Uniformity Comparison of Selected Spunbond Fabrics

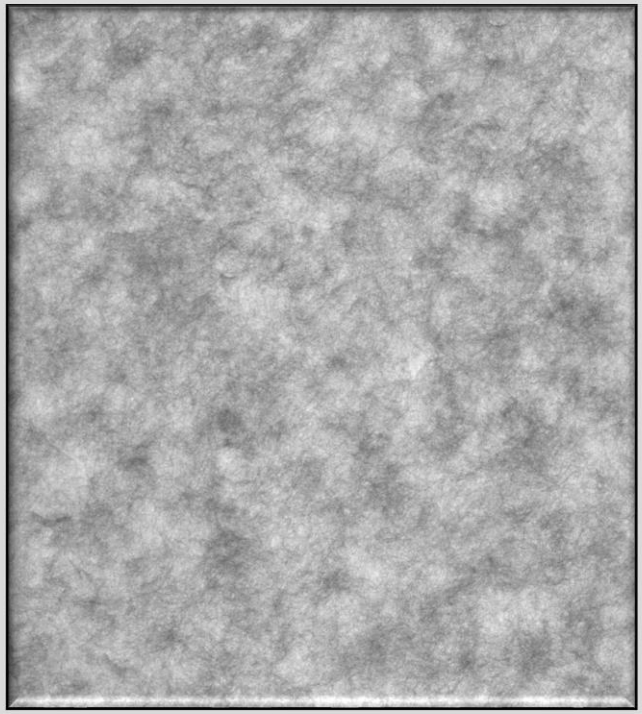
AFS 2017 Spring Conference

April 12, 2017

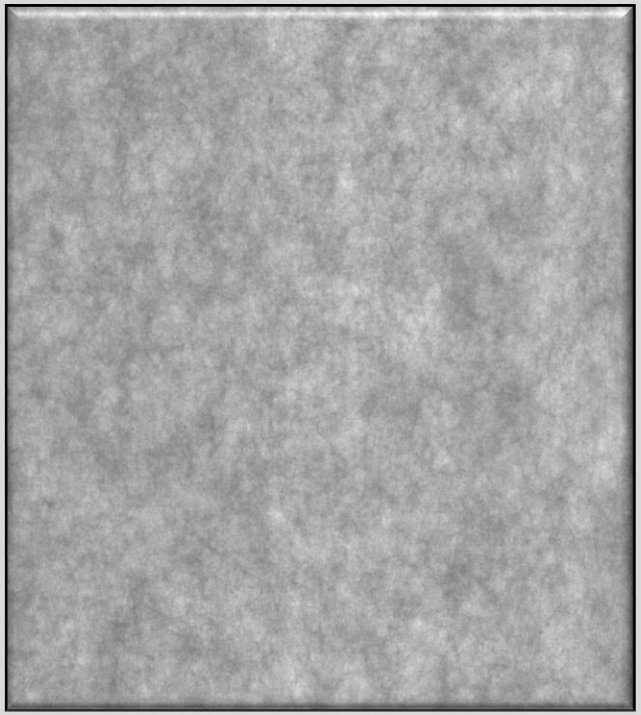
Purpose of Study

- **Compare uniformity of flat spunbond nylon fabric to flat spunbond polyester fabric**
  - ✓ ***Optically***
  - ✓ ***Using previously presented Avintiv Uniformity Indices***
  - ✓ ***Using transmitted light data***
- **Discuss advantages of more uniform fabric**

Optical Comparison
(20 gsm spunbond fabrics)



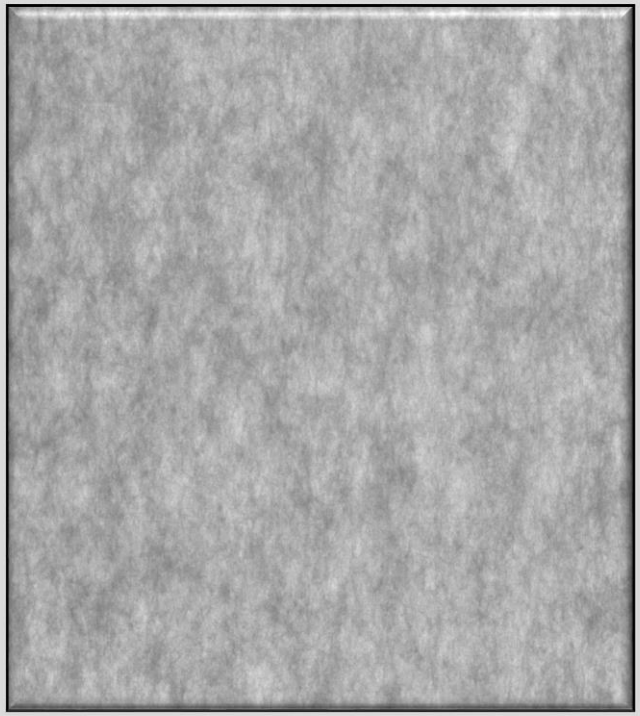
Polyester



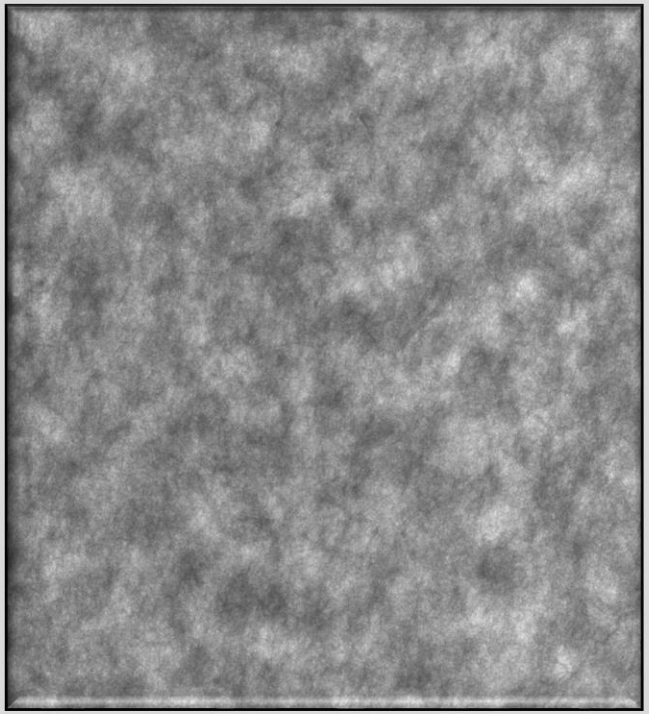
Nylon

Sample size is 17 cm by 15 cm

Optical Comparison
(34 gsm spunbond fabrics)



Nylon



Polyester

Subjectively, most people agree that the optical uniformity of nylon is better than polyester

Sample size is 17 cm by 15 cm

Avintiv Uniformity Indices

$$\mathbf{M2} = (\sigma_{\text{basis weight}} + \sigma_{\text{thickness}}) * 100$$

$$\mathbf{M3} = (\sigma_{\text{basis weight}} + \sigma_{\text{thickness}} + \sigma_{\text{air permeability}}) * 100$$

More uniform fabrics have a "Lower" index

These indices were developed by Avintiv to compare materials

Reference: "Impact of Substrates on Nanofiber Formation" Betty J. Wells; AFS 2015 Fall Conference October 7, 2015

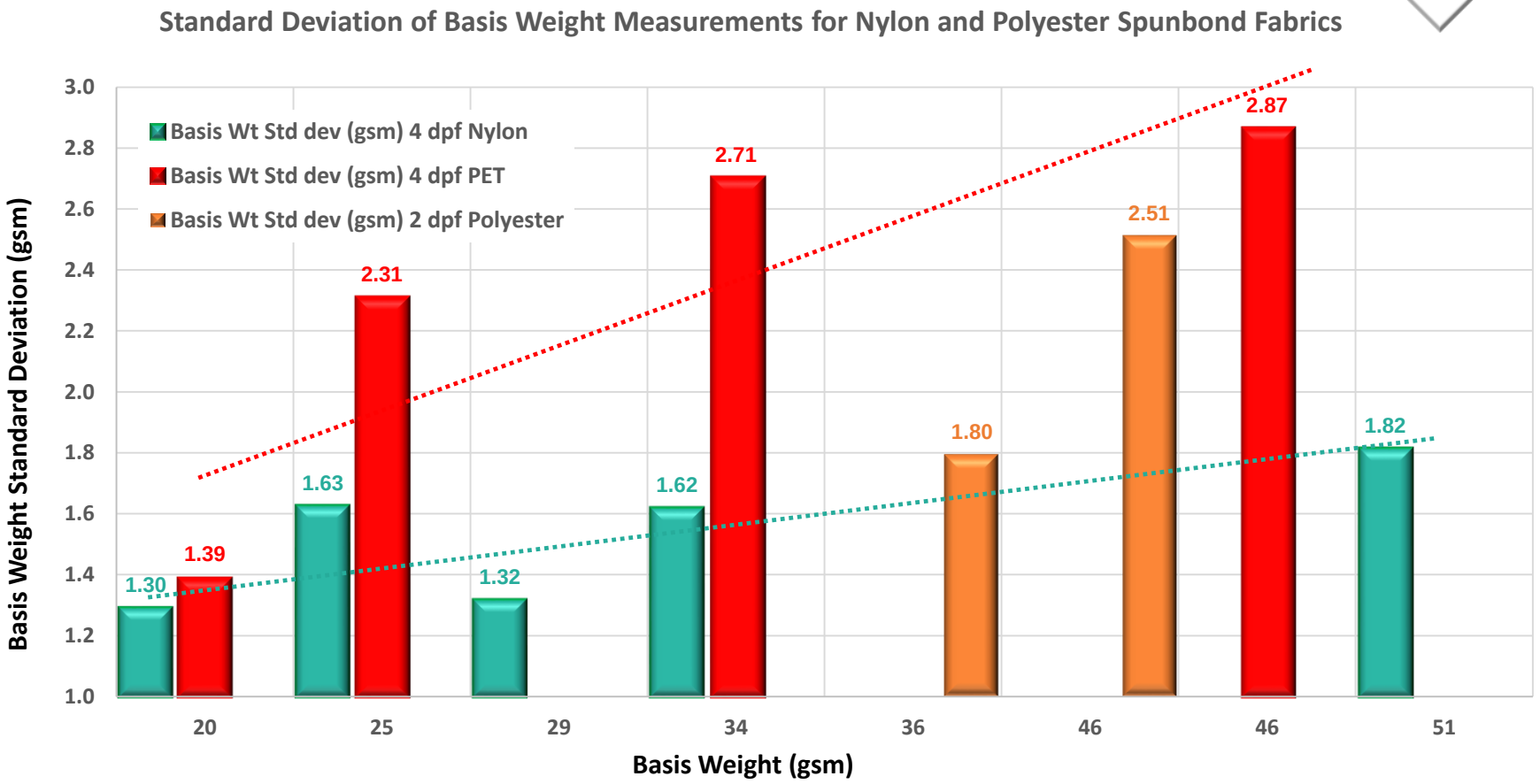
Sampling Plan and Test Methods

- Commercially available polyester spunbond fabrics were purchased at a minimum width of 64 inches
- Basis weights between 20 and 51 gsm
- 10 samples taken in the machine direction
- Cross directional samples taken every 30 cm

ASTM Test Methods

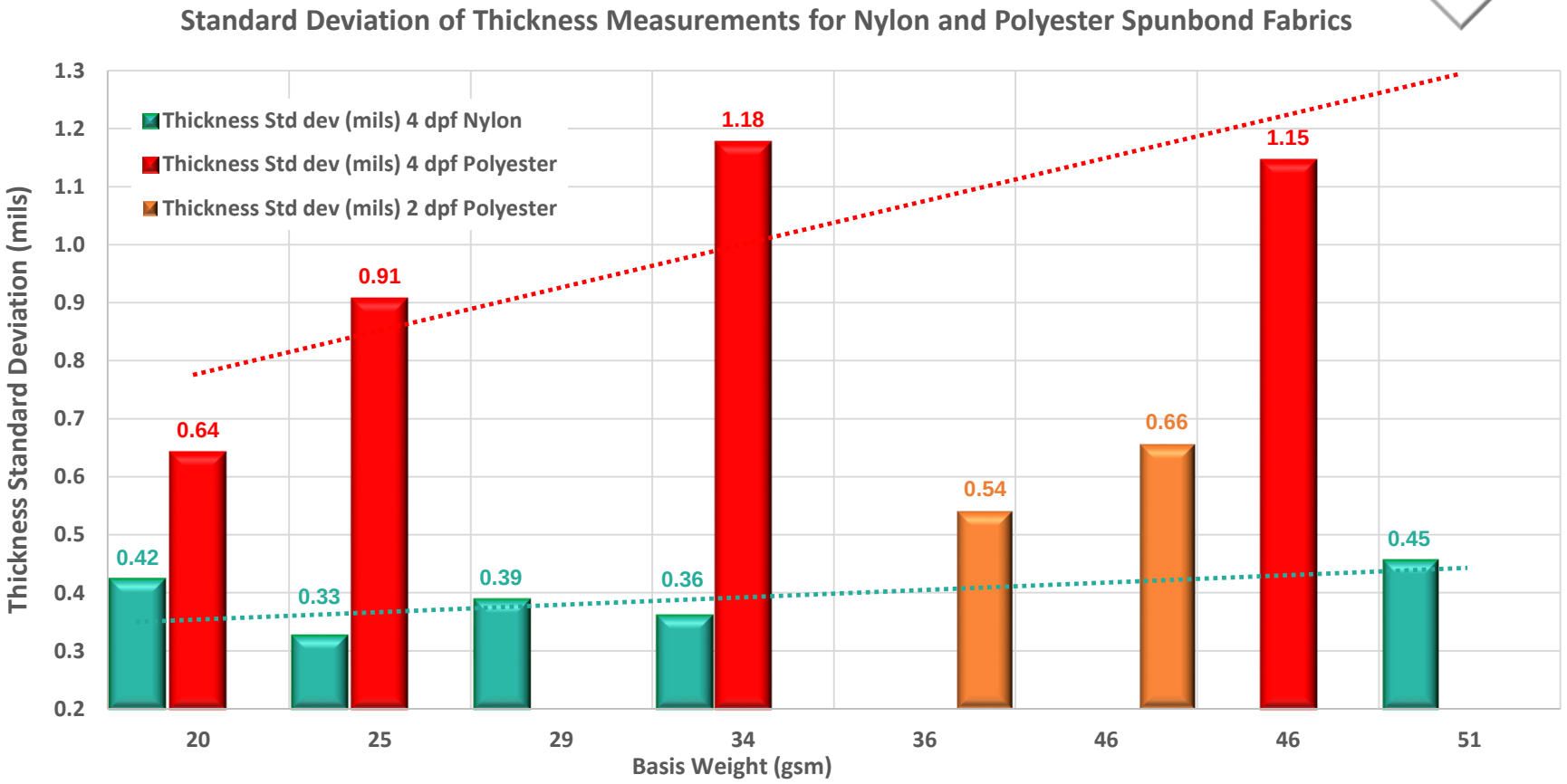
Basis Weight	Thickness	Air Perm
D3776	D1777	D737

Basis Weight Variability



Mass distribution of 4 dpf nylon spunbond fabrics is less variable than 2 or 4 dpf polyester fabrics

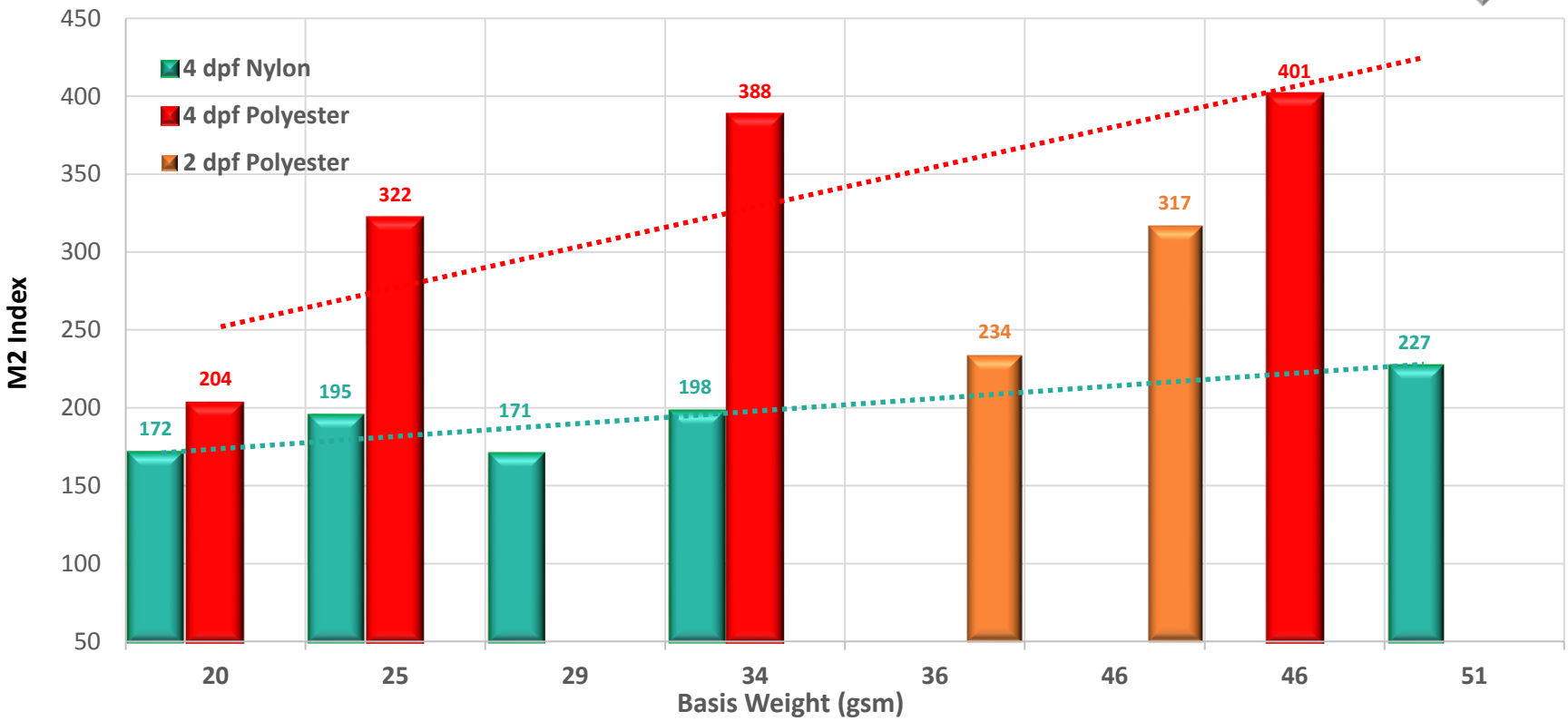
Thickness Variability



Thickness variability of nylon fabrics is considerably less than polyester fabrics

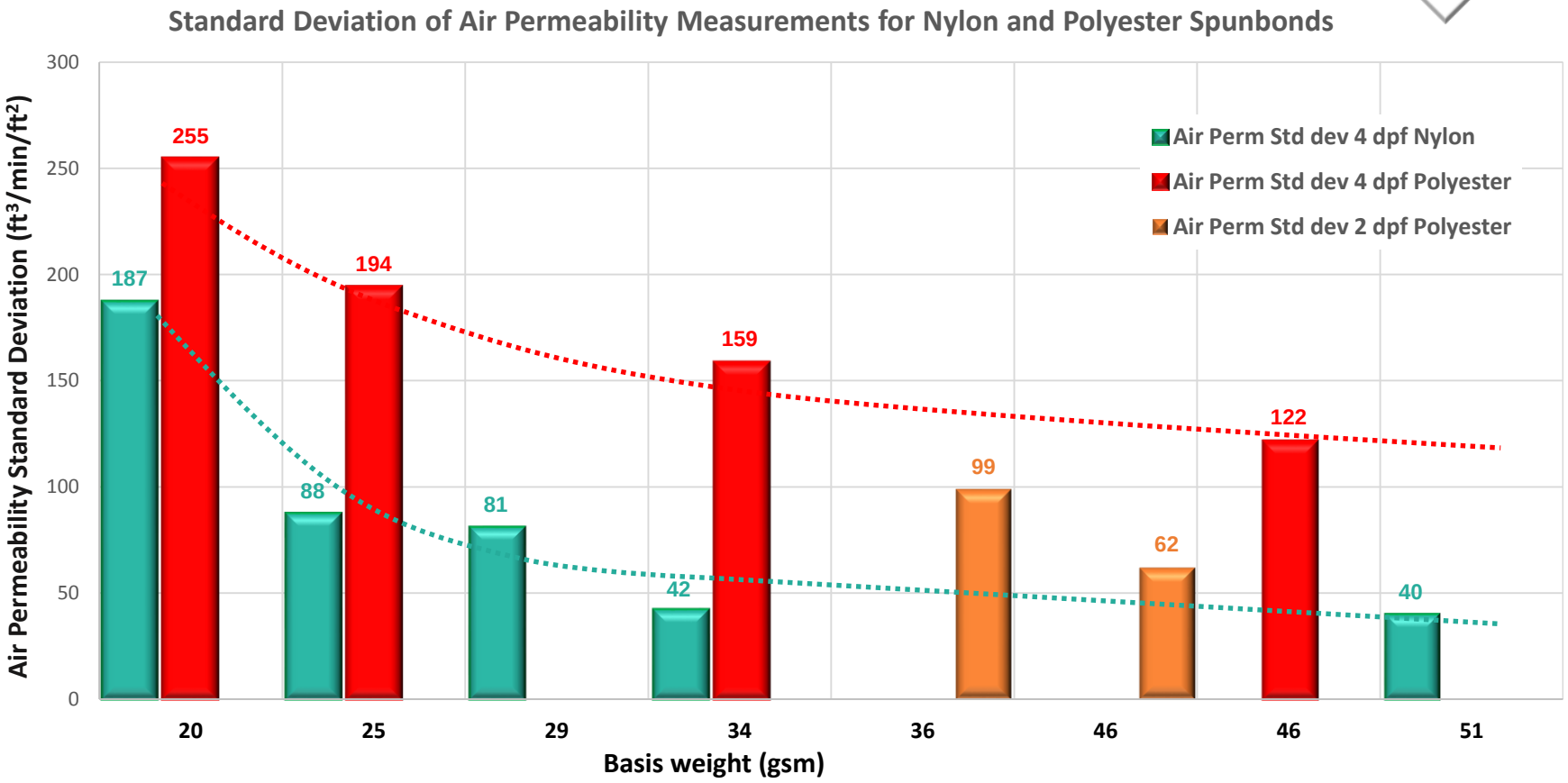
M2 Uniformity Index

$$(\sigma_{\text{basis weight}} + \sigma_{\text{thickness}}) * 100$$



M2 uniformity index of nylon spunbond is much lower than polyester spunbond indicating the nylon has a more uniform filament distribution

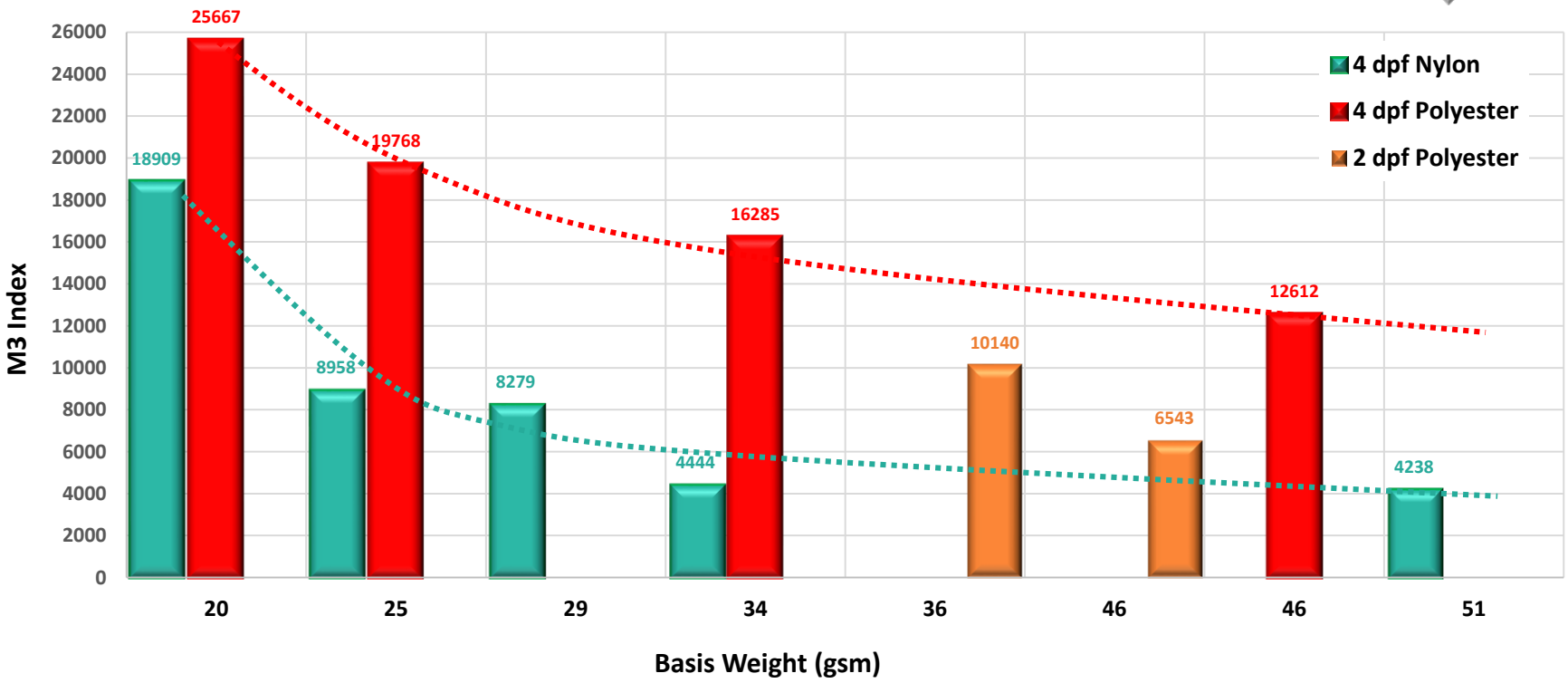
Air Permeability Variability



Air permeability variability of nylon fabrics is less variable than polyester fabrics

M3 Uniformity Index

$(\sigma_{\text{basis weight}} + \sigma_{\text{thickness}} + \sigma_{\text{air permeability}}) * 100$

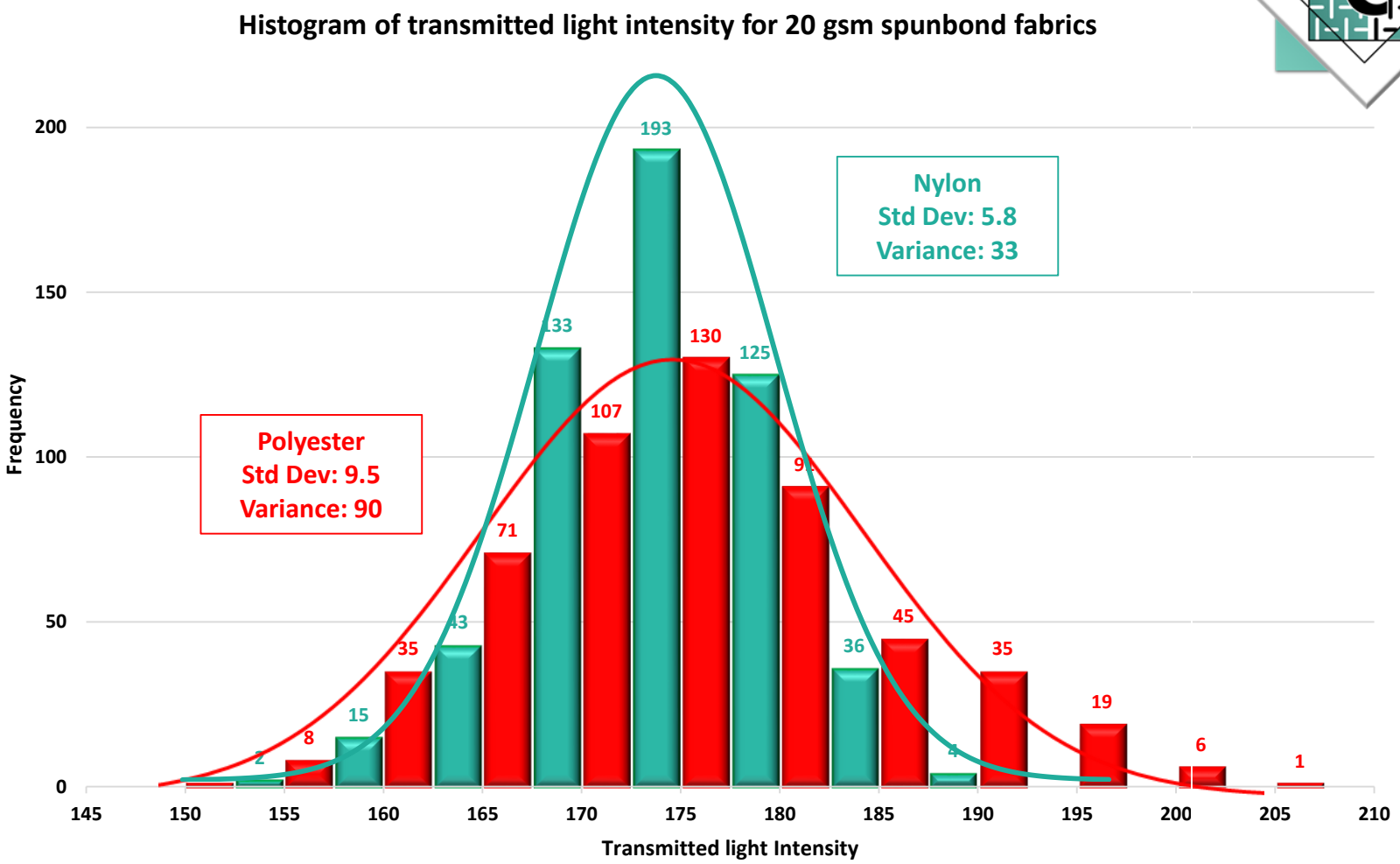


Nylon spunbond's M3 index is less than half that of polyester spunbond fabric confirming nylon has a much more uniform filament structure

On-Line Camera Inspection system

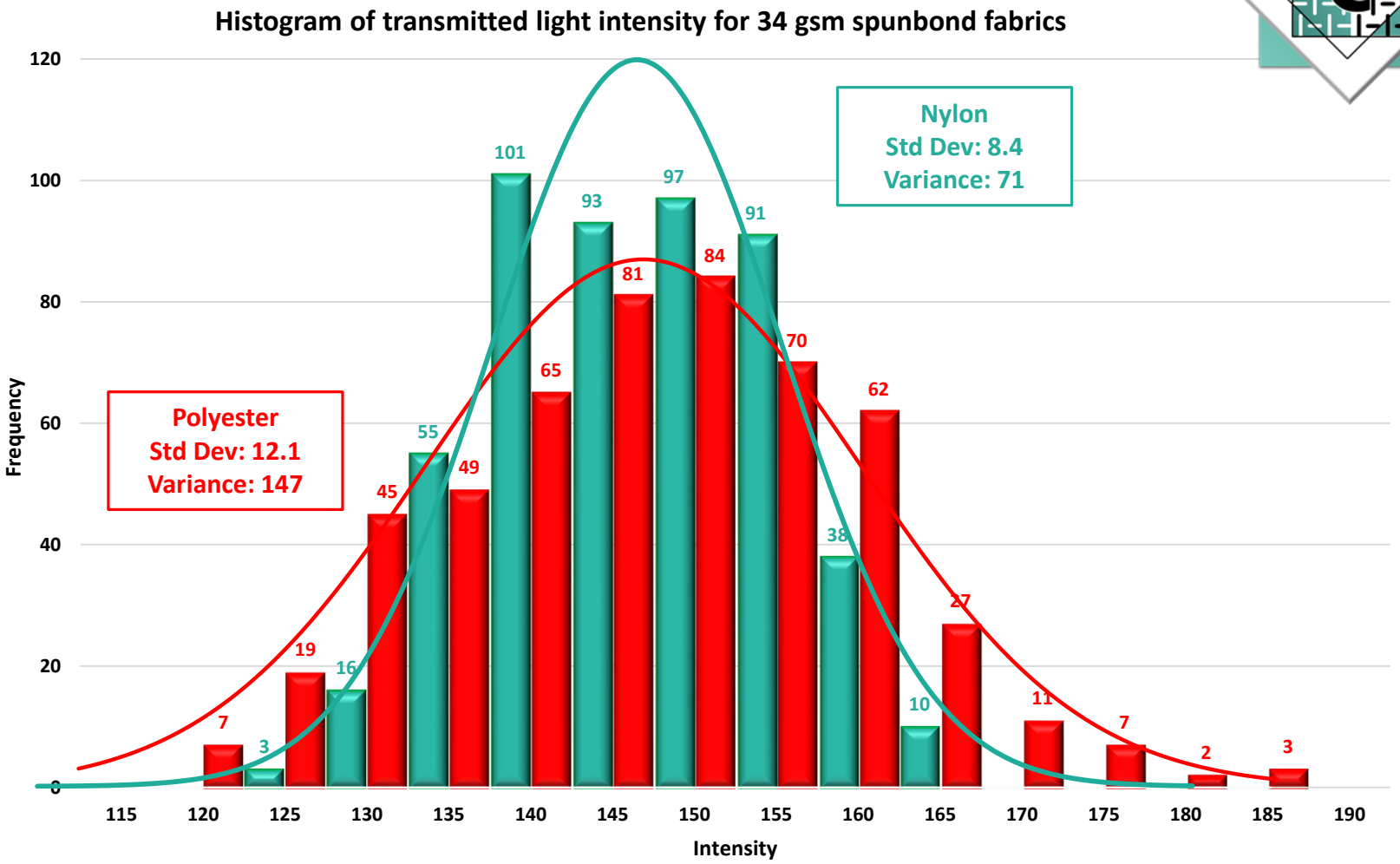
On-line camera system provides grey scale output of transmitted light showing thick and thin spots on fabrics

Optical Representation of Fabrics



Variance (σ^2) of transmitted light intensity for 20 gsm nylon spunbond is 63% lower than for polyester spunbond.

Optical Representation of Fabrics



Variance of transmitted light intensity for 34 gsm nylon spunbond is less than half that of polyester

Summary
Nylon Compared to Polyester

	Nylon	Polyester
• Visually more consistent	☑	☐
• Lower variability of physical properties	☑	☐
• Avintiv M2 and M3 indices are better	☑	☐
• Lower variability of transmitted light	☑	☐

Case Study – Nanofiber Application

Similar Process Conditions

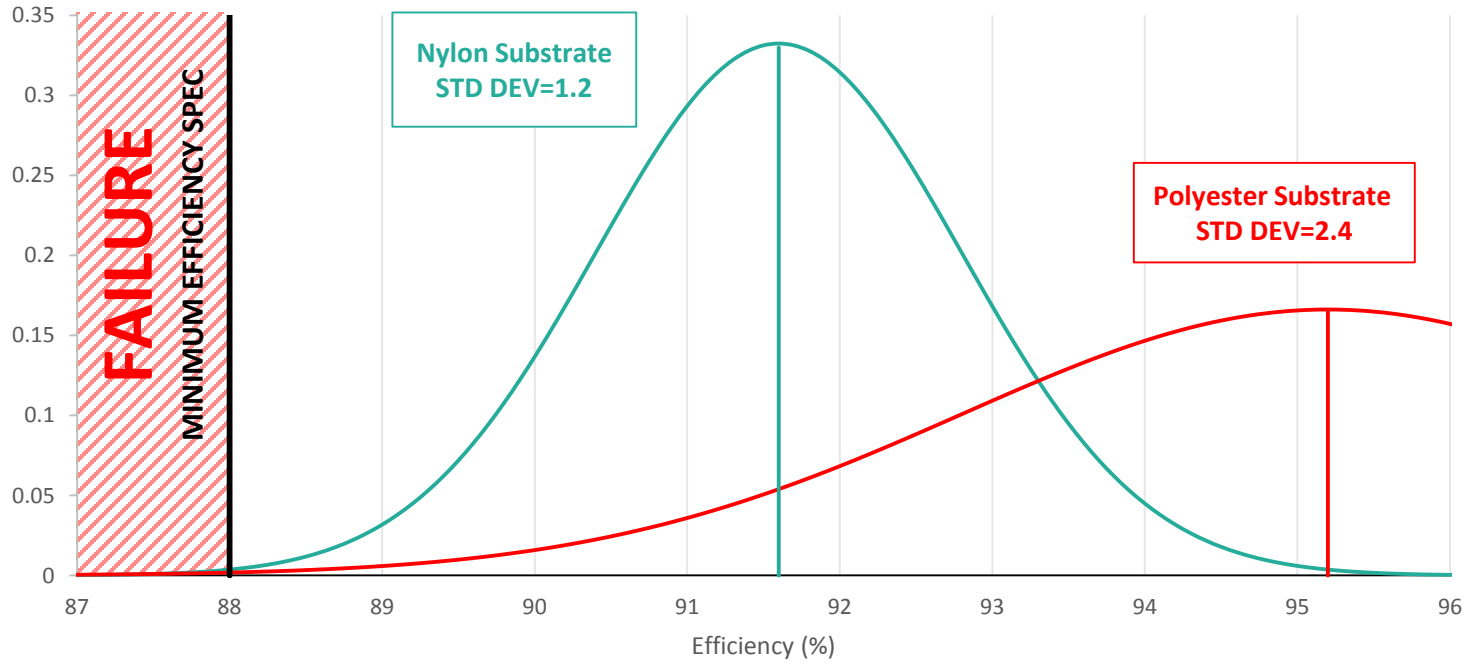
TSI 8130 @32 lpm (0.3 µ particle)

Efficiency	34 gsm Cerex®	46 gsm Polyester
Average	91.6	93.7
Std Dev	1.2	2.4
Variance	1.4	5.7

When nanofibers are applied to a lighter weight nylon substrate, the variance of efficiency measurements is 75% lower than that of the same media substituting a heavier weight PET substrate

Benefits of using nylon substrate to form nanofibers

Nanofiber media made with 34 gsm nylon and 46 gsm polyester with different efficiencies



Nylon's higher uniformity allows the use of a lighter substrate to achieve the same minimum design performance

Potential benefits for filtration applications

Improved uniformity in nylon….

- Increases consistency in filter media performance in nanofiber, meltblown and membrane casting production
- Minimizes downstream fiber migration, contaminate shedding and channeling in dynamic flow applications
- Combined with nylon's greater strength, temperature and chemical resistance enables high performance advanced media designs
- Provides more consistent protection against burst failures during system pulsations and better media protection during pleating

Thank You!

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

Albert E. Ortega
Director of Technology
Cerex Advanced Fabrics, Inc.

www.cerex.com

Related Work Previously Presented at AFS Conferences

- "The Advantages of Nylon Nonwovens in Filtration"; Ortega, Carter; AFS 2013 Spring Conference; May 8, 2013
- Using Nylon 6,6 Spunbond Fabric to "Prevent Catastrophic Filter Media Failure Caused by Ethylene Glycol Contamination"; Ortega, Carter; AFS 2015 Fall Conference: October 7, 2015
- "Longer Life Nylon Spunbond Fabric For Filtration Media"; Forcucci; AFS 2016 Fall Conference; October 25, 2016