Longer Life Nylon Spunbond Fabric for Filtration Media

AFS Fall Conference 2016

Session S2.2.3

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Items of Discussion

Lubrication Oil Market issues

- General Market Introduction

Phase 1 Study

- Ethylene Glycol Contamination

Phase 2 Study

- Longer Life Issues associated with Corrosive Oils

Lube Oil Filtration Challenges

Market Drivers

- Increased Fuel Efficiency
- Reduced Greenhouse Gas Emissions
- Lower Operating Costs

New Engine Designs

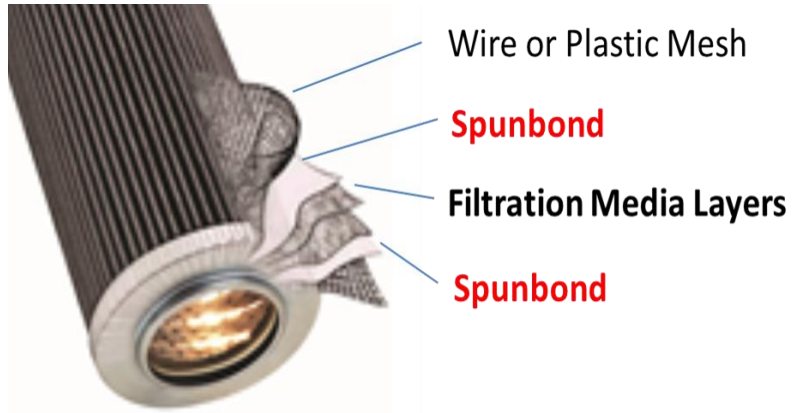
- Higher Operating Temperatures
- Long Service Life Intervals
- More Chemical Additives
- Finer Particle Retention

Advanced Substrate Media Development

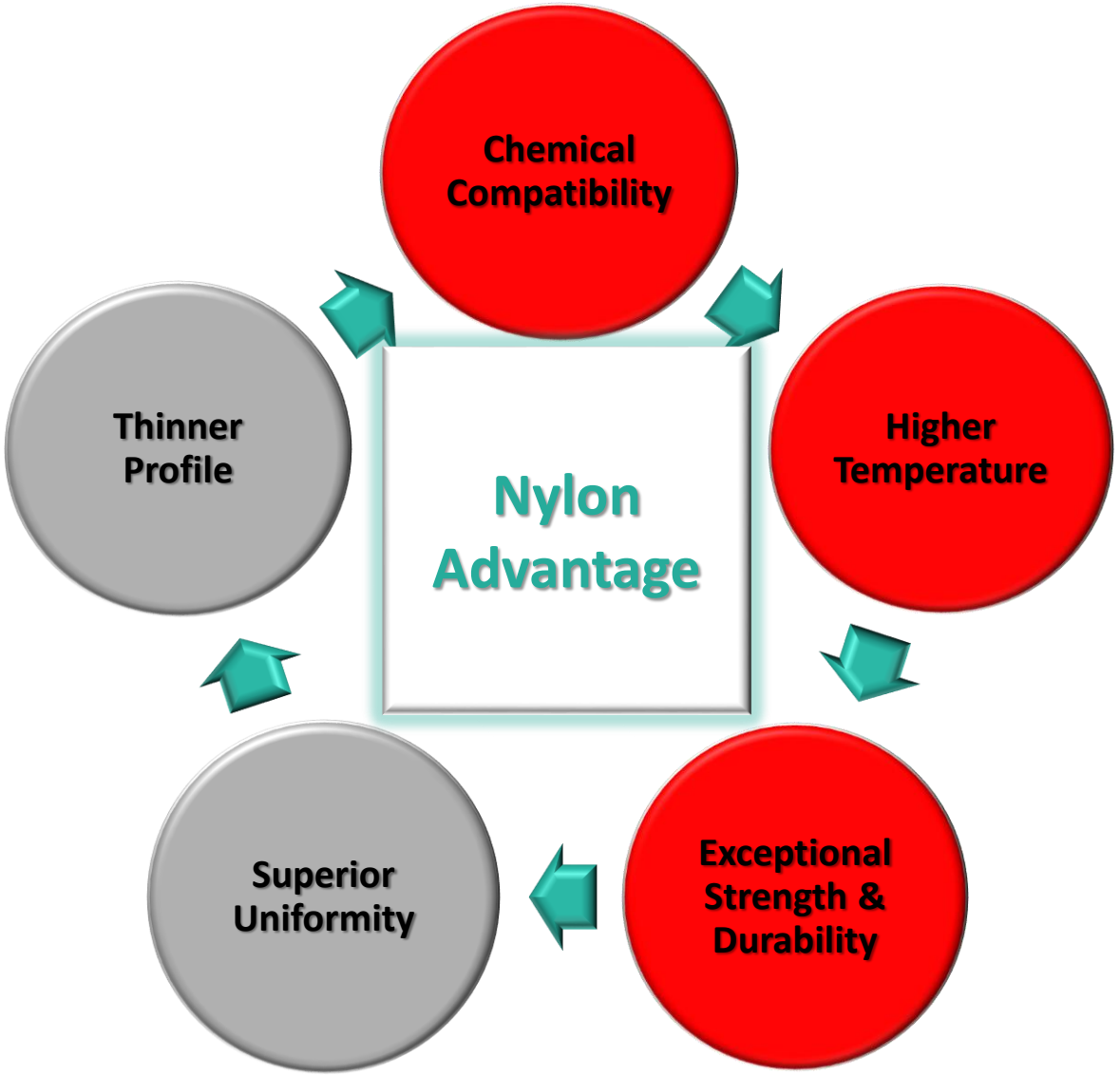
Advanced Filtration Enabling Media Development

Spunbond Substrates are an important component in advanced Lube Oil filters

- ✓ Provides **strength** for burst & pulsation protection.
- ✓ Acts as a **barrier** between the media and mesh screen providing abrasion protection to the media.
- ✓ **Protects** media in pleating and assembly.
- ✓ Provides overall media **support** to withstand compression and stress.



Nylon (PA66) Advantage vs Polyester Substrates



Phase 1

Ethylene Glycol Contamination

Ethylene Glycol – Industry wide concern

"When a lubricating oil is contaminated with coolant, your machines are exposed to a powerful and poisonous mixture of chemicals with the potential to cause massive failure of machine components in little time. In fact, a major diesel engine OEM has estimated that 53 percent of all catastrophic engine failures are due to coolant leaks"

Effects of Coolant Contamination in Engine Oil

- Allen Bender, OAI Manager

"62% of lubrication professionals say glycol contamination has caused problems for their company's equipment…"

The Effects of Glycol Contamination in Engine Oils

- Wes Cash, Noria Corporation

"…in a study by the Fleetguard filter division of Cummins Engine…reported as much as 77 grams of filterable solids are formed when oil is contaminated with coolant containing ethylene glycol at a concentration of just two percent."

"…heavy-duty fleet equipment deployed in mining and construction reported that glycol was found in 8.6 percent of motor oil samples over a period of years – about one in 12 samples."

Glycol in Lubricating Oil – Detection, Analysis and Removal

- Jim Fitch, Machinery Lubrication

"Oil filtration suffers as filter material becomes plugged. The filter may even experience such high pressure differential that interior parts may collapse."

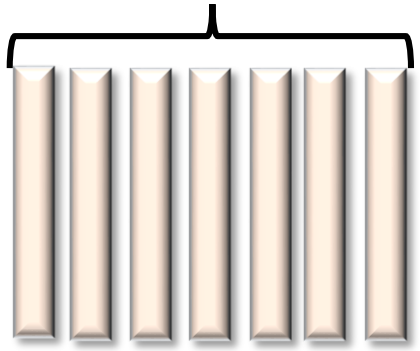
Technical Service Bulletin 89-1R2

- Filter Manufacturers Council

Experimental Methodology

Evaluate the impact of temperature and the concentration of coolant on the tensile strength of commonly used spunbond fabrics using the ASTM D543 chemical immersion procedure.

Tested 34 gsm Nylon 6,6 & PET Spunbond Fabrics



7 specimen sample size

Temperature

- 100°C

Concentration Levels

1. 96% Oil with 4% Coolant
2. 98% Oil with 2% Coolant

Test Fluids

Oil - Chevron Delo® 400LE

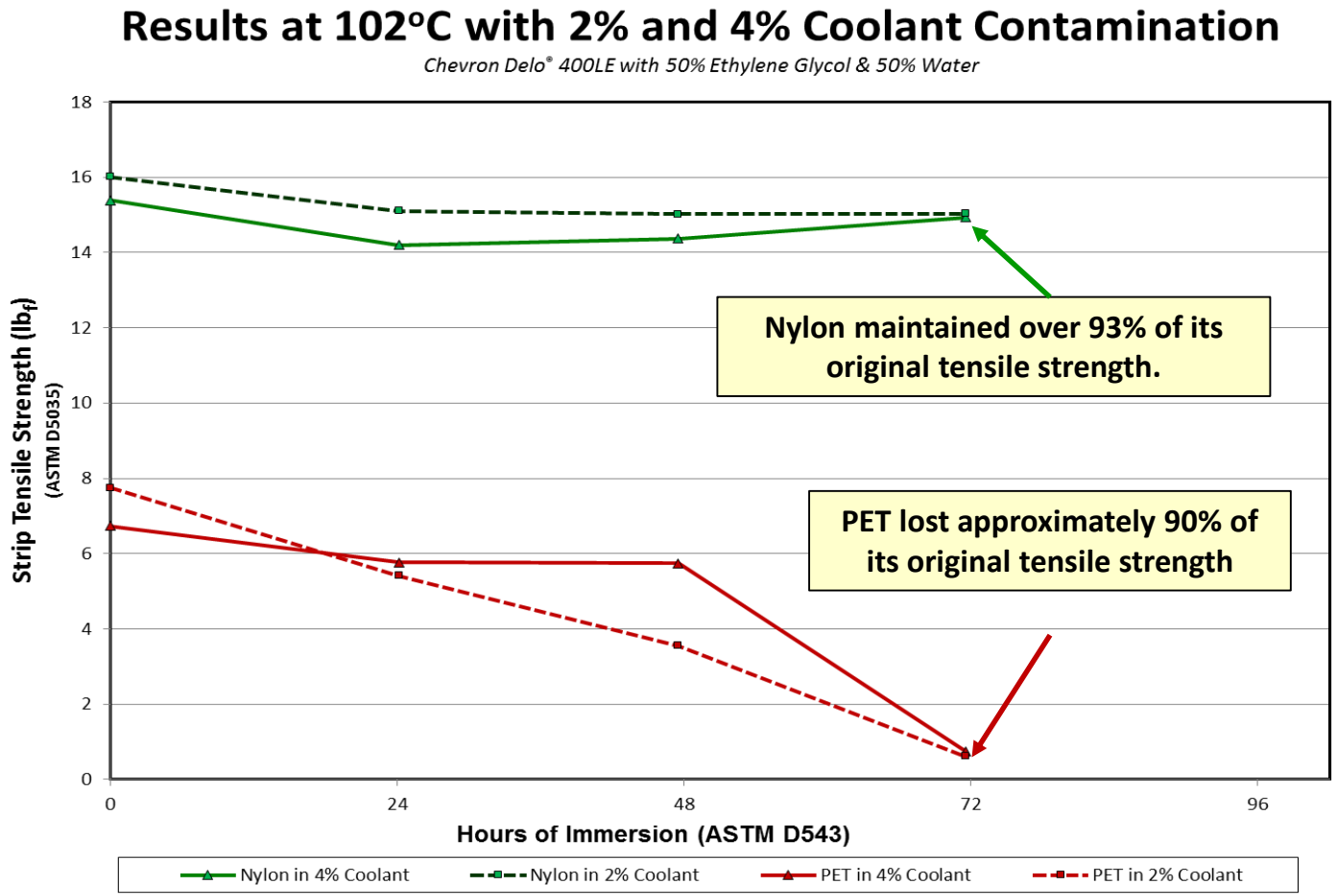
Coolant - 50% EG / 50% Deionized H_20

Strip Tensile Testing

Mark 10 Tester (ASTM D5035)

2% vs 4% EG Contamination @ 102°C

- Doubling the coolant concentration did not significantly impact the results for either spunbond.
- PET deteriorates rapidly in the 72 hour test timeframe.
- Nylon spunbond was unaffected by the coolant.

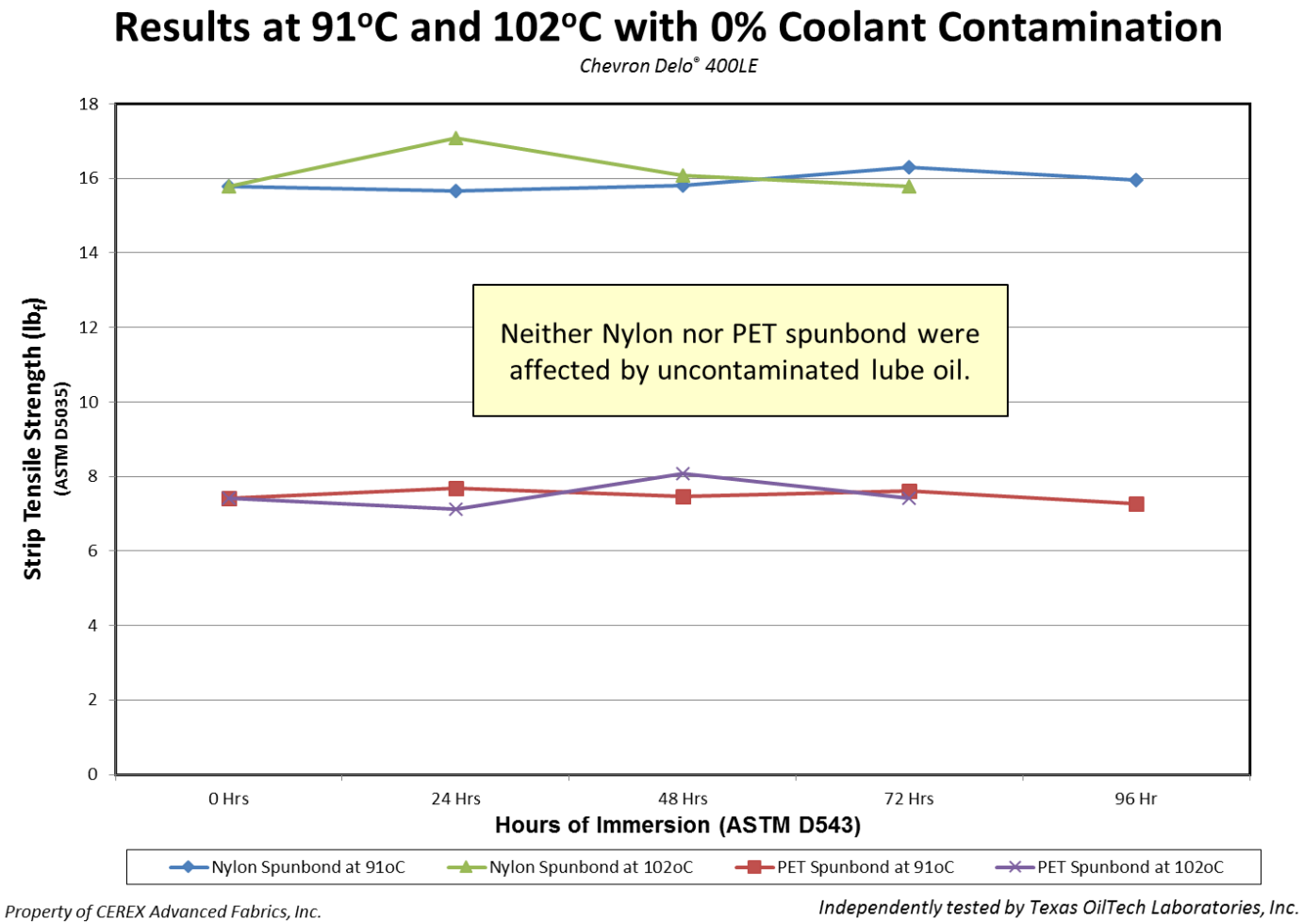


Property of CEREX Advanced Fabrics, Inc.

Independently tested by Texas OilTech Laboratories, Inc.

Polyester & Nylon in Uncontaminated Lube Oil

- As a test control, both the Polyester and Nylon spunbond were exposed to uncontaminated lube oil at elevated temperatures.
- This test confirms that the coolant contamination is the chemical component that attacks the Polyester spunbond.



Independently tested by Texas OilTech Laboratories, Inc.

How Long will the Nylon Last?

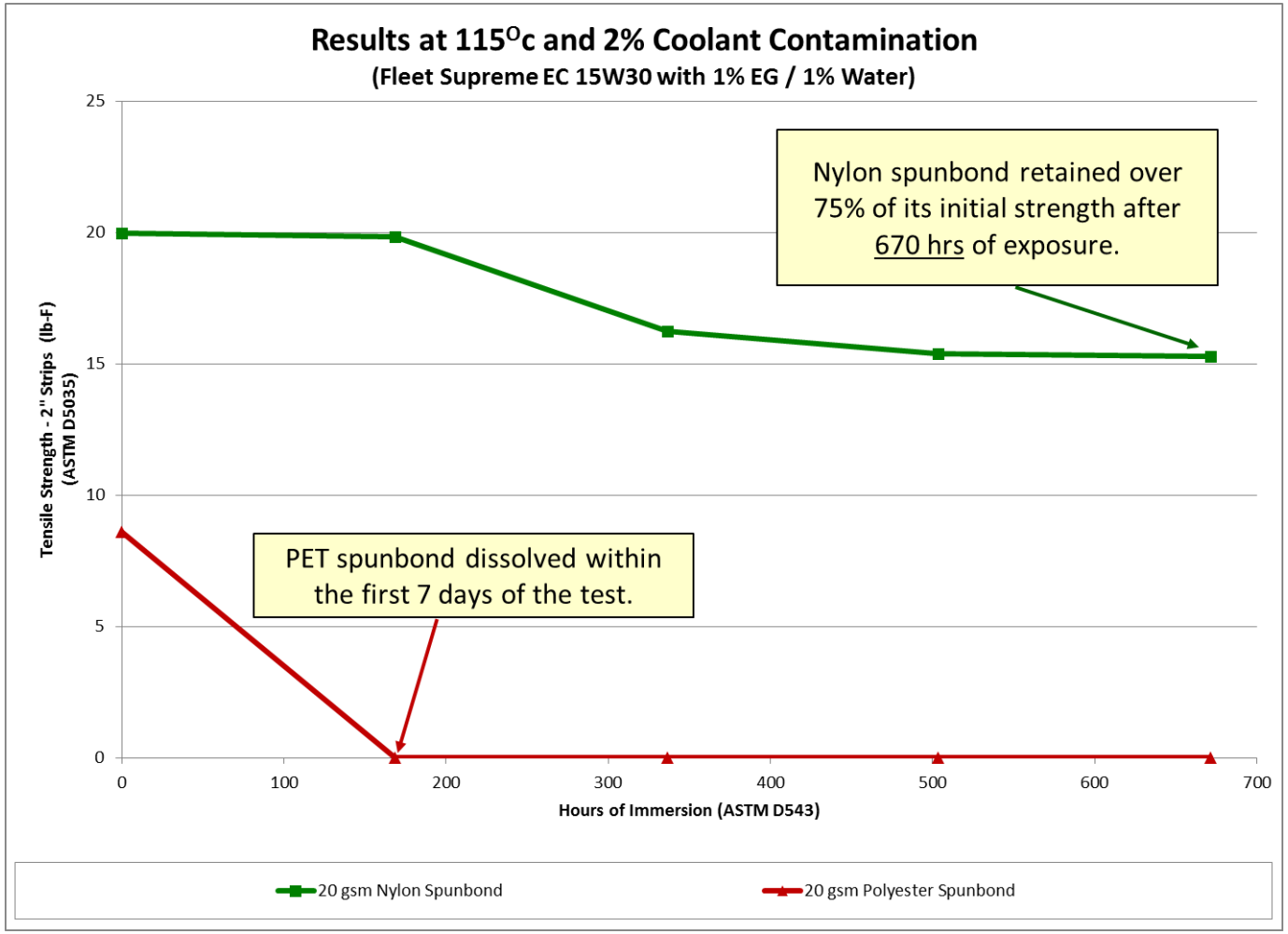
More Aggressive Accelerated Test

- ***at 115^{O}C***
- ***with a 2% coolant contamination***
- ***over a period of 670 hours (28 days)***
- ***using 20 gsm (vs 34 gsm) spunbond fabrics***

These conditions create a much more difficult long term exposure test that should identify any durability issues with the Nylon spunbond substrate.

670 hours of continuous exposure equates to more than 40,000 miles on the road

- **The 20 gsm Polyester was completely dissolved during the first 7 days of exposure.**
- **The 20 gsm Nylon strength declined ~25% over the life of the test.**



Phase 2

Longer Life Issues associated with Corrosive Oils

Extend Filter Life in "Corrosive Oil"

- Objective – Extend Filter life from 25000 to 40000 mile cycle
- Evaluate – Nylon substrate in longer life application in corrosive oil environments
- Two Lubrication Oil Samples
  - Each sample with approx. 25000 miles of service life
- Sample Oil A
  - TAN 3.7
  - TBN 3.8
  - High degree of acidification of the oil has occurred
- Sample Oil B
  - TAN 2.9
  - TBN 4.8 (Oil Buffers still active)
  - Sample Oil B suspected of having make-up oil and/or additives

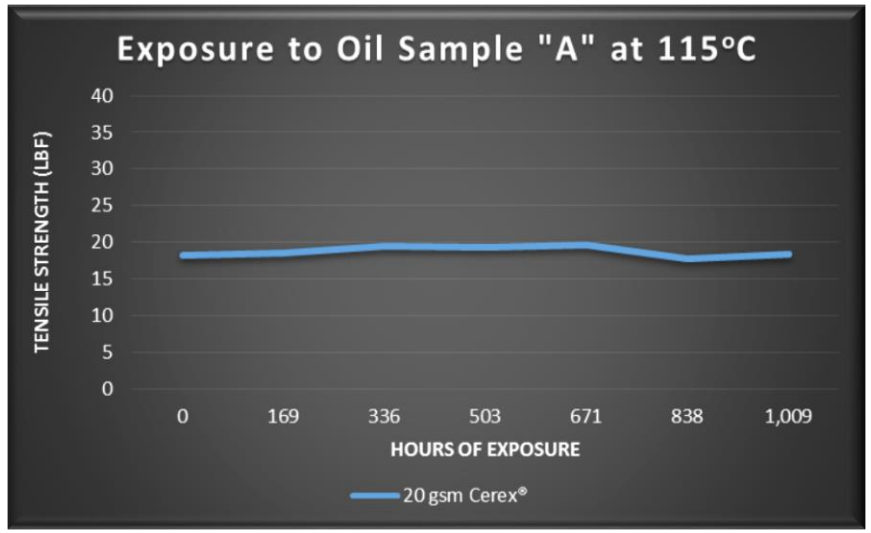
Results of Chemical Evaluation

Fluid	Exposure	EPA 9045D Corrosivity (pH)	EPA 9056A Nitrate (ppm)	EPA 9056A Sulfate (ppm)
Fleet Supreme EC	No Heat	7.2	474	7,550
Sample Oil "A"	No Heat	6.7	874	8,990
After 670 hours at 115°C		6.1 (9%)	845 (3%)	8,030 (10%)
Sample Oil "B"	No Heat	6.9	774	6,690
After 670 hours at 115°C		5.7 (17%)	644 (17%)	4,150 (38%)

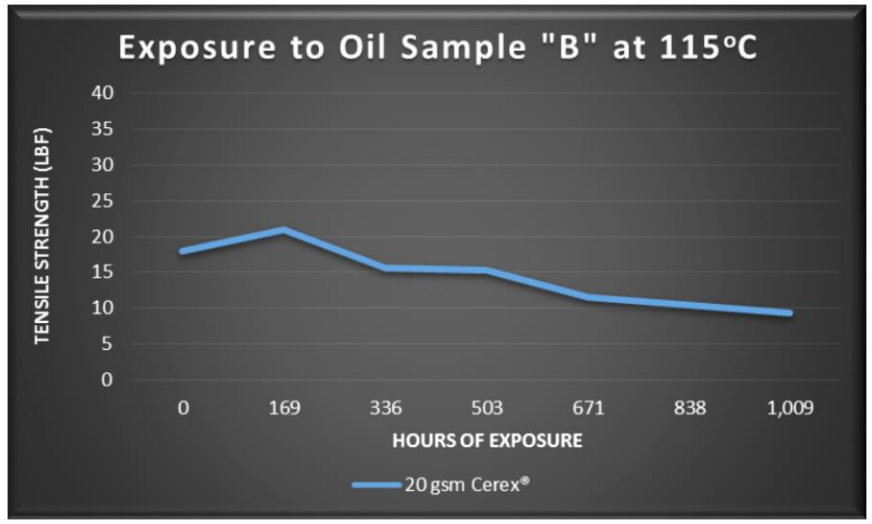
Sample "B" showed a greater change in Nitrate and Sulfate levels during a 670 hour (additional 40,000 miles) exposure to 115°C.

20 gsm Nylon Spunbond Exposure Test

- **The tensile strength of the 20 gsm Nylon "control" was stable over the entire 1,000 hrs. in Sample Oil A**

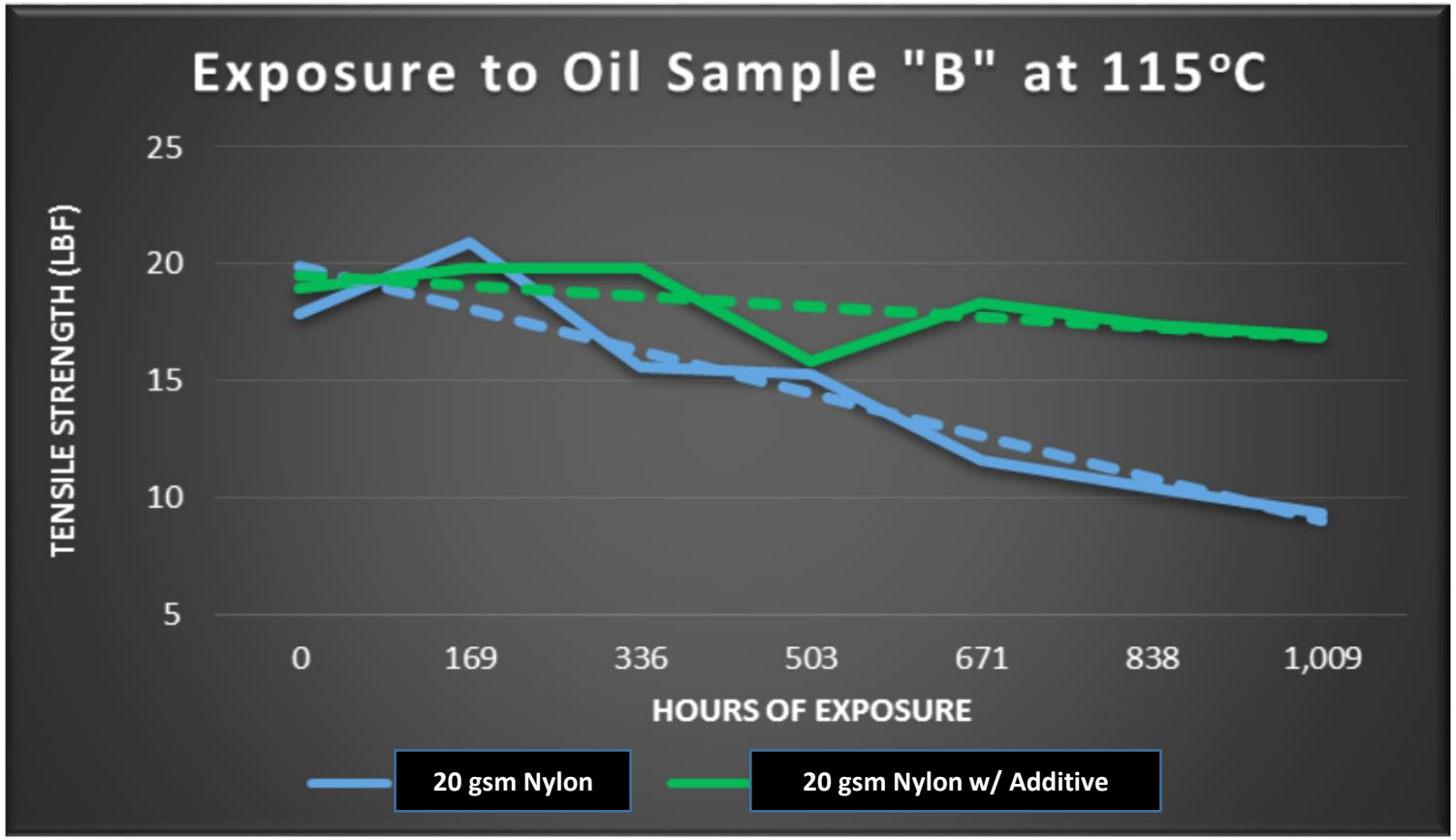


- **The tensile strength of the 20 gsm Nylon "control" declined 48% in 1,000 hrs. in Sample Oil B**



Nylon Spunbond Exposure in Sample Oil "B"

- A modified Nylon substrate utilizing a longer life additive was evaluated in Sample Oil B to minimize loss of Tensile Strength
- The rate of Tensile Strength decline was reduced from 48% in the Nylon Control to 12% in the Nylon with the longer life additive



Use of an additive appears to be a good option for extending the nylon spunbond service life.

Conclusions

- **Lubrication Oil filter design should employ Nylon Substrate over Polyester Substrate if Ethylene Glycol contamination is a concern**

- **Lubrication Oil filter life can be extended beyond normal change-out periods (even in "corrosive oils") if a modified Nylon Substrate with an enhancing longer life additive is utilized**

Thank You!

Please visit our Tabletop Display or contact us for additional information about CEREX Advanced Fabrics' high quality spunbond Nylon products.

John Hancock
Filtration Sales Manager
(615) 630-1986
JHancock@Cerex.com

www.cerex.com