



## **Filter Media Options for Coal Fired Boilers**

**Acrylic – PPS – Polyimide – PTFE – Blends**  
**January 8, 2014**

# Testori Group

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- ✖ 100+ year old manufacturer of technical textiles for dust collection and liquid filtration, both process and pollution control
- ✖ Five operations in Italy (2), France, UAE and USA
- ✖ Manufactures woven fabrics and needle felts to produce dust bags and liquid filter cloths; sales of roll goods to bag fabricators (USA)
- ✖ Full lab and technical support; VDI testing; failed bag media analysis
- ✖ US warehouse and sales office; full converting in Italy, France and UAE

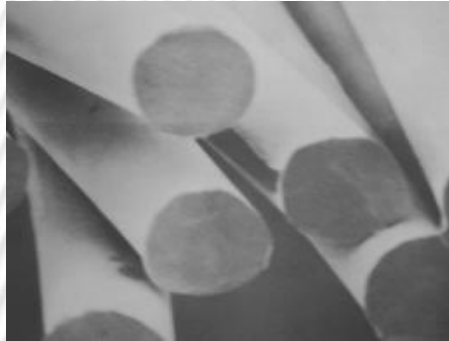
# Selecting Media

FILTER MEDIA SELECTION CHART FOR POWER						
FIBER TYPE	COMMON BRAND NAMES	TEMP LIMITS* F/C	RESISTANCE TO ACIDS	RESISTANCE TO ALKALIS	RESISTANCE TO HYDROLYSIS	RESISTANCE TO OXIDATION
COTTON	NA	180°/85°	Poor	Good	Good	Good
PVC	Rhovyl, Clevyl	150°/65°	Excellent	Excellent	Excellent	Excellent
POLYPROPYLENE	Herculon	190°/90°	Excellent	Excellent	Excellent	Poor
NYLON	Enka, Antron	230°/110°	Poor	Excellent	Poor	Good
HOMOPOLYMER ACRYLIC	Dolanit, Aksa	257°/125°	Good	Fair	Good	Good
POLYESTER	Fortrel, Dacron, et al.	300°/150°	Good	Poor	Poor	Good
PPS	Torcon, Procon, et al.	375°/190°	Excellent	Excellent	Excellent	Fair
ARAMID	Nomex, Conex, et al.	400°/205°	Poor	Excellent	Poor	Fair
POLYIMIDE	P84	450°/235°	Fair	Poor	Good	Good
PTFE	Profilen, Toyoflon, et al.	500°/260°	Excellent	Excellent	Excellent	Excellent
FIBERGLASS	NA	550°/285°	Good	Fair	Excellent	Excellent
*Dry heat only						Testori USA, Inc. www.testori-usa.com

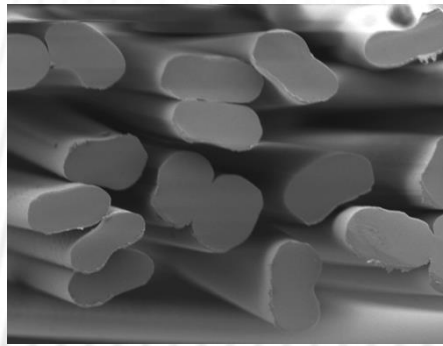
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<b>HOMOPOLYMER ACRYLIC</b>	<b>Dolanit, Aksa</b>	<b>257°/125°</b>	<b>Good</b>	<b>Fair</b>	<b>Good</b>	<b>Good</b>
<b>PPS</b>	<b>Torcon, Procon, et al.</b>	<b>375°/190°</b>	<b>Excellent</b>	<b>Excellent</b>	<b>Excellent</b>	<b>Fair</b>
<b>POLYIMIDE</b>	<b>P84</b>	<b>450°/235°</b>	<b>Fair</b>	<b>Poor</b>	<b>Good</b>	<b>Good</b>
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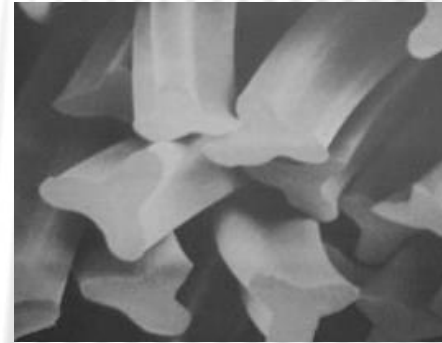
# Typical fibers for CFB: cross section shapes



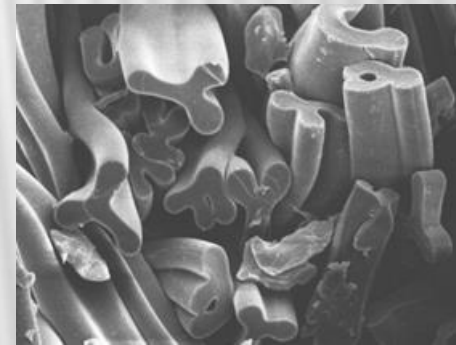
**ROUND**  
*PPS / PTFE*



**DOG BONE**  
*PAN*



**TRILOBAL**  
*PPS*



**MULTILOBAL**  
*P84®*

HIGHER FILTERING SURFACE  
(considering the same titre)

$m^2/kg$

STANDARD  
SHAPED FIBERS

**MORE SURFACE AREA = INCREASED FILTRATION  
EFFICIENCY IN SAME BASIS WEIGHT FELT**

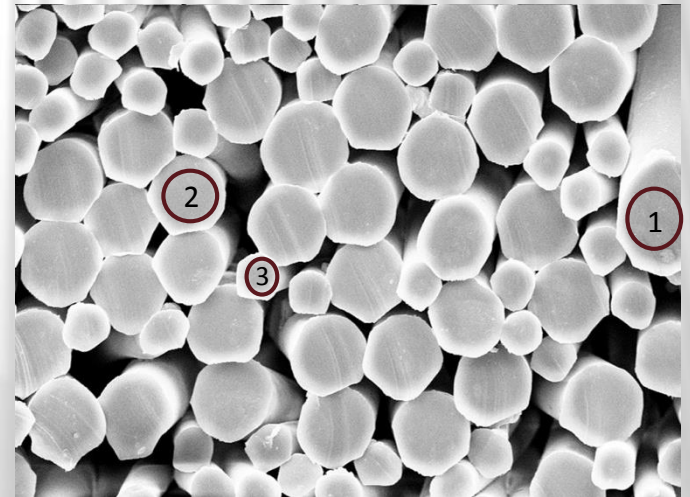


# Fiber Diameters

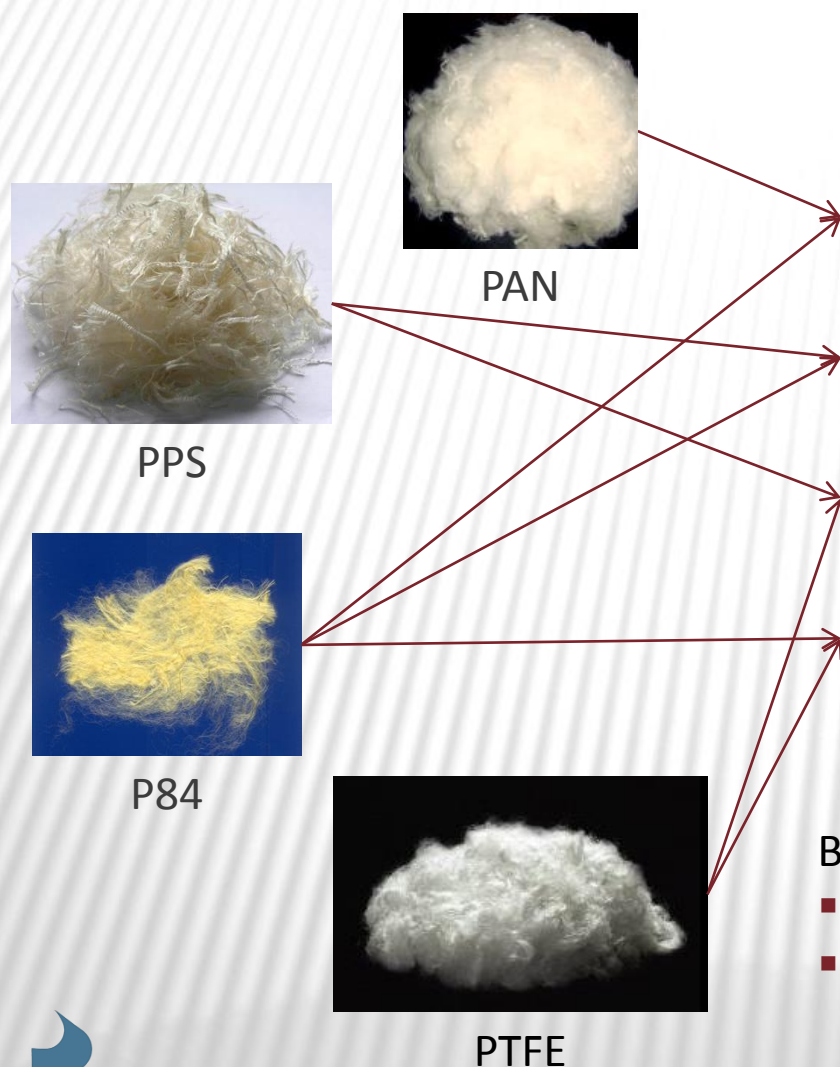
- ✖ Expressed in denier or decitex (dtex)
- ✖ Denier is weight in grams of 9,000 lin meters of one filament
- ✖ The higher the number, the coarser the fiber
  - Standard denier fibers: 2 – 3 denier
  - Fine denier fibers: 1 – 2 denier
  - Microfibers < 1 denier (PP, PE, ACR, PPS, P84)

*Example:  
1 d fiber = 1/10 size of human hair*

*9,000 lin meters weighs 1 gram  
(or less)*



# Main Fiber Blends for Coal Fired Boilers



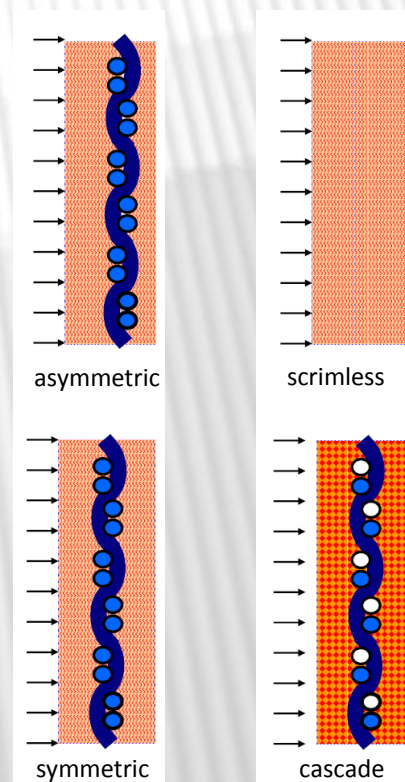
## *Testori code*

PAN/P84 (DX)

PPS/P84 (SX)

PPS/PTFE (SF)

P84/PTFE (XF)



Blends are designed to be:

- combination of different fibers in the batt
- combination of batt and scrim made with different polymers

# Supported vs Unsupported Felts



Unsupported Felt



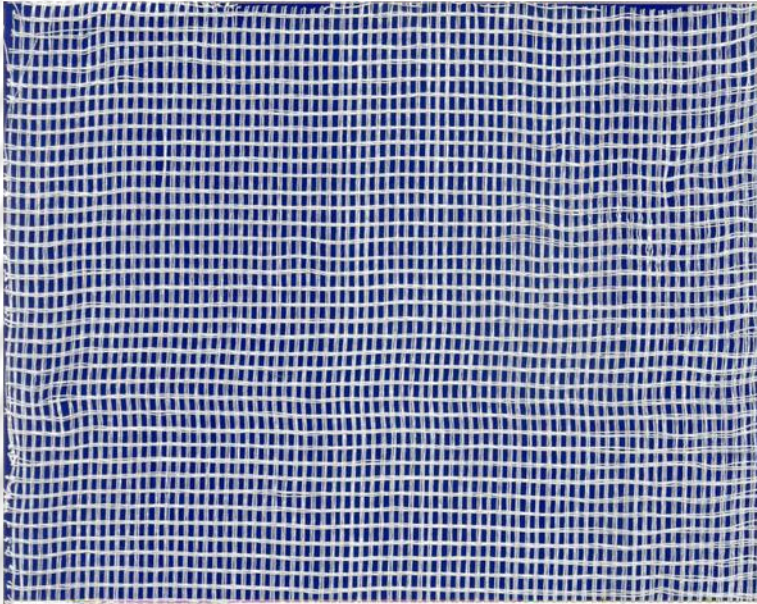
Scrim Supported Felt

- ✘ Virtually all CFB Baghouse felts are scrim supported because:
  - More dimensionally stable/stronger
  - Able to resist pulse pressures better/minimize dust penetration
  - Able to support heavy filter cake on long bags (up to 10 meter) without stretching (40-60 lbs of dust on 10 m bag)



# Scrims

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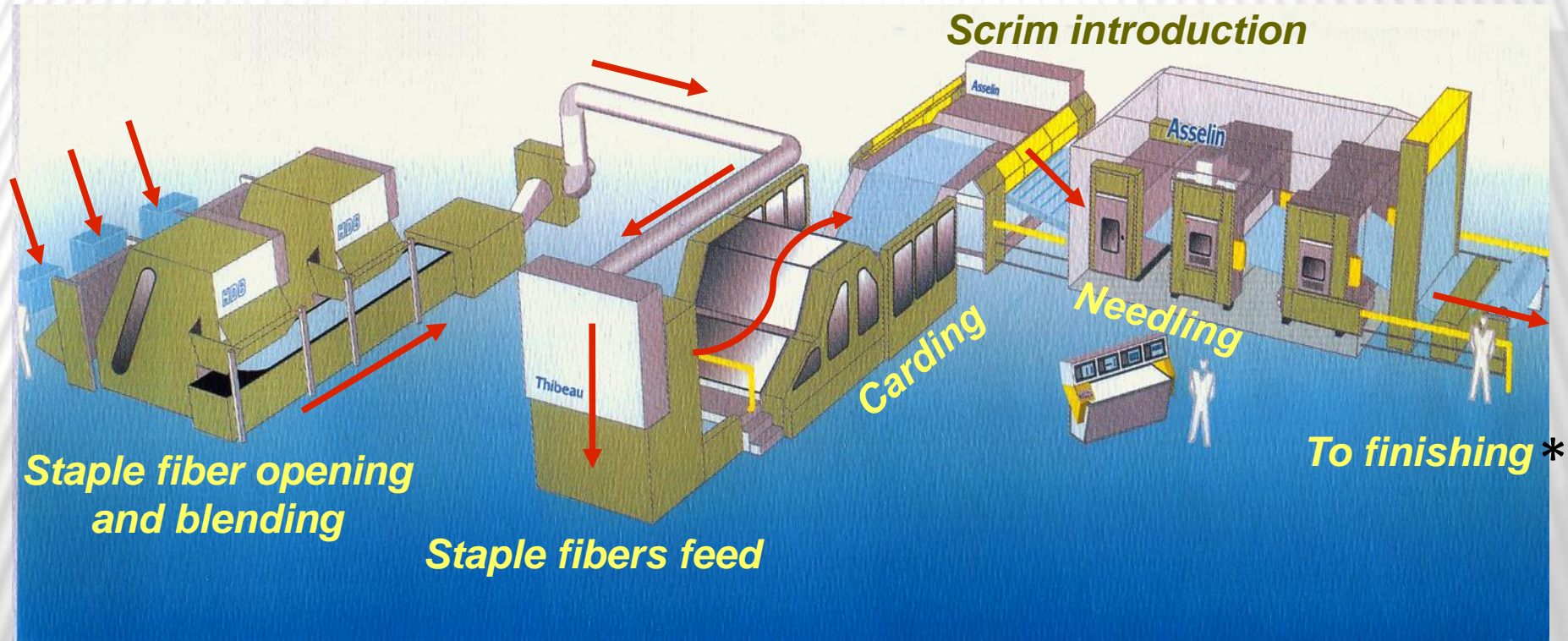
Scrim



In Needled Felt

Scrim fiber may be same as fleece fiber or better (temperature, chemically stable, etc.); weights may vary; filament or spun

# Needlefelt Production Line

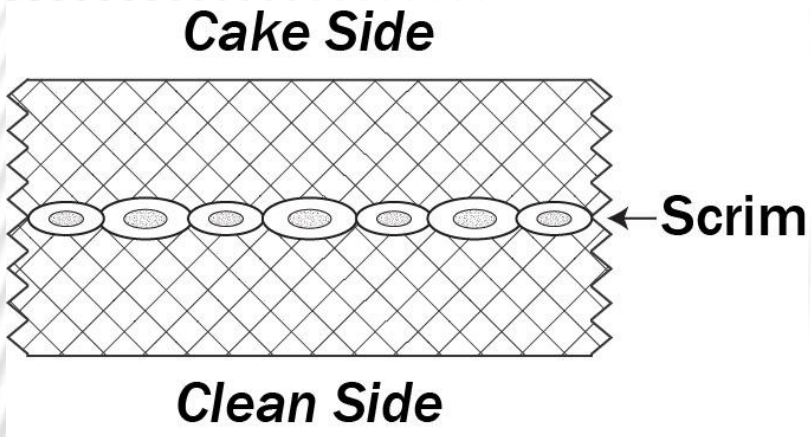


\* Heat setting  
Calendaring  
Singe & glaze  
Chemical treatment

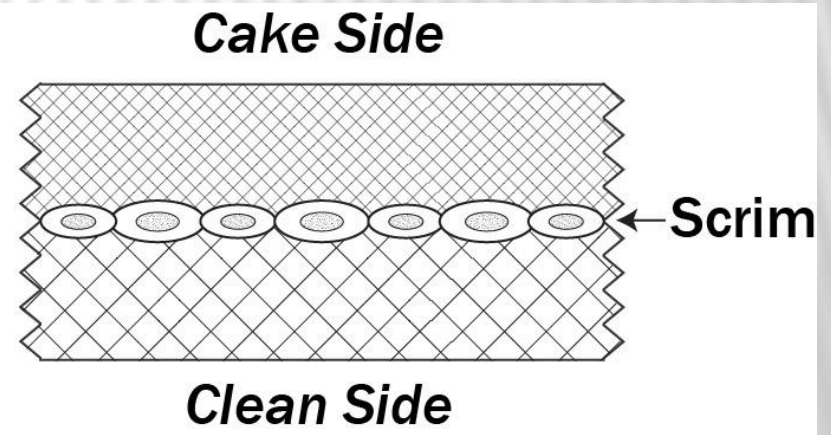


# Needled Felt Constructions

## 1. Same Fiber Both Sides

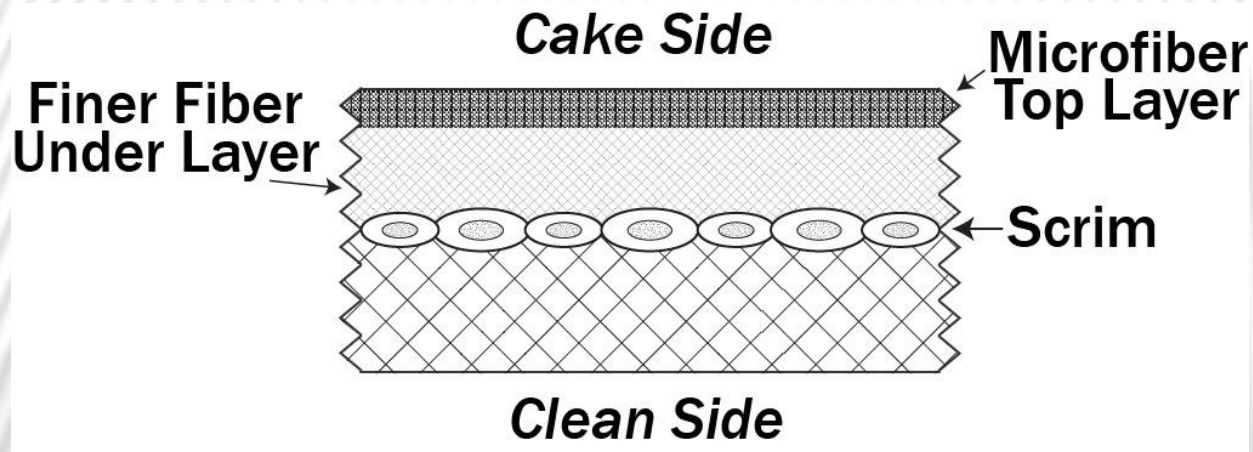


## 2. Dual Density – Finer Fiber Cake Side

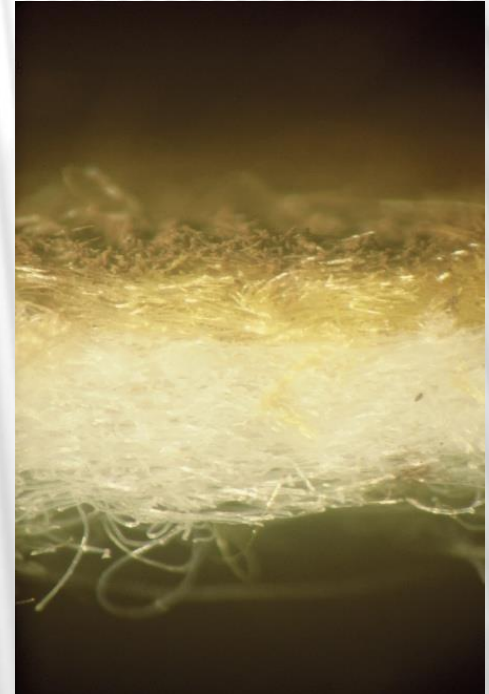


# Needled Felt Constructions

## 3. Multi-Layer



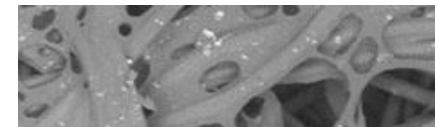
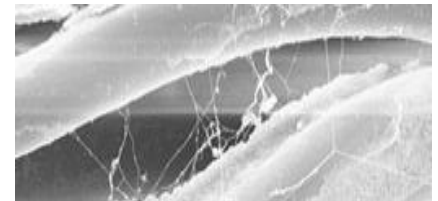
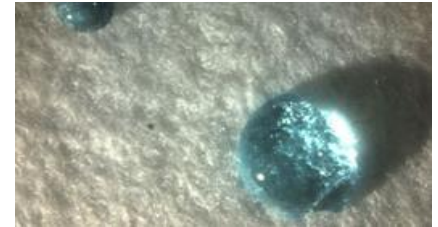
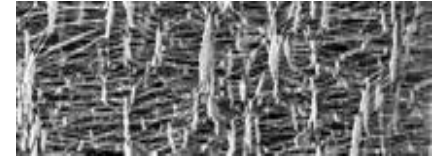
*Standard Fiber or Finer  
Fiber Blend Clean Side*





# Needlefelts: Finishing and Treatments for CFB

	<i>Description</i>	<i>Fibers</i>	<i>Benefit</i>
<b>ePTFE MEMBRANE</b>	Expanded PTFE membrane laminate on the dust side	PAN, PPS, P84, GLASS, PTFE	<ul style="list-style-type: none"> <li>- Controlled low emissions                             <ul style="list-style-type: none"> <li>- Better efficiency</li> <li>- Cleanability</li> </ul> </li> <li>- <b>Disadvantage:</b> abrasion, oils, special install, tight fit</li> </ul>
<b>KLEENTES</b>	- Fluorinated resins for bath impregnation of the felt	PAN	<ul style="list-style-type: none"> <li>- Water repellency</li> <li>- Better cake release</li> <li>- Suitable for sticky dust</li> </ul>
<b>MANTES</b>	-PTFE resins for bath impregnation of the felt	PAN, PPS, P84, PTFE	<ul style="list-style-type: none"> <li>-Water and oil repellency</li> <li>- Very good cake release</li> <li>- Increased bag lifetime</li> <li>- Adds surface area</li> </ul>
<b>RHYTES</b>	-Fluorinated and PTFE resins (high concentration) for bath impregnation of the felt	PAN, PPS, P84	<ul style="list-style-type: none"> <li>- Water and oil repellency</li> <li>- Better cake release</li> <li>- Suitable for sticky dust</li> </ul>
<b>SUPERNOVATES</b>	- Copolymer foam deep coating suitable for temperature up to 200°C	PPS	<ul style="list-style-type: none"> <li>- Better filtration efficiency</li> <li>- Very low emissions below 5mg/Nm<sup>3</sup></li> </ul>



# Needling

- ✖ Almost infinite variety possible
- ✖ No fixed media designs
- ✖ No “micron rating” system
- ✖ “Chinese Menu” approach to media design

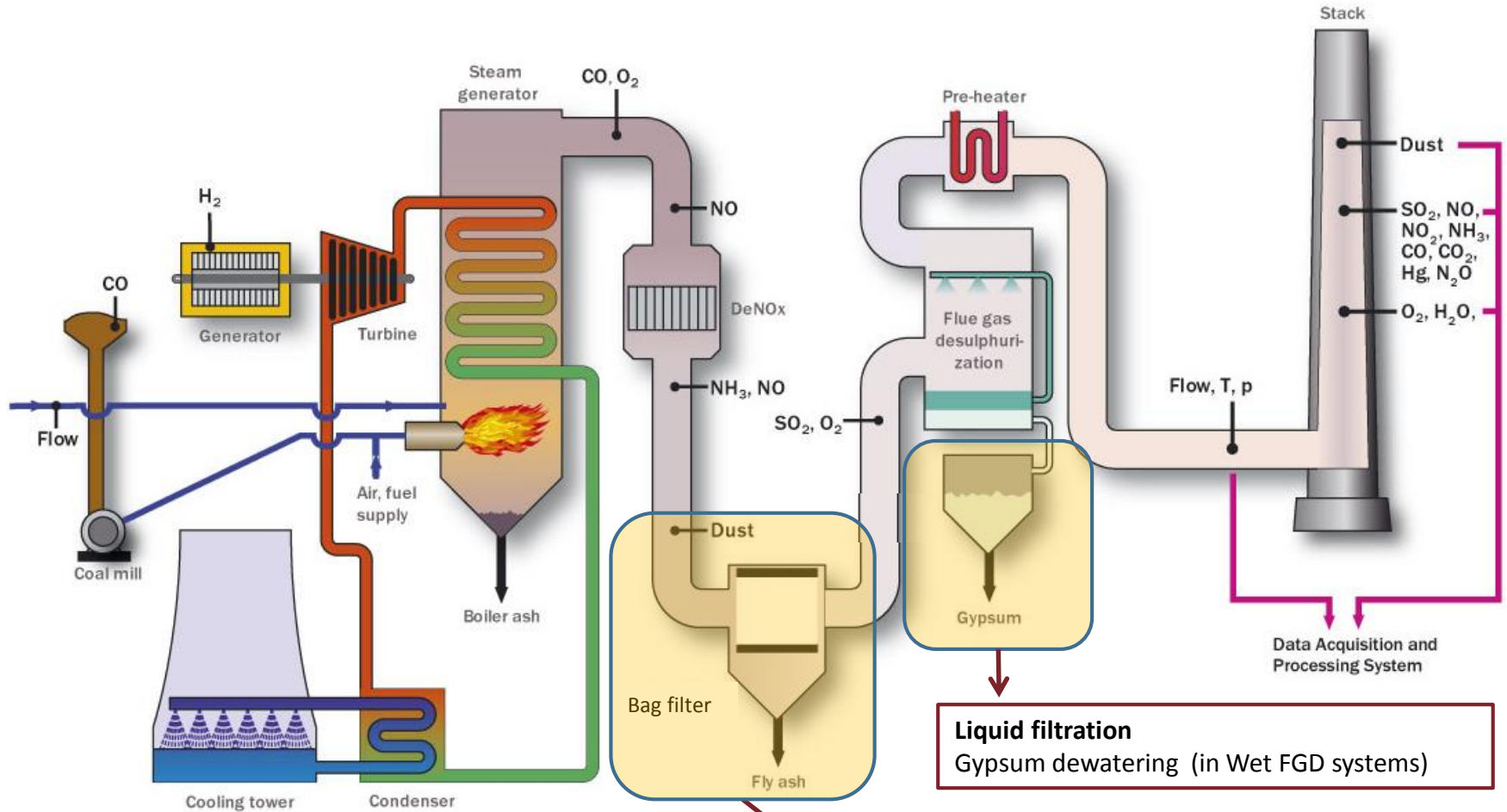


A	B	C
Fiber: type, size, blend Scrim: type, count, weight, strength	Basis Weight Layering Needle size & Design Needling Density	Heat Stabilization Calendering Mechanical Finishes: singe or glaze Chemical Finishes: fluorocarbon, PTFE, surface coating

# Variables to Consider When Selecting Filter Media for a CFB Dust Collector

PROCESS	EQUIPMENT	PERFORMANCE
Inlet Temperature (normal and peak)	Neutralizing Agents (deNOx, deSOx, Br)	Outlet Emission Limits
Moisture/Hydrolysis	Grain Loading	Bag Life and dp Warranties
Potential Chemistry	Air to Cloth Ratio	
Oxidizers	System Design	
Hydrocarbons (oil)		
Dust & Dust Characteristics (Shape, Size & Distribution, Agglomeration Tendency, Static)		

# General Flue Gas Treatment Layout in CFB Plant



## Liquid filtration

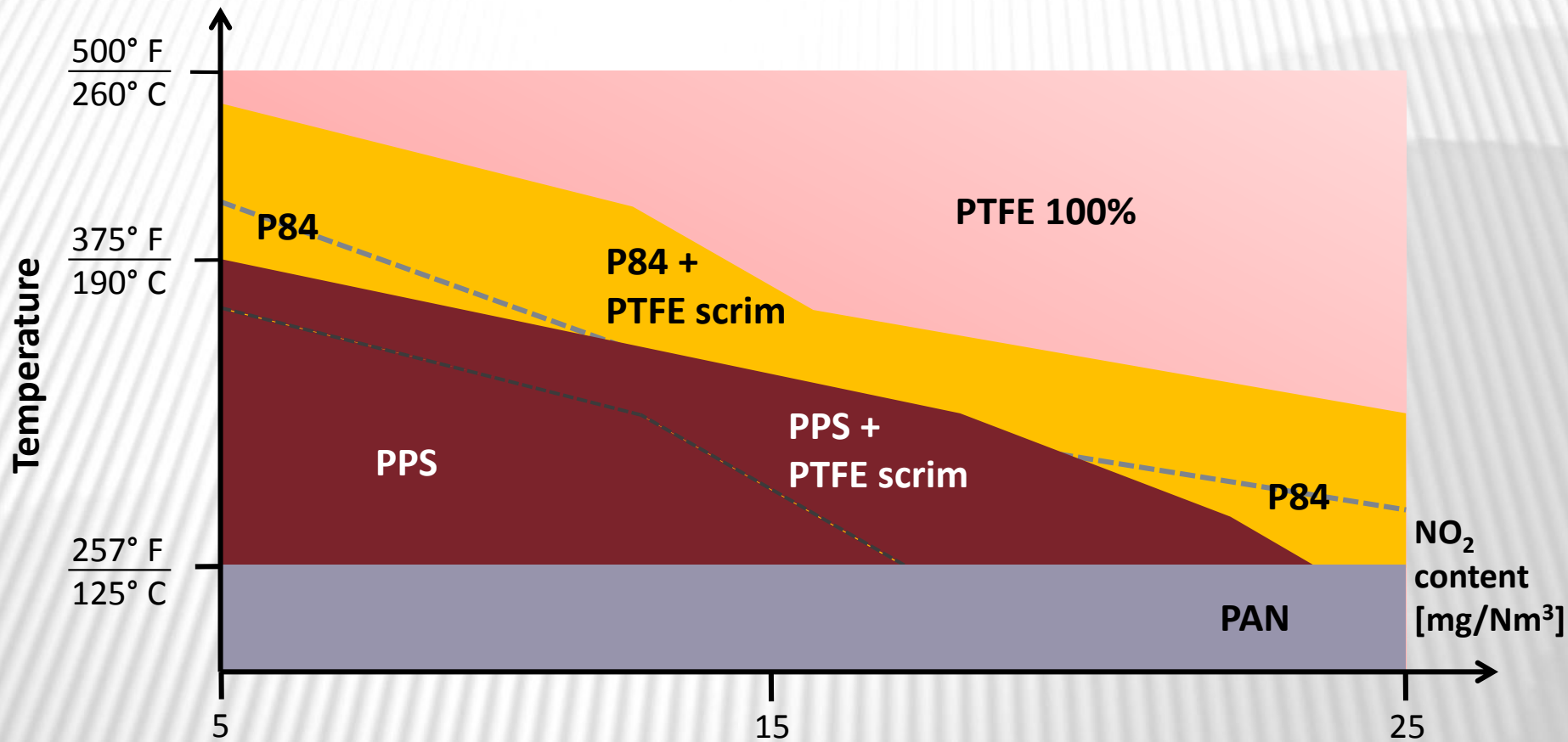
Gypsum dewatering (in Wet FGD systems)

## Gas filtration

Removal of dust and solid precipitates (from DeNO<sub>x</sub> or DeSO<sub>x</sub> dry systems)



# DeNOx flue gas treatment – Fiber suitability guidelines



**High dust SCR/SNCR**  
*Parallel Plate catalyst*

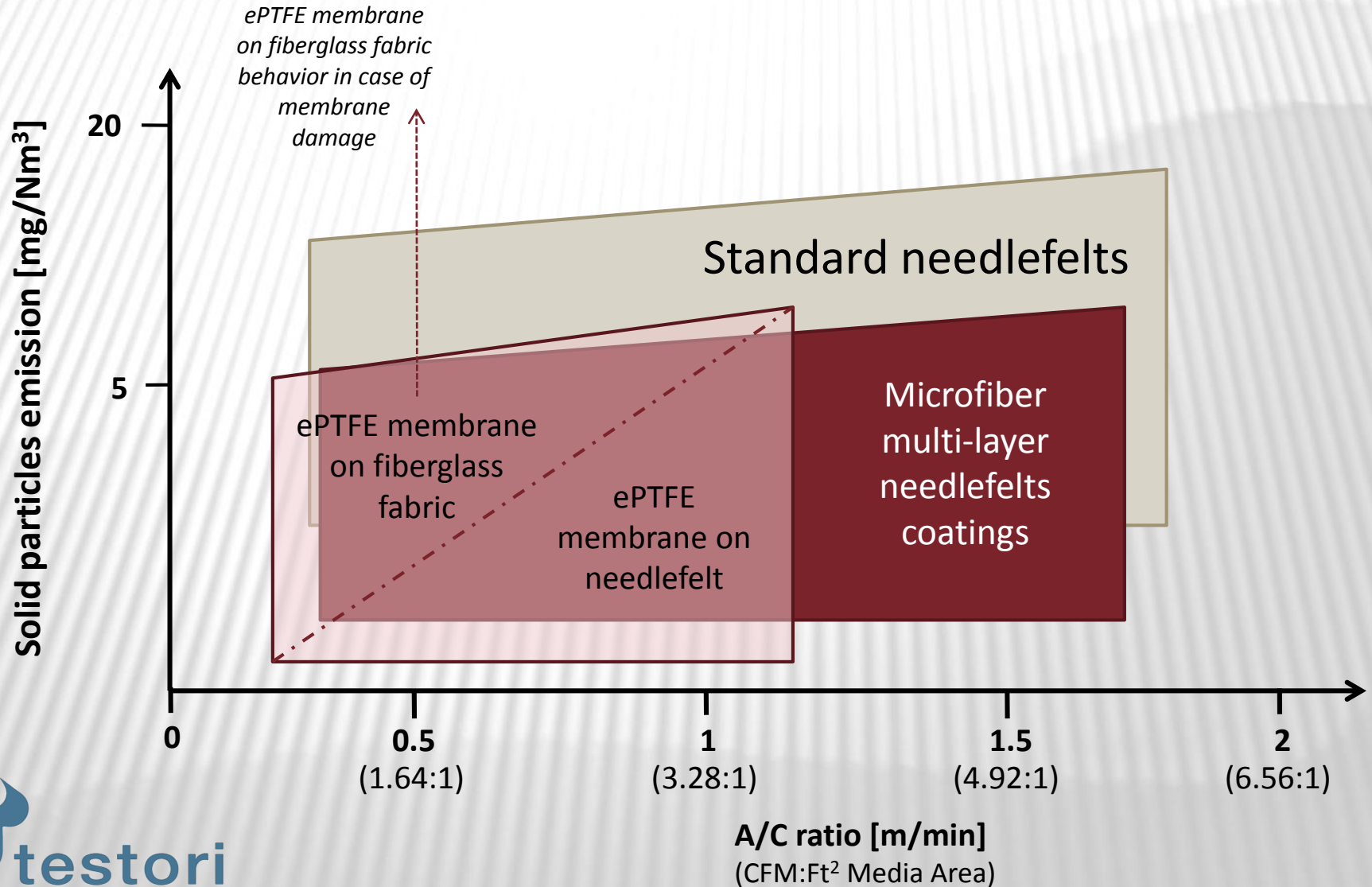


**Low dust SCR**  
*Honeycomb catalyst*



# Filter Media Application

(Based on Air to Cloth Ratio and Outlet Emission Objectives)



# DeSOx – Removal of sulfur based acid gases

-Risk of chemical degradation of P84® fiber when dosing Na-based sorbents.

## Dry Sorbent Injection

- Ca-based
- Na-based
- Typical Media: PAN, PPS, Glass

## Semi-Dry Spray-Drying

- Atomized lime slurry spraying
- Drying with a part of the inlet flue gases in counter current
- Typical Media: PAN, PPS

-Risk of degradation for P84® due to residual SO<sub>2</sub> and moisture  
-Chemical treatment for water repellency.

-High dust load due to recirculation of reagents  
-High weight needlefelt  
-Surface finishing for abrasion, with high efficiency of separation

## NID™

- Removal of acidic components of flue gas by reacting with hydrated lime
- Recirculation of reagents; additional gas absorption
  - PAC injections
- Typical Media: PAN, PPS, Glass, P84

## Wet FGD

- Gypsum dewatering
- Liquid filtration with PA, PP or PES fabric depending on filtering equipment

# Selecting Filter Media for CFB Dust Collection



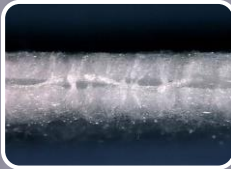
## Wide Range of Options

- Multiple fiber, scrim, felt and finish options available



## Varied Applications

- No “One Size Fits All” media possible



## Determining Outcomes

- Process conditions, equipment designs and performance outcomes dictate media recommendations and solutions



## Optimum results

- Favorable emissions and bag life result from a thorough understanding of filter media, process conditions and dust characteristics.



# Thank You

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## **Testori USA, Inc.**

### **Clint Scoble**

Cell 513-720-9063

Office 513-528-0172

Fax 513-528-0506

email: [cscoble@testori-usa.com](mailto:cscoble@testori-usa.com)

**Please visit our US website at [www.testori-usa.com](http://www.testori-usa.com)**

