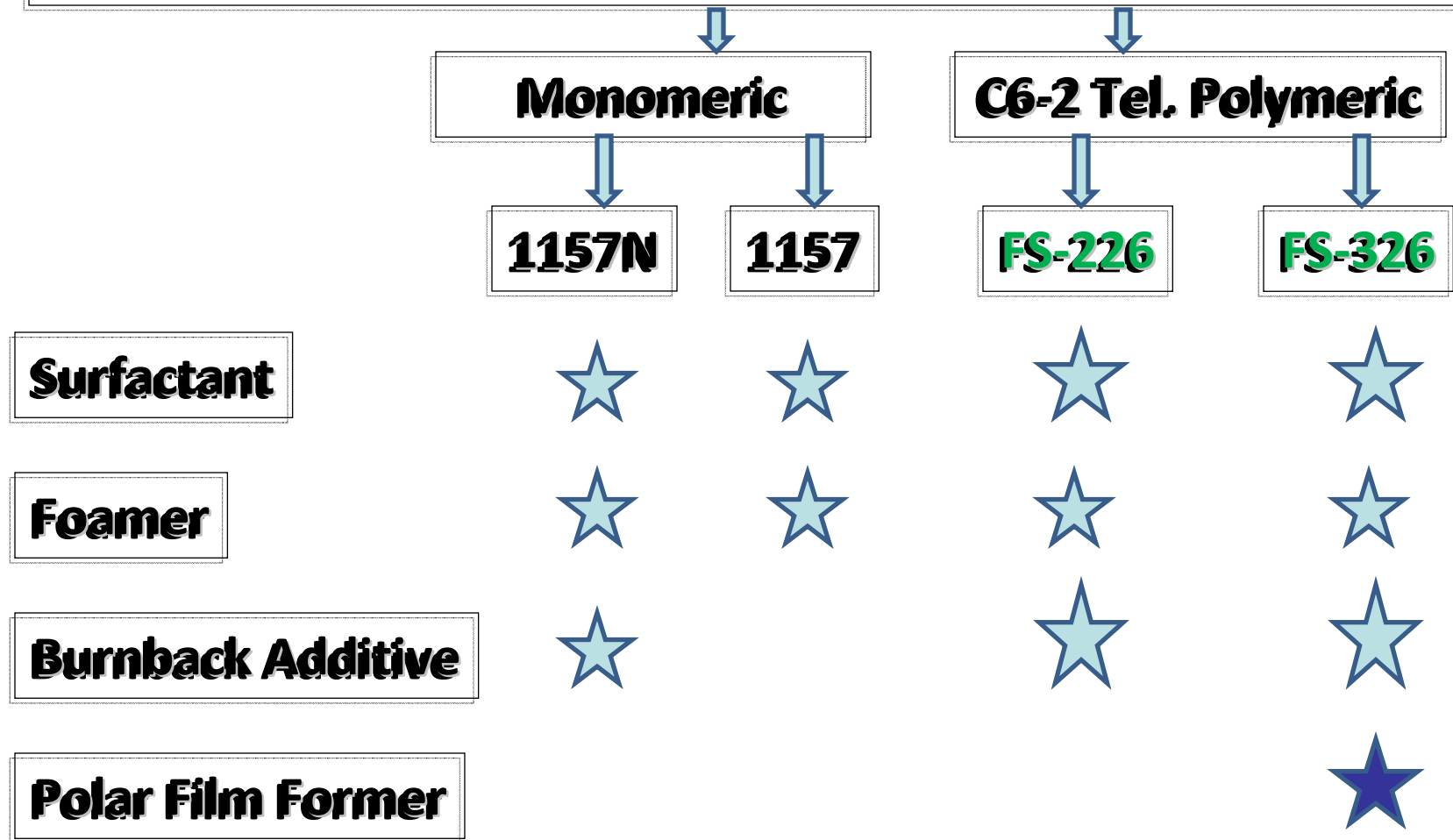
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Innovative C6-2 Telomer Based Polymeric Surfactants Replace C8-2 Telomer Based Fluorosurfactants

- ✓ **Chemguard has invented a series of High Molecular Weight Fluoropolymer Surfactants (HMW) for use in AFFF and AR-AFFF agents.**
- ✓ **These Fluoropolymer Surfactants improve foam expansion, drain time, and burnback resistance similar to C8-2 Telomer based FS-220B.**
- ✓ **The two being introduced, reduce surface tension to below 15.0 dynes/cm in warm water at 0.10% actives.**
- ✓ **Chemguard FS-226 (37% actives, 8.6%F) is formulated into AFFF or AR-AFFF concentrates as a replacement for C8-2 telomer based products.**
- ✓ **Chemguard FS-326 (30% actives, 7.5%F) is formulated into AR-AFFF concentrates as a replacement for C8-2 telomer based products and DX-5011 or 5022.**
- ✓ **Since Chemguard FS-326 is both a surfactant and polar stabilizer, less standard fluorosurfactant is needed to obtain low surface tension in AR-AFFF concentrates.**

Fluorochemicals for Fire Extinguishing Foams



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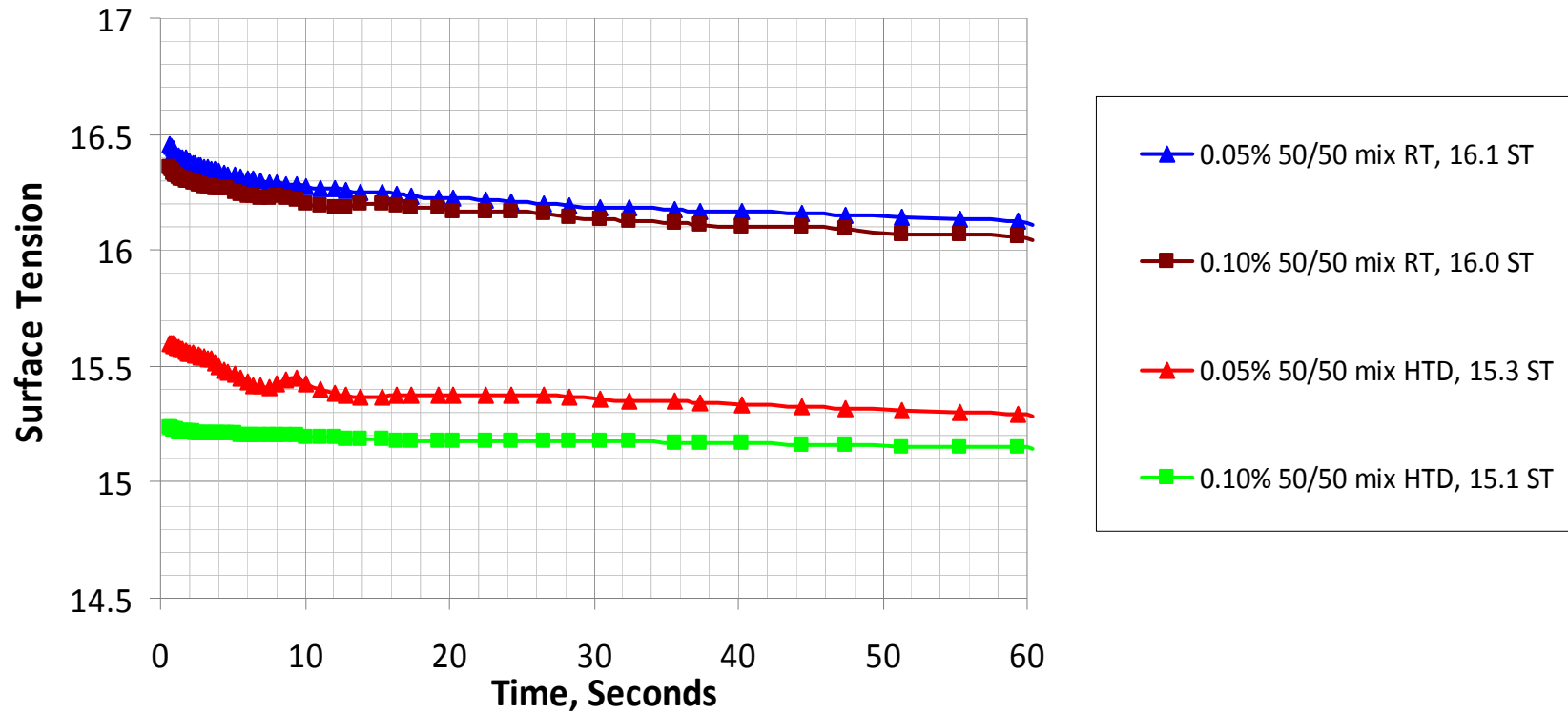
How would Chemguard FS-226/326 be incorporated into formulations? Like FS-220B!

<u>Possible Fluorosurfactant Concentrates:</u>	<u>226/326 %</u>	
Chemguard S-103A/S-106A (F-102R Type)	50	0
Chemguard S-103A/S-106A (F-410A Type)	30	0
Chemguard S-103A/FS-818-6 (40/60)	50	0
Chemguard S-103A/FS-818-6 (40/60)	30	0
Chemguard FS-157	50	0
Chemguard FS-157	30	0
Chemguard FS-157	0	55

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Mixing Chemguard S-103A/S-106A (50%) and FS-226 (50%) Gives a Strong F-102R Type Surfactant Concentrate Similar to Chemguard F-410A

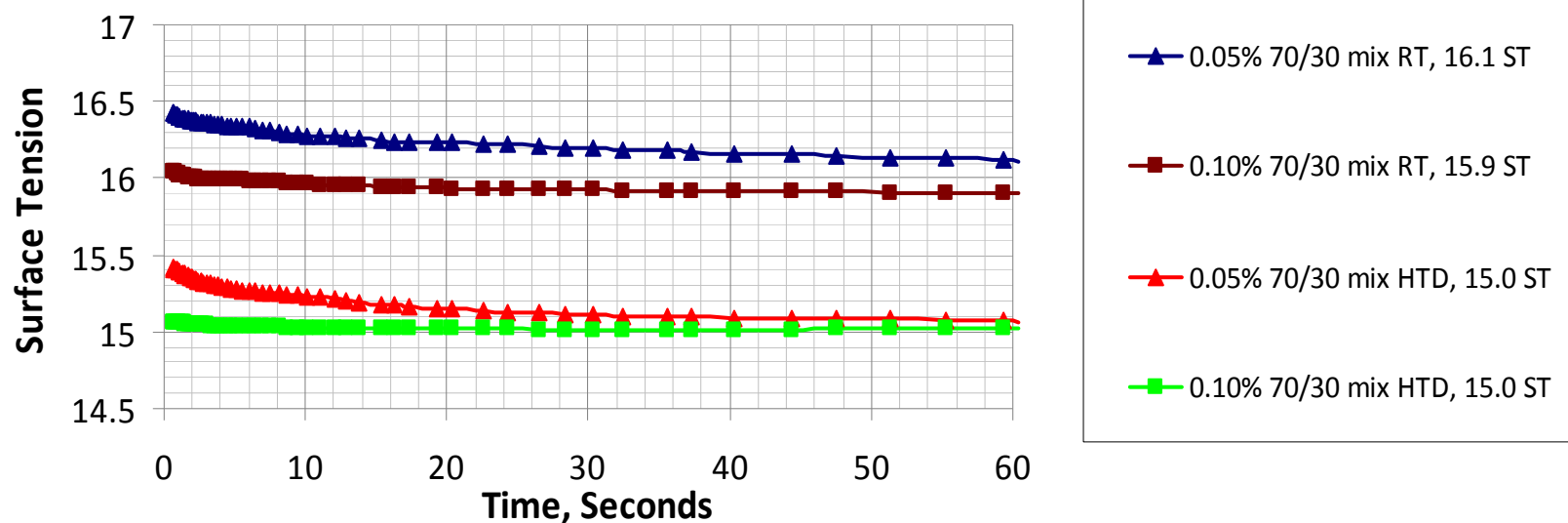


Percent Actives in Tap Water, RT = Room Temperature, HTD = heated
Surface tensions run on Kruss K-100 Tensiometer (dynes/cm)

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Mixing Chemguard S-103A/S-106A (70%) & FS-226 (30%) Gives a Strong F-410A Type Surfactant Concentrate Similar to Chemguard F-102R

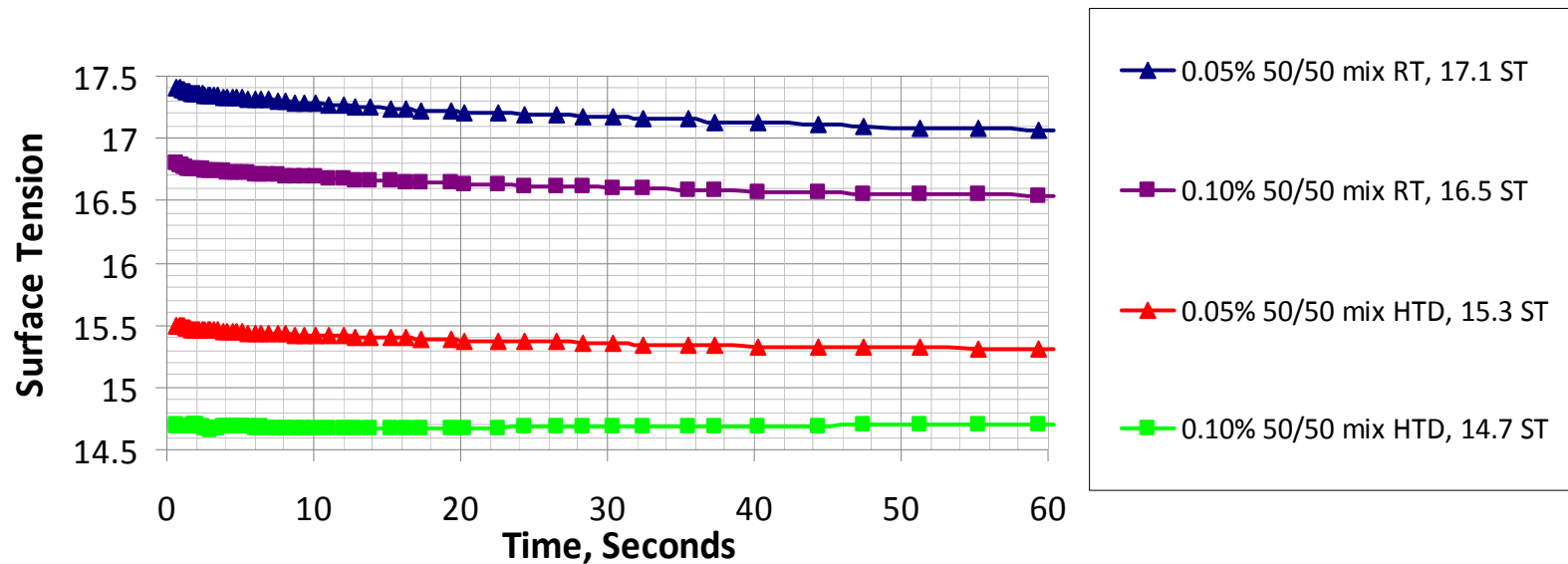


Percent Actives in Tap Water, RT = Room Temperature, HTD = heated
Surface tensions run on Kruss K-100 Tensiometer (dynes/cm)

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Mixing Chemguard S-103A/FS-818-6 (50%) & FS-226 (50%) Gives a Strong Surfactant Concentrate

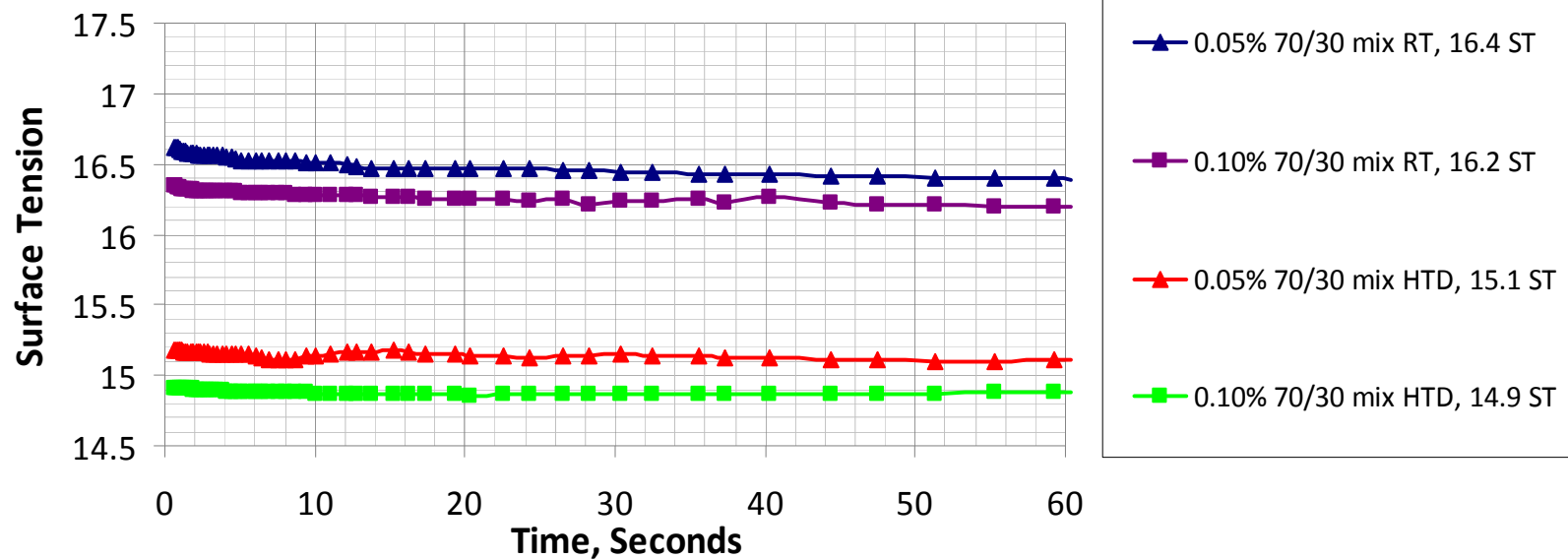


Percent Actives in Tap Water, RT = Room Temperature, HTD = heated
Surface tensions run on Kruss K-100 Tensiometer (dynes/cm)

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Mixing Chemguard S-103A/FS-818-6 (70%) & FS-226 (30%) Gives a Strong Surfactant Concentrate

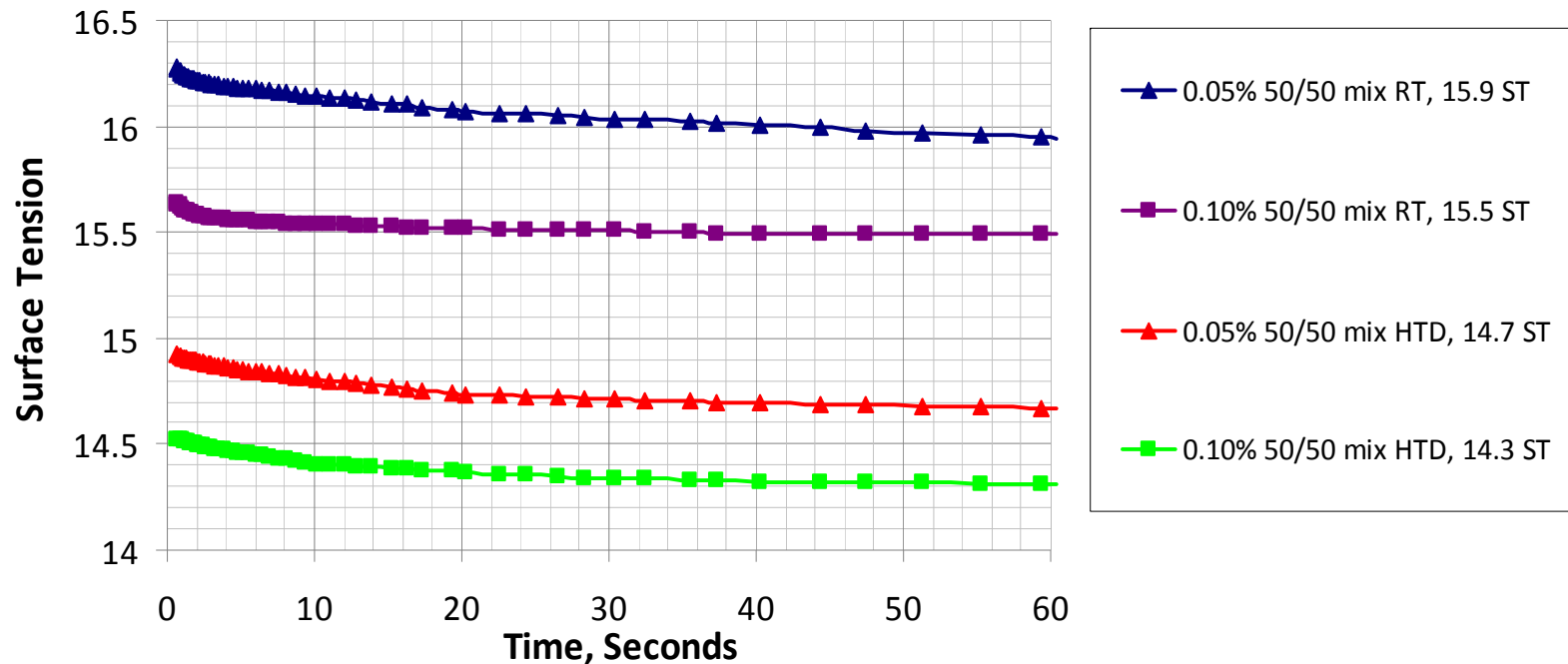


Percent Actives in Tap Water, RT = Room Temperature, HTD = heated
Surface tensions run on Kruss K-100 Tensiometer (dynes/cm)

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Mixing Chemguard FS-157 (50%) and FS-226 (50%) Gives a Strong Surfactant Concentrate

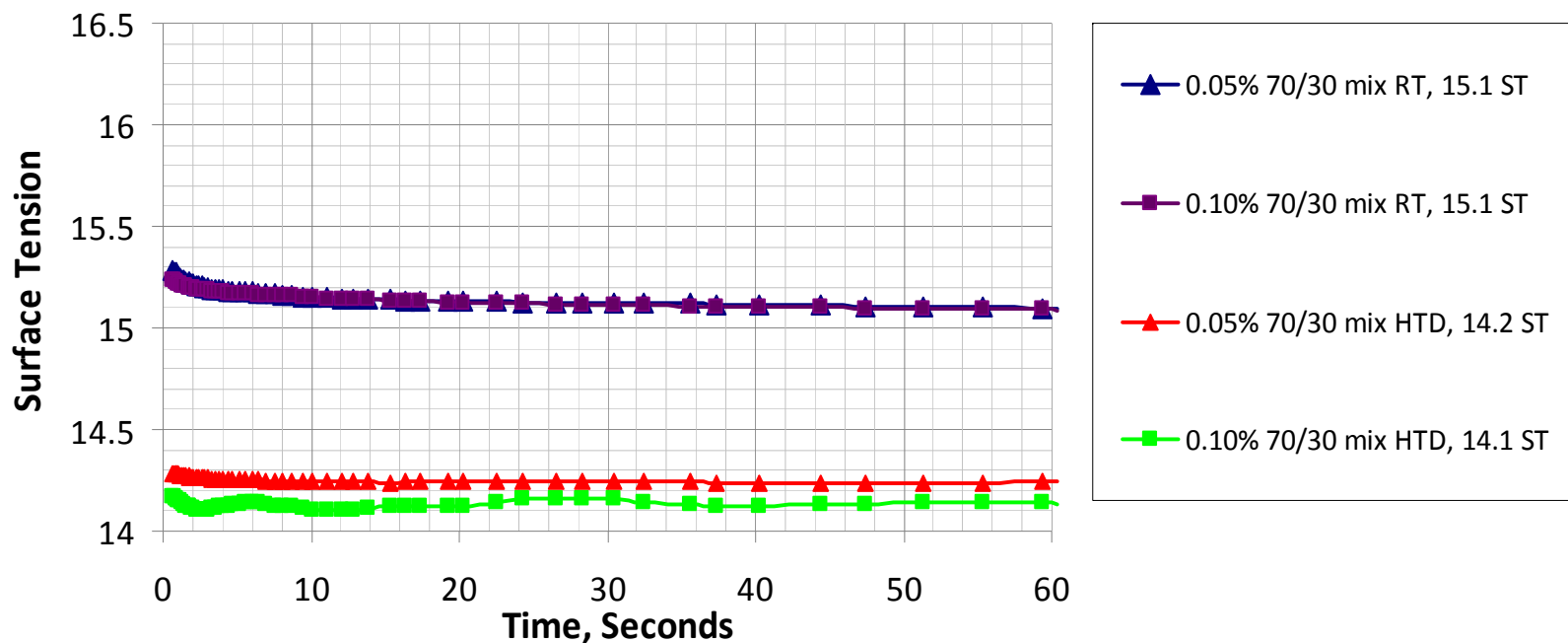


Percent Actives in Tap Water, RT = Room Temperature, HTD = heated
Surface tensions run on Kruss K-100 Tensiometer (dynes/cm)

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Mixing Chemguard FS-157 (70%) and FS-226 (30%) Gives an Even Stronger Surfactant Concentrate

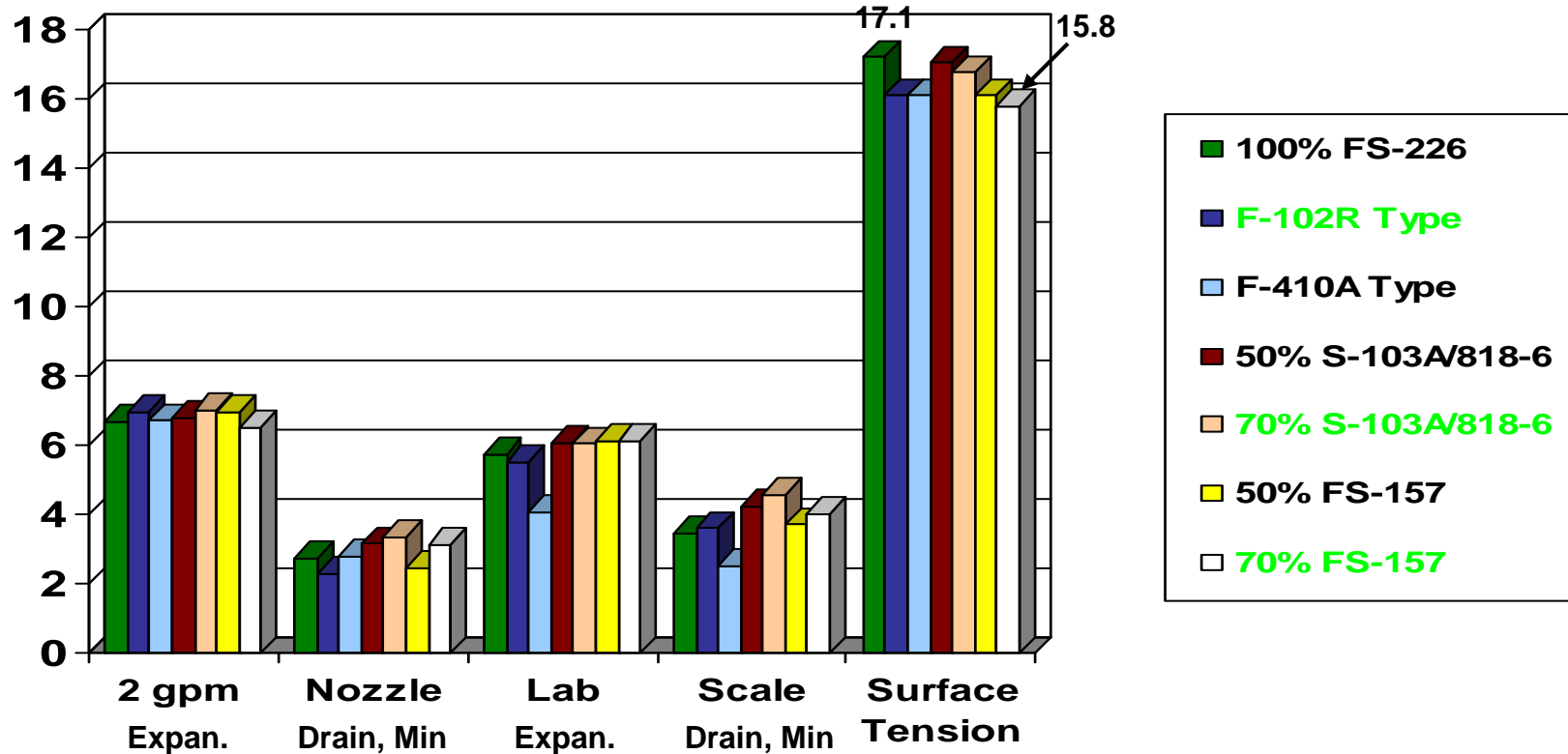


Percent Actives in Tap Water, RT = Room Temperature, HTD = heated
Surface tensions run on Kruss K-100 Tensiometer (dynes/cm)

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Foam Properties of Chemguard FS-226 Mixtures at 0.50%F In a Low Hydrocarbon Type 3% AFFF Concentrate



Diluted all samples to 3% in tap water. Surface Tension as Dynes/cm on a Kruss K-100 Tensiometer.

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3% AFFF Agent Made From Chemguard FS-226 Mixtures UL 162 Heptane Fire Tests (No FS-220B or C8/+)

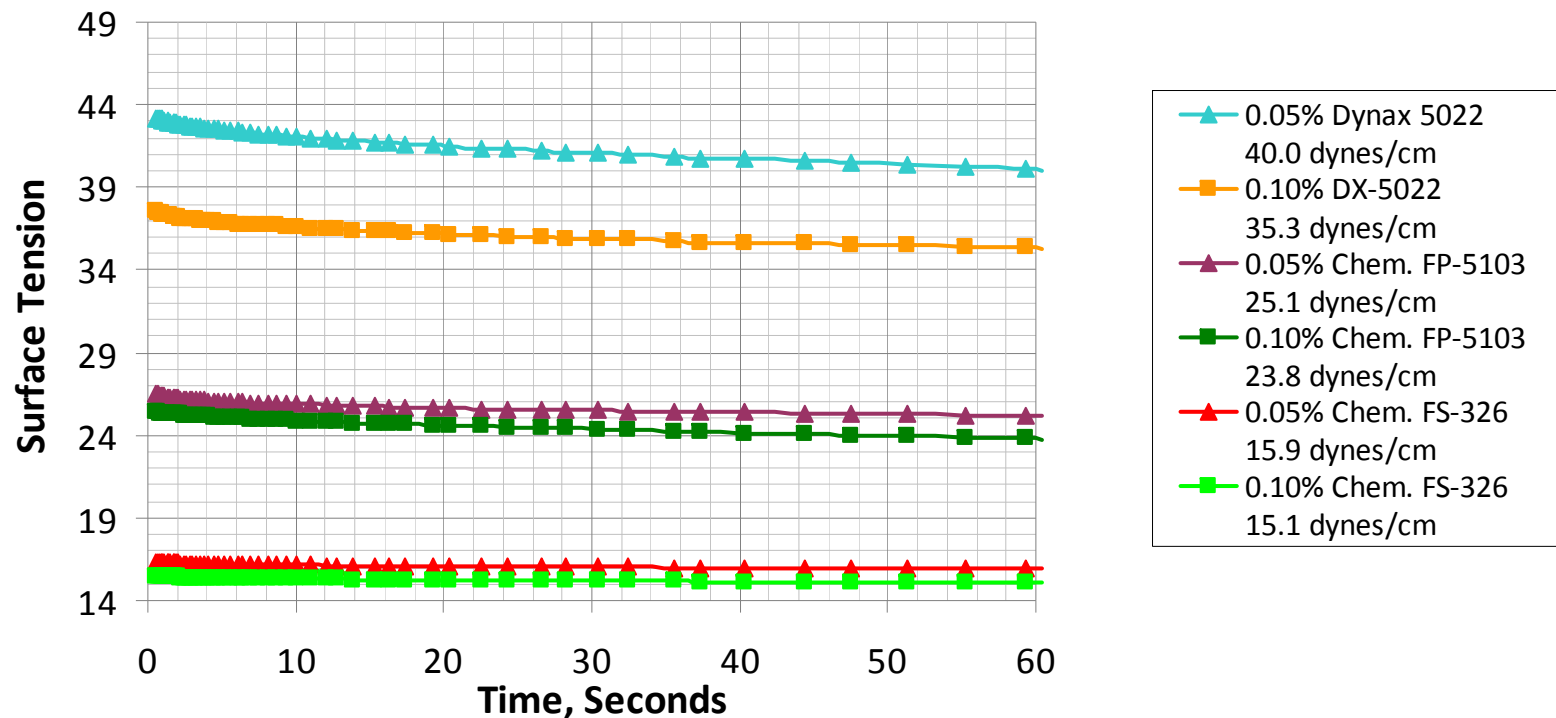
Components	% of "As Is" in 3% AFFF
Glucopon 325 (50%)	2.7
Sodium Decyl Sulfate	5.5
Sodium Octyl Sulfate	2.7
Cocoamido Hydroxy Sulfobetaine	0.5
Butyl Carbitol	8.0
Magnesium Sulfate Hydrate	2.0

Concentrate	% F FS-157	% F FS-226	%F in 3% Conc.	Exting. Time Min.	Time to 20% BB Min.	Expansion/Drain in Fire Test
No FS-226	0.49	0	0.49	1'36	6'21	8.5/4'10
45% FS-226	0.33	0.21	0.54	1'35	8'30	8.8/4'21
62% FS-226	0.22	0.27	0.49	1'38	10'08	9.3/4'08

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Chemguard FS-326: A Powerful AR-AFFF Additive And for the First Time: An Exceptional Surfactant

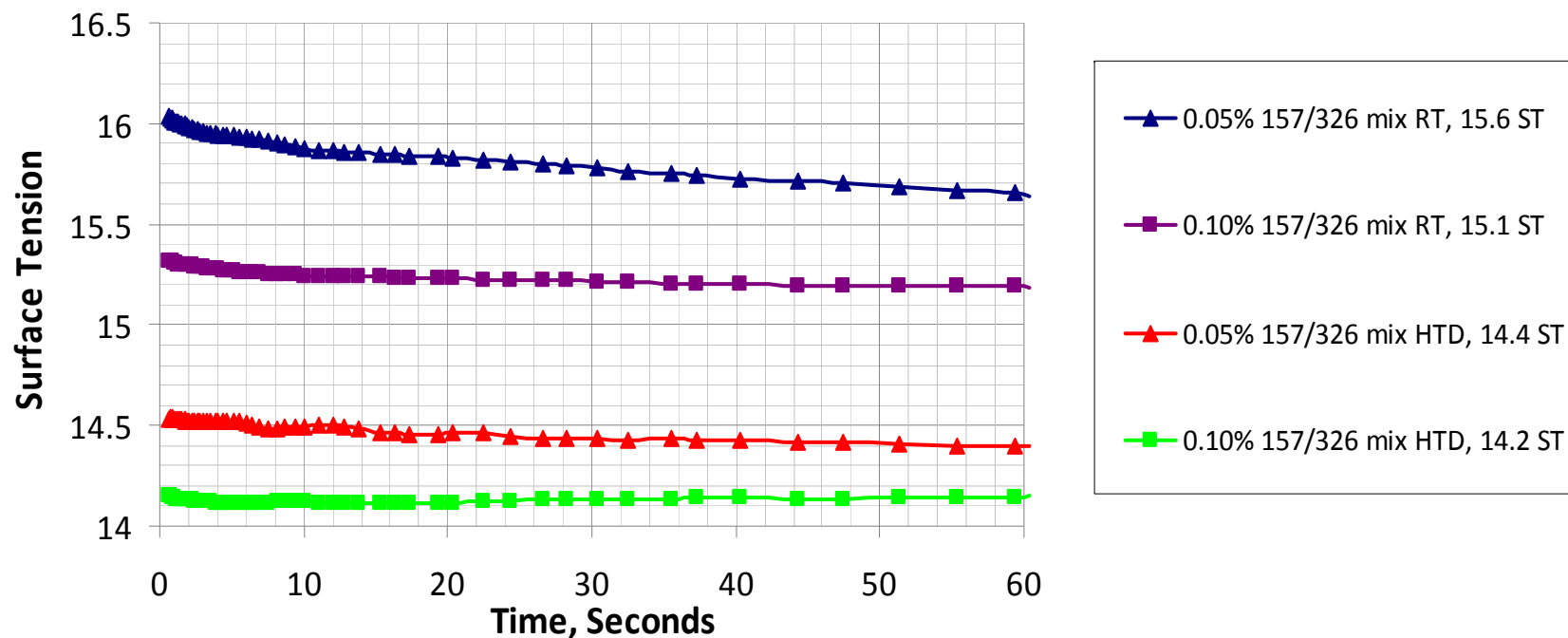


Percent Actives in Tap Water at Room Temperature
Surface tensions run on Kruss K-100 Tensiometer (dynes/cm)

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Mixing Chemguard FS-157 (45%) and FS-326 (55%) Gives Exceptional Surfactant Performance at Low Actives While Providing a Powerful Polar Solvent Barrier

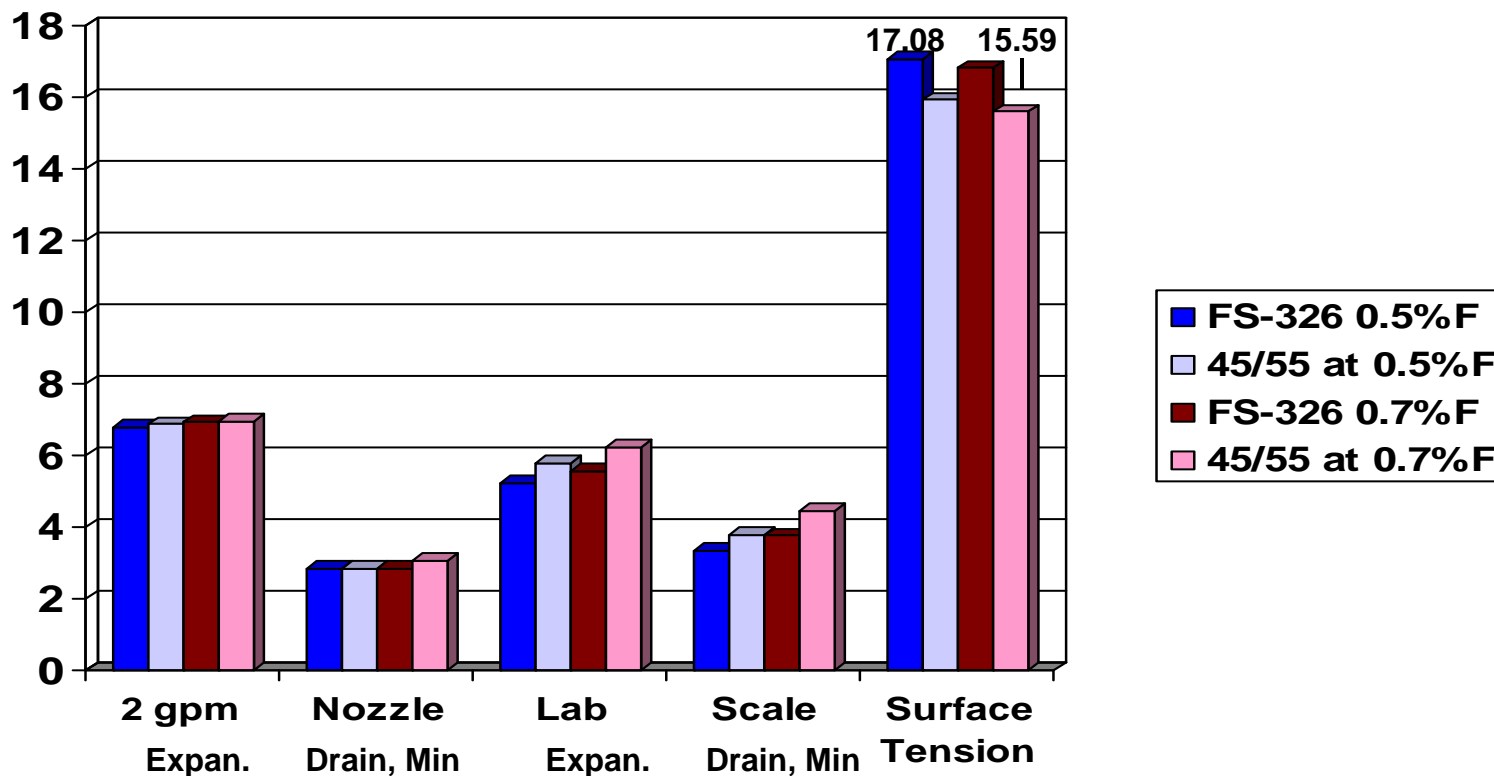


Percent Actives in Tap Water, RT = Room Temperature, HTD = heated
Surface tensions run on Kruss K-100 Tensiometer (dynes/cm)

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Chemguard FS-326 and Mixtures With 45% FS-157 at 0.5/0.7%F In a Low Hydrocarbon Type 3% AFFF Concentrate (No Polysaccharide Included)



Diluted all samples to 3% in tap water. Surface Tension as Dynes/cm on a Kruss K-100 Tensiometer.

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**Fluoropolymer Concentrate 45/55 FS-157/FS-326 at 0.70%F
UL162 Fire Tests With and Chemguard FP-5103
(No DX-5011, DX-5022 or C8-2/+ Telomer)**

Components	% of "As Is" in 3% AFFF
Glucopon 325 (50%)	4.0
Sodium Decyl Sulfate	8.0
Sodium Octyl Sulfate	4.0
Cocoamido Hydroxy Sulfobetaine	1.0
Butyl Carbitol	8.0
Polysaccharide Gum	1.0/1.2
Magnesium Sulfate	1.5

Concentrate	% F of 45/55 mix	% F FP-5103	%F in 3% Conc.	IPA Temp (F)	Exting. Time Min.	Time to 20% BB Min.	Expansion/ Drain in Fire Test
1.2% Polysac.	0.70	0	0.70	58	2'43	8'50	6.1/NA
1.0% Polysac.	0.70	0.05	0.75	63	2'27	10'55	5.6/10'24

IPA Fire test run at 3% in tap water at 4.2 gpm and 104 psi.

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What is the bottom line on Chemguard FS-226/326?

- ✓ Chemguard FS-226/326, when mixed with FS-157, S-103A/FS-818-6, and S-103A/S-106A, enhance their surface tension and foam properties.
- ✓ Chemguard FS-226/326 work best with FS-157 to formulate AFFF and AR-AFFF agents with premium properties at low fluorine content.
- ✓ Both products have been prepared on a pilot scale (>2,400 lb) and are ready for sampling to potential customers.
- ✓ PMN preparation for Chemguard FS-226/326 is nearing completion.
- ✓ Two broad based patent applications are nearly completed covering Chemguard FS-226/326 as surfactant and fire agent additives.
- ✓ A third polymer is being studied for use in Protein Concentrate: Early results look promising.

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