SAVING ENERGY AT REDUCED EMISSIONS

AFCM 24TH Technical Symposium on
'Upgrading Technology for Sustainable Development'

Dr. Georg Rathwallner

Evonik Fibres GmbH

Hanoi, April 2015

EVONIK INDUSTRIES

www.ximang.vn - www.cement.vn

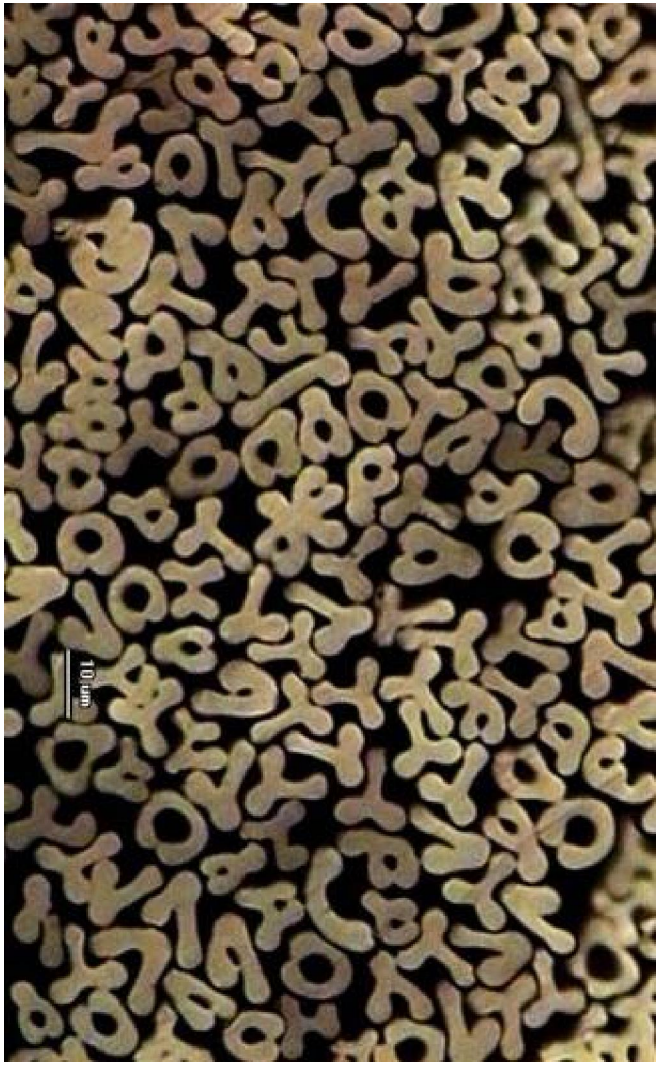
Evonik Fibres GmbH
The company with profile

Portfolio:

- Development, manufacturing and sales of P84® polyimide products
- Sales of Toyobo PPS-Procon® fibres outside Japan and Korea

Services:

- bag material recommendation
- bag condition monitoring / failure analysis
- flue gas measurement



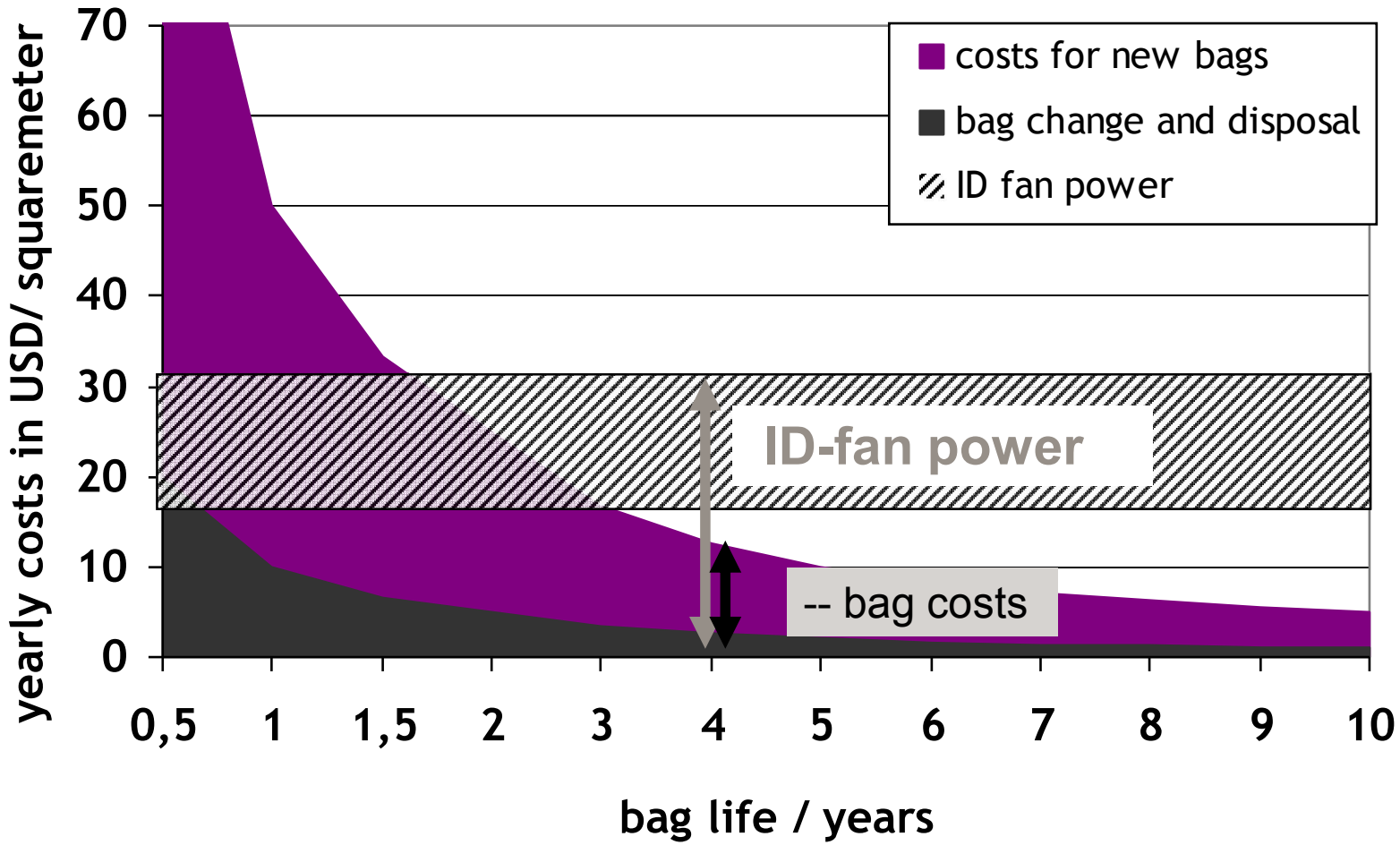
www.ximang.vn - www.cement.vn

Content

- **Bag house operating and maintenance costs**
- **WHY needle felts?**
- **WHY P84?**
- **Performance tests of kiln filter media**
- **Polyester/P84 blends in clinker mill filters**
- **Summary**

www.ximang.vn - www.cement.vn

Bag House Operating And Maintenance Costs



www.ximang.vn - www.cement.vn

Content

- Bag house operating and maintenance costs
- WHY needle felts?
- WHY P84?
- Performance tests of kiln filter media
- Polyester/P84 blends in clinker mill filters
- Summary

www.ximang.vn - www.cement.vn

WHY needle felts?

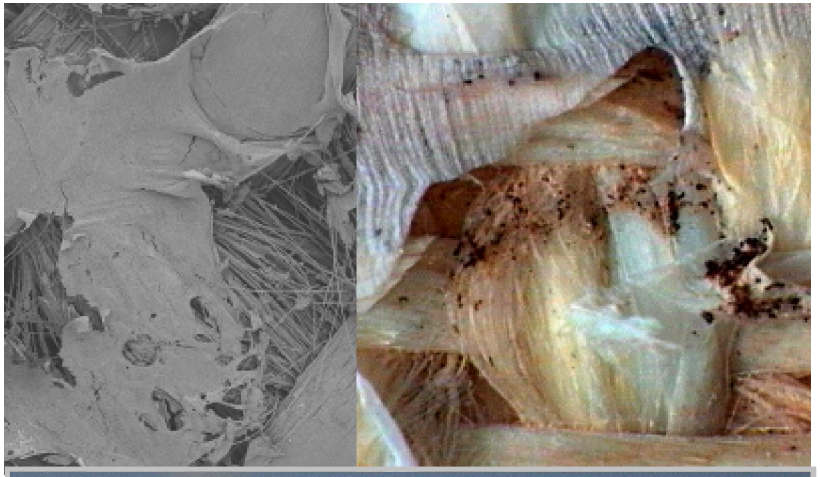
Membrane filter media rely on a thin surface layer from expanded PTFE.

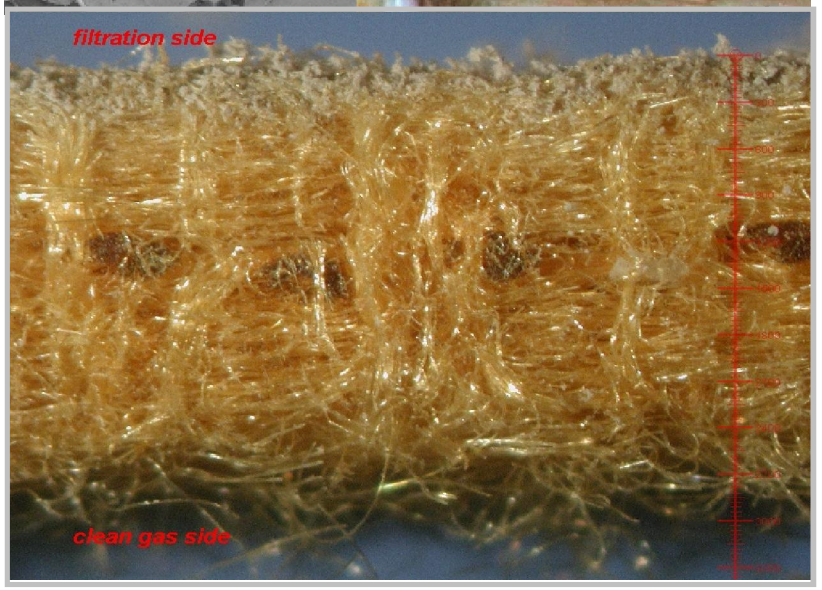
The pictures on the right show a SEM picture of a membrane that was damaged during production and a picture of a damaged membrane from a cement kiln filter.

Needle felts are robust and if the surface is damaged the next layer of fibres does the job.

The picture on the right shows a P84 needle felt after 8 years operation in a kiln filter.

At the end of the life P84 bags can be used as alternative fuel.





www.ximang.vn - www.cement.vn

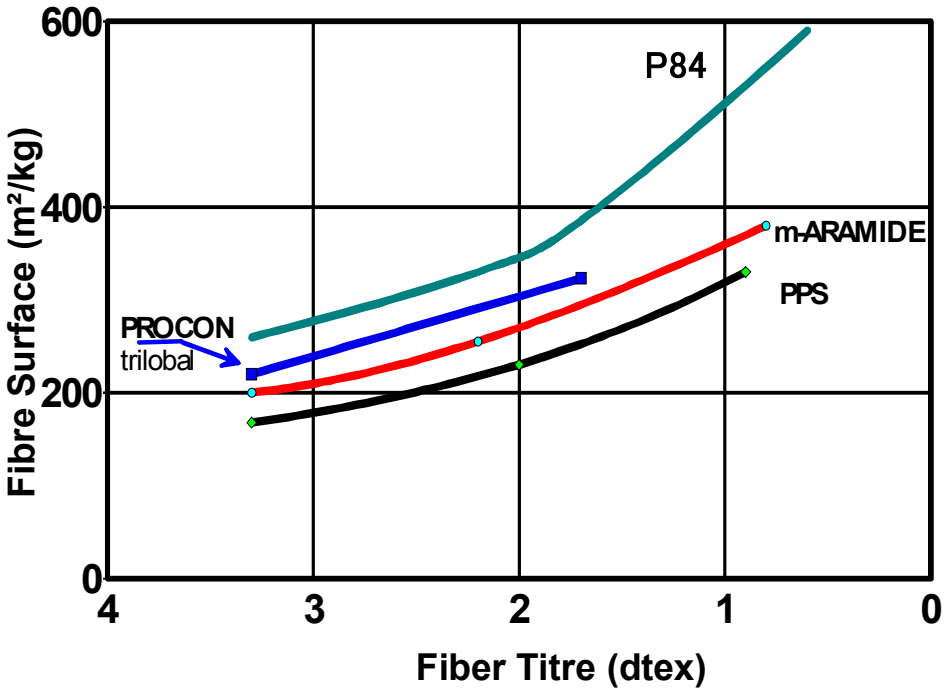
Content

- Bag house operating and maintenance costs
- WHY needle felts?
- **WHY P84?**
- Performance tests of kiln filter media
- Polyester/P84 blends in clinker mill filters
- Summary

www.ximang.vn - www.cement.vn

WHY P84?

High Specific surface for high filtration efficiency



Fine fibres and irregular fibre cross sections are a common approach to

- increase filtration efficiency

and - prevent from dust penetration

P84
(multilobal)
2,2 dtex
(340 m²/kg)

Procon (PPS)
2,2 dtex
round
(206 m²/kg)

Procon (PPS)
1,7 dtex
trilobal
(317 m²/kg)

M-aramide
2,2 dtex

www.ximang.vn - www.cement.vn

WHY P84?
WHY blending?

•The chemical and thermal stability of **P84** opens a wide range of applications like clinker cooler and kiln/raw mill filters. → up to **260°C** (peak)

•In low temperature applications (e.g. finish mills) the filtration efficiency of P84 can be utilized by blending into various base materials like polyester (PET), poly acrylic (PAN), poly phenylene sulfide (PPS) or m-aramide.

•P84/PTFE blends offer the chemical stability of PTFE with the high filtration efficiency of P84. A solution for harsh chemical environment, e.g. bypass filters.

Examples for P84 in cement applications

PES/P84 PAN/(PES)/P84	Cement mill
P84	Kiln / raw mill Clinker cooler
PTFE/P84	Bypass filter

www.ximang.vn - www.cement.vn

Content

- Bag house operating and maintenance costs
- WHY needle felts?
- WHY P84?
- Performance tests of kiln filter media
- Polyester/P84 blends in clinker mill filters
- Summary

www.ximang.vn - www.cement.vn

PERFORMANCE TEST - KILN FILTER MEDIA
Comparative test of needle felts and membranes

- **Operation of test bags in the filter unit (29 months)**

  →realistic ageing mechanisms

  on the contrary to accelerated laboratory ageing tests

The finish mill was chosen because of easy drawing of test bags in comparison to a kiln filter.

- **Comparative filtration efficiency tests (acc. VDI 3926 / ISO 11057)**

  →evaluation of air permeability, dust penetration,..

  in the laboratory

Tested bag materials: - woven glass with PTFE **membrane**

- 100% P84 **needle felt**

www.ximang.vn - www.cement.vn

KILN FILTER MEDIA

Comparative test of needle felts and membranes

grinding line with ball mill

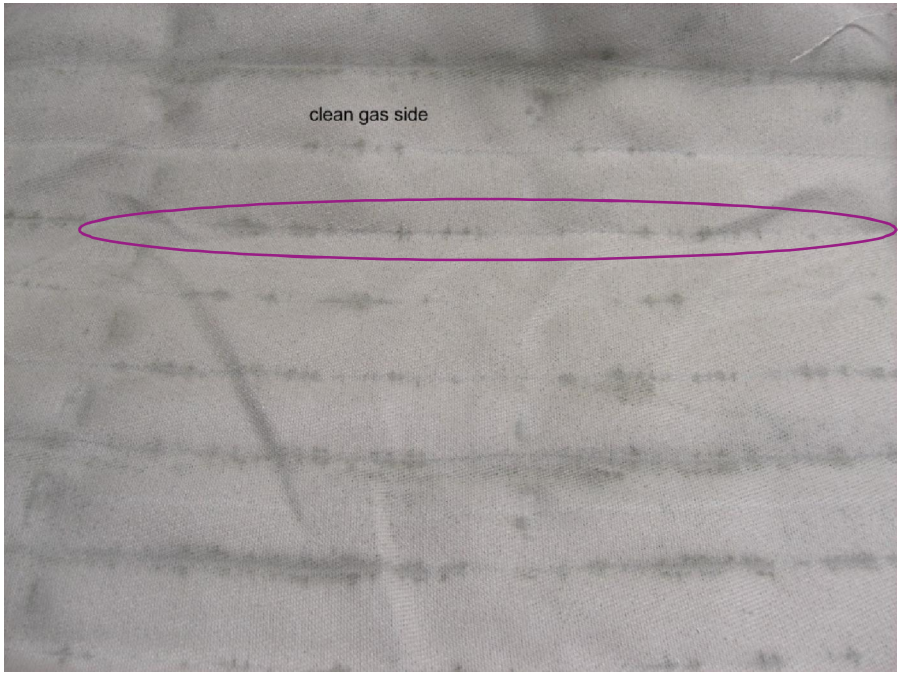
Bag filter :

- size: 720 m²
- A/C ratio: 1,2-1,3 m/min
- dust load: 500 g/m³
- Temperature: 85 °C

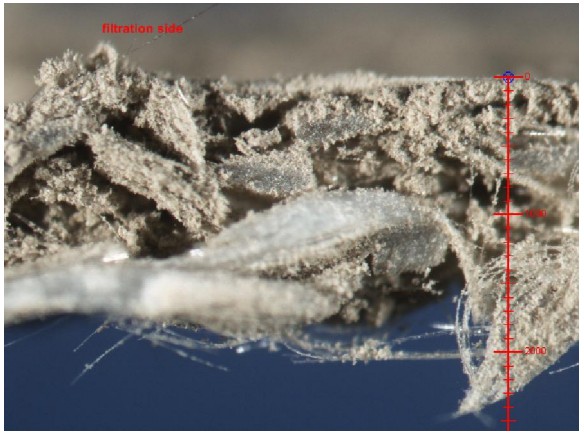
www.ximang.vn - www.cement.vn

KILN FILTER MEDIA

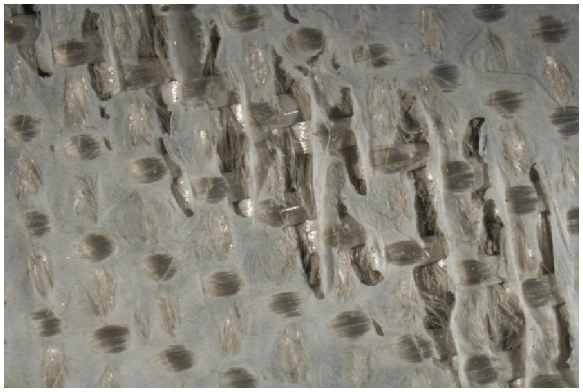
glass/e-PTFE membrane – condition after tests



Above: clean gas side of the woven glass bag. Dark discolouration from dust along the marks of the cage wires



Penetration through the woven glass material

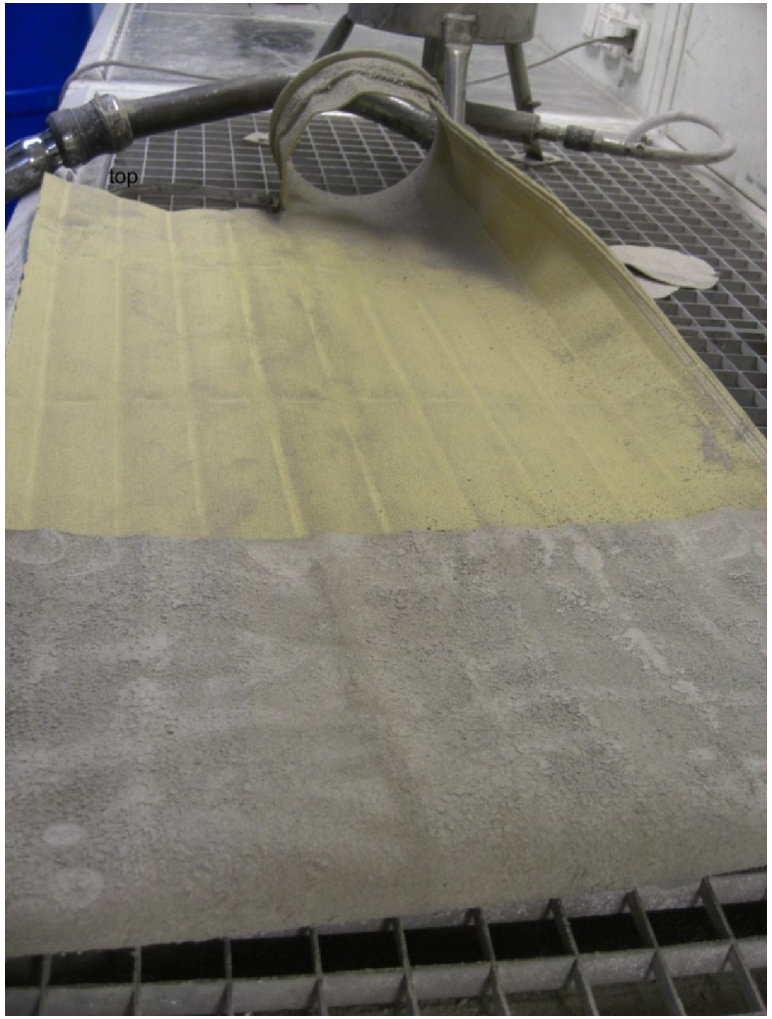


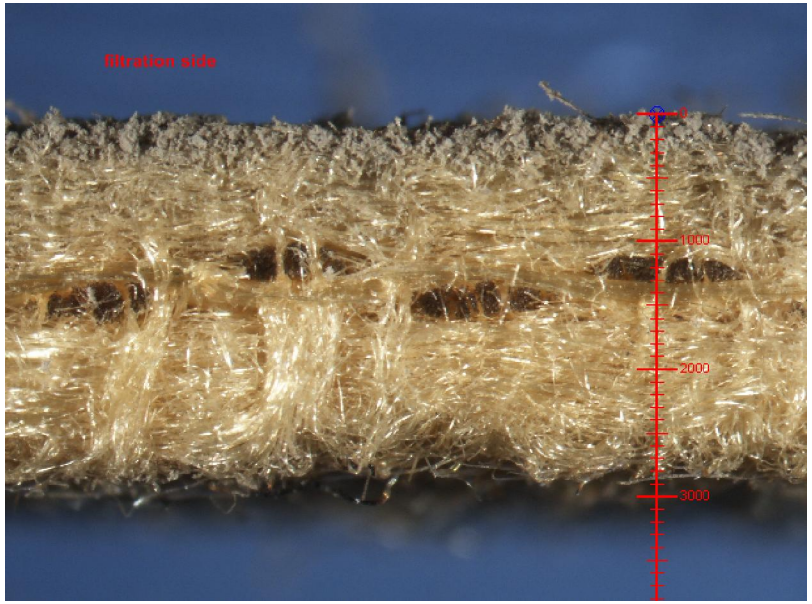
Damaged membrane

www.ximang.vn - www.cement.vn

KILN FILTER MEDIA

P84 needle felt – condition after tests



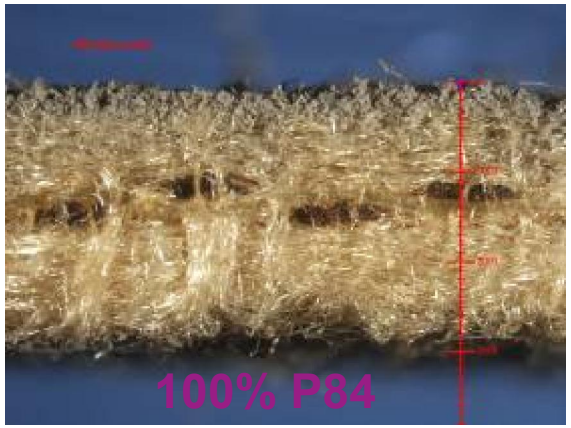


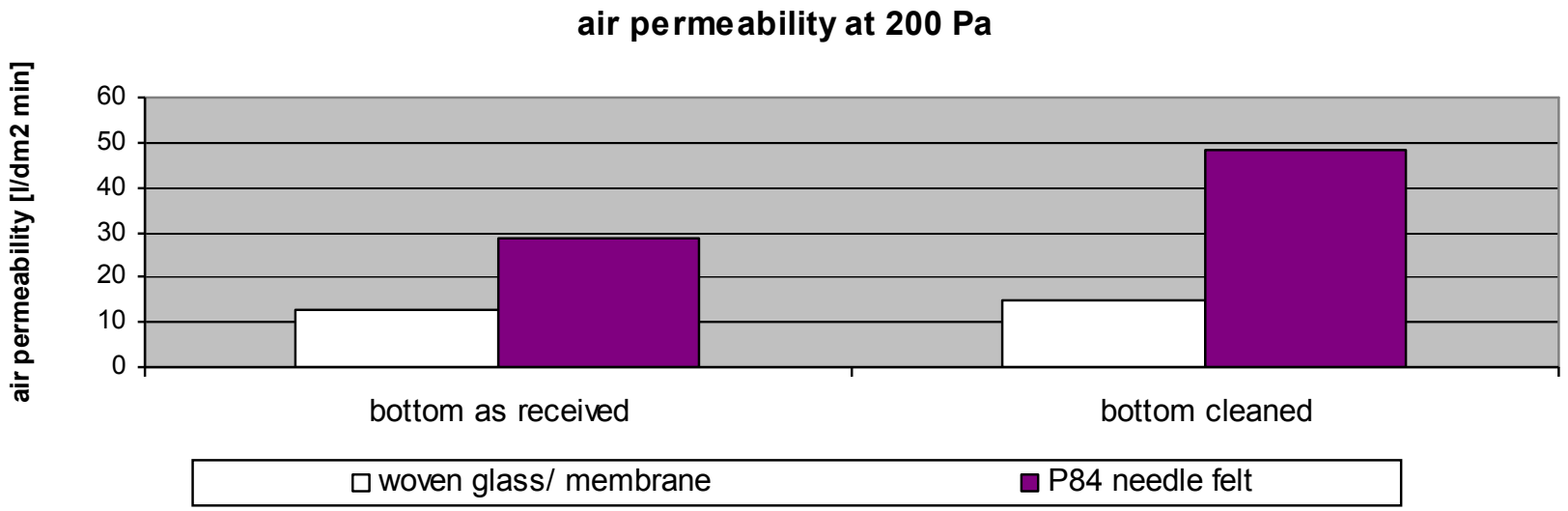
Above: dust-free cross-section of the needle felt

Left: dismounted bag (clean gas side free from dust)

www.ximang.vn - www.cement.vn

KILN FILTER MEDIA
BAG MATERIALS AFTER 29 MONTHS OPERATION



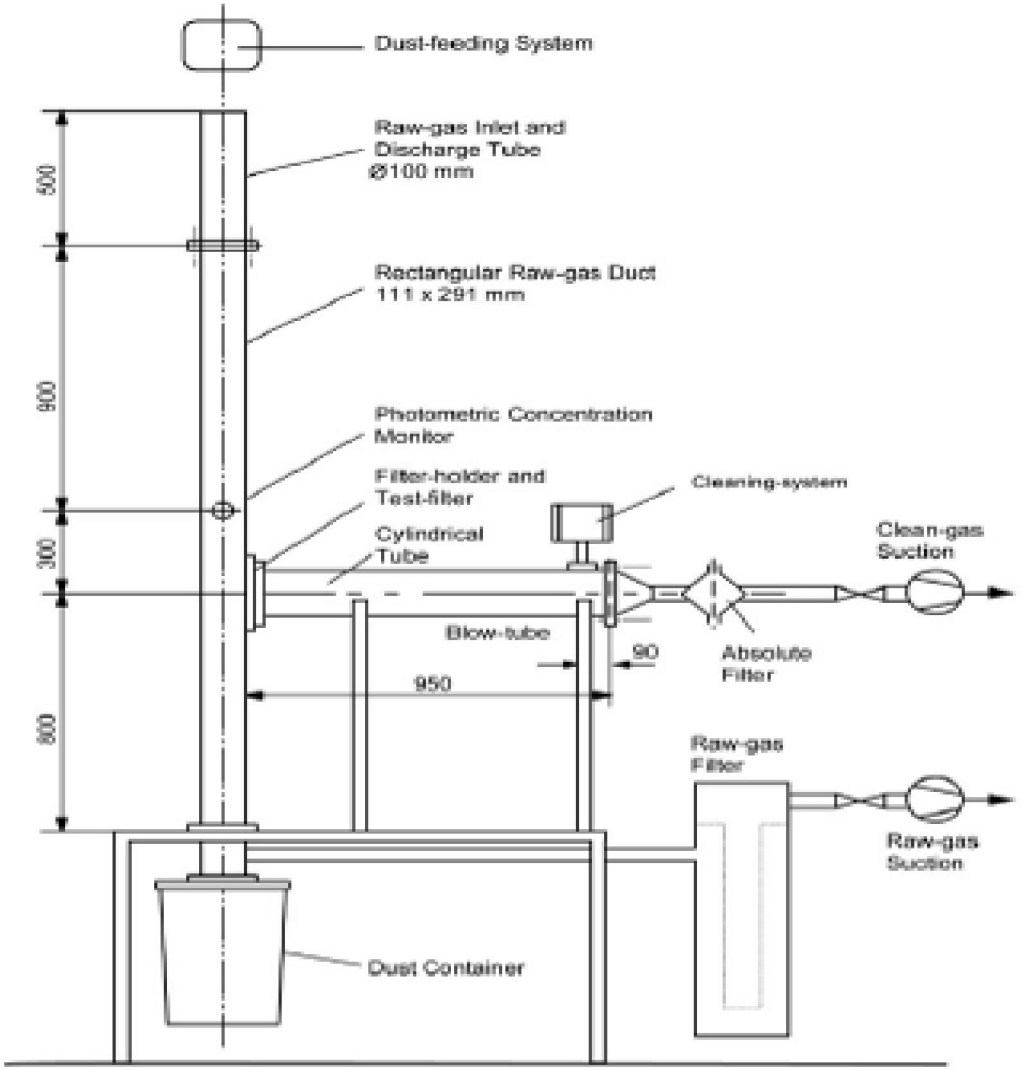


www.ximang.vn - www.cement.vn

LABORATORY EQUIPMENT
FOR COMPARATIVE TEST AFTER AGEING

Schematic drawing of the laboratory filtration test rig

according to VDI/DIN 3926



www.ximang.vn - www.cement.vn

KILN FILTER MEDIA

Comparative test of needle felts and membranes

Test sequence for filtration efficiency tests

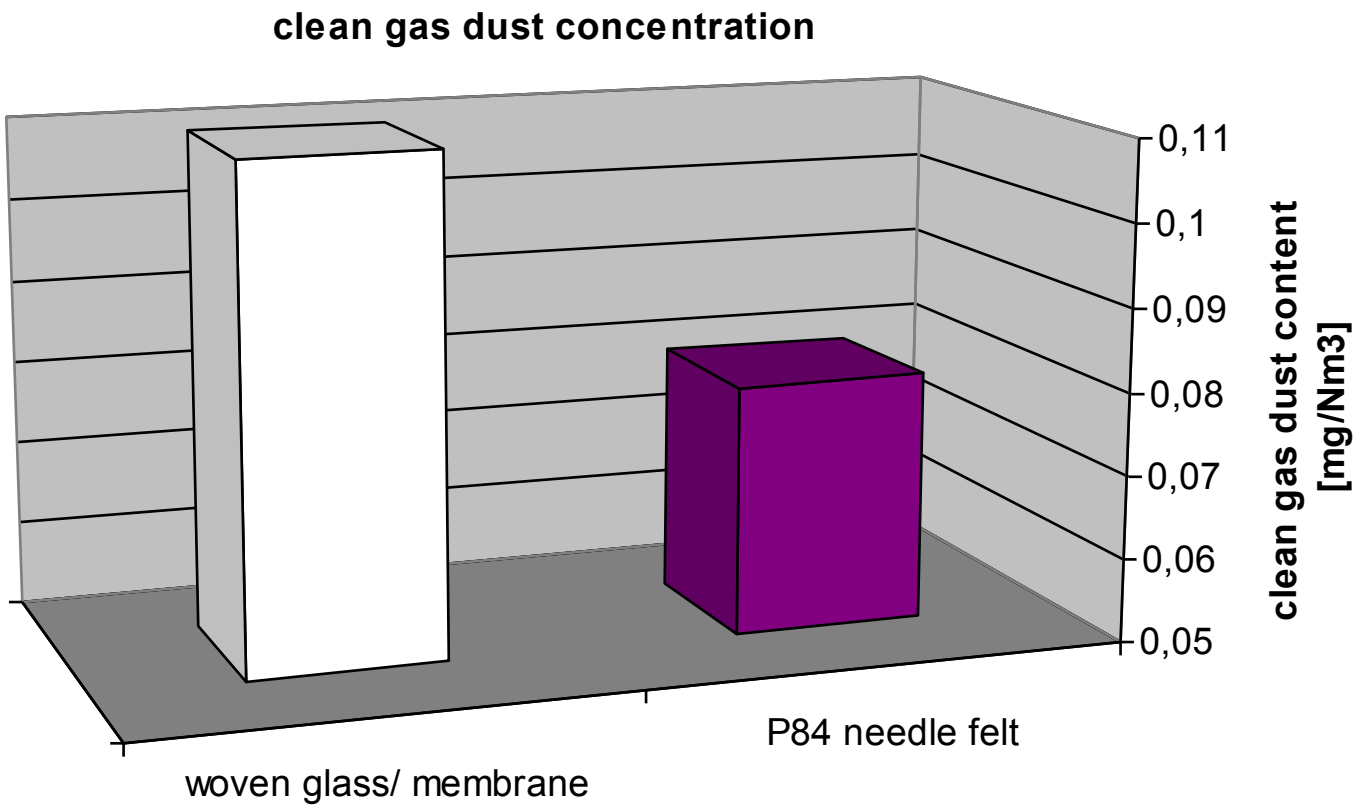
after ageing in the real filter unit

Sample	*woven glass/ PTFE membrane*	*100% P84 needle felt*
Test dust	*cement dust from the hopper*	
Dust load	*14 g/m3*	
Test sequence	*2 hours with pressure drop controlled cleaning at 1000 Pa*	
a/c ratio	*2 m/min*	

www.ximang.vn - www.cement.vn

KILN FILTER MEDIA

clean gas dust concentration during VDI 3926 test



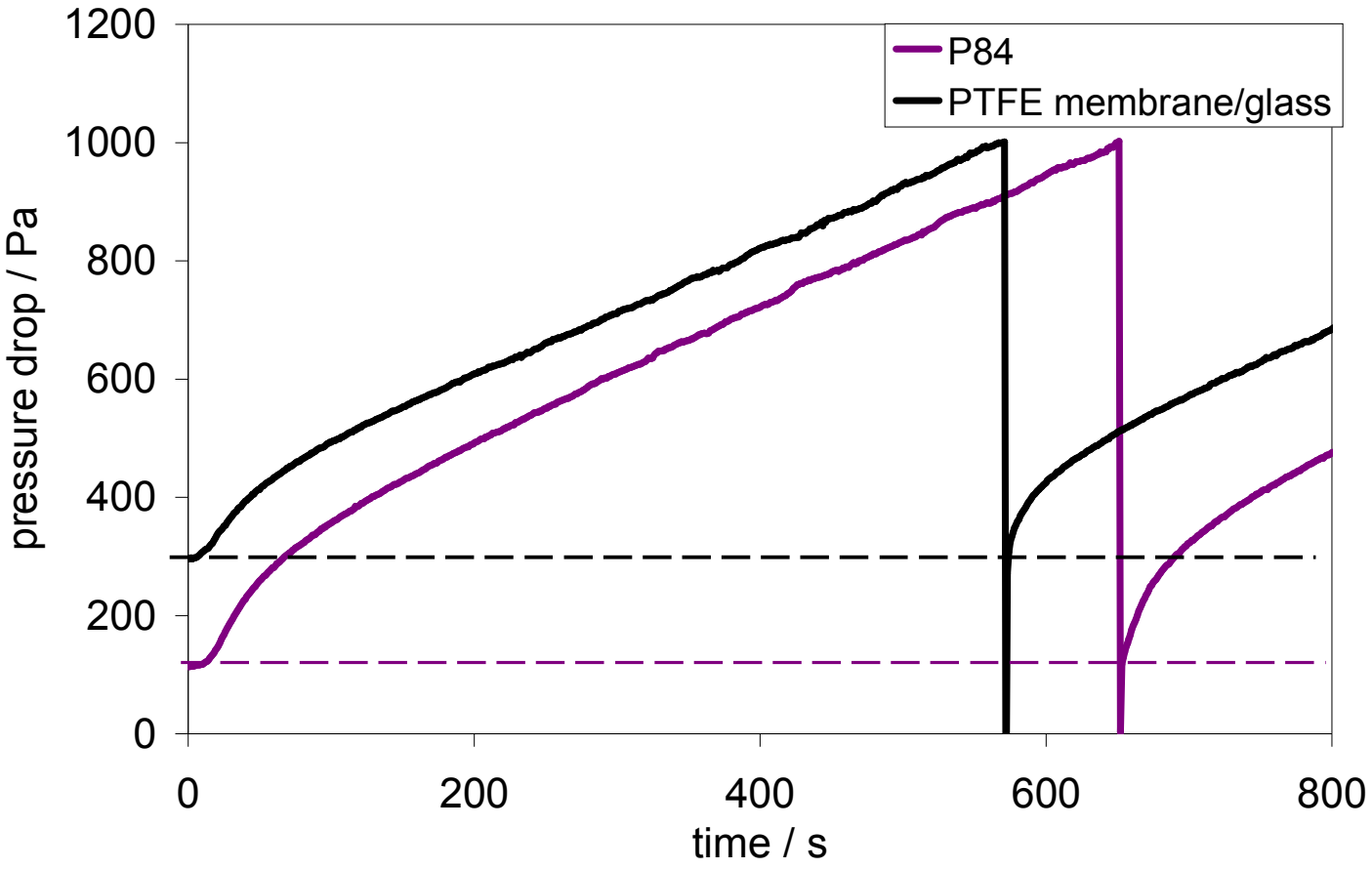
Lower emissions with P84:

Emissions of needle felts can outperform membrane materials in many applications

www.ximang.vn - www.cement.vn

KILN FILTER MEDIA

pressure drop development during a filtration cycle



20% lower pressure drop

with P84 needle felts

(at lower emissions)

www.ximang.vn - www.cement.vn

Content

- Bag house operating and maintenance costs
- WHY needle felts?
- WHY P84?
- Performance tests of kiln filter media
- Polyester/P84 blends in clinker mill filters
- Summary

www.ximang.vn - www.cement.vn

Cement Grinding line
Comparative test of PET and PET+P84

2 similar grinding lines with ball mills

Bag filter :

- size: 720 m²
- A/C ratio: 1,2-1,3 m/min
- dust load: 500 g/m³
- Temperature: 85 °C

As a result of an increase of the a/c-ratio the bag life of the polyester felts dropped from 18 to 7 months.

Problems with increasing pressure drop and dust emissions were experienced.

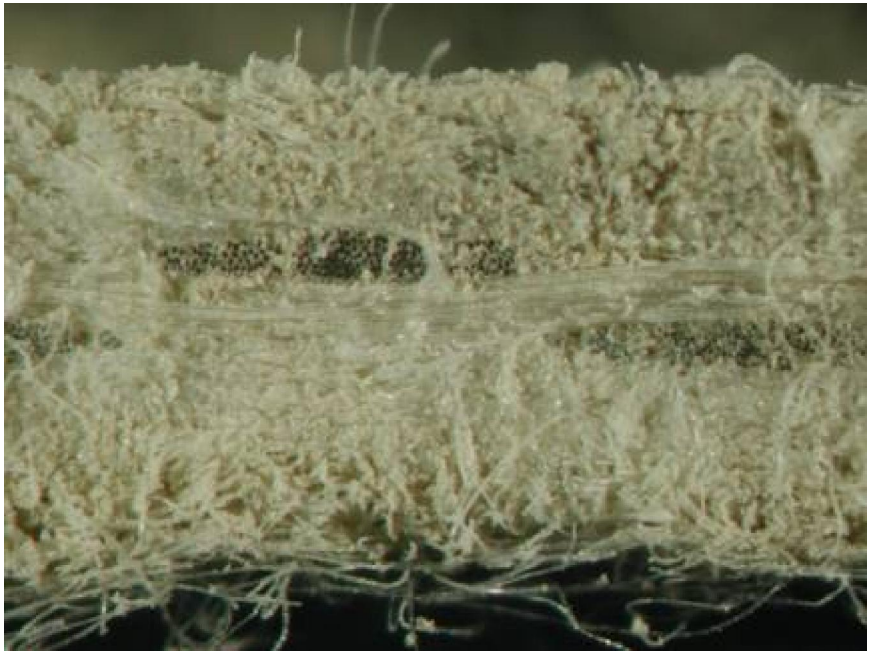
www.ximang.vn - www.cement.vn

Cement Grinding line
Comparative test of PET and PET+P84

		Polyester Fine Fibre	P84/Polyester
Bag construction	Filtration side	PET with scrim	40% P84 / 60% PET
	scrim	PET	PET
	Clean gas side	PET	PET
Felt weight		600 g/m^2	600 g/m^2
Air permeability @ 200 Pa		40-50 l/dm^{2}min	40-50 l/dm^{2}min
Performance		**Bag change after** **7 months**	**Pressure drop flange-flange: 1500 Pa, stable for >48 months**

www.ximang.vn - www.cement.vn

Cement Grinding line
Comparative test of PET and PET+P84



Polyester (PET) fine fibre after **7 months**

Air permeability[1)]: 7 l/m²min *as received*
10 l/m²min *cleaned*

Dust incorporation: 730 g/m²

P84-PET fibre blend after **48 months**

Air permeability[1)]: 10 l/m²min *as received*
18 l/m²min *cleaned*

Dust incorporation: 260 g/m²

www.ximang.vn - www.cement.vn

Content

- Bag house operating and maintenance costs
- WHY needle felts?
- WHY P84?
- Performance tests of kiln filter media
- Polyester/P84 blends in clinker mill filters
- Summary

www.ximang.vn - www.cement.vn

SUMMARY

The initially higher price of filter bags from P84 or P84 blends pays back more than once:

- easy installation without risk for damage
- long-term stable operation at low emissions
- reduced pressure drop → lower electricity consumption of the ID fan
- longer filtration cycles → lower consumption of compressed air / reduced mechanical wear
- used bags can be utilized as an alternative fuel (low content of minerals and no harmful combustion gases)
- easy storage of spare bags without damage is possible for years

Some hundreds of kiln/mill filter worldwide are operated with P84 needle felts without filter media related problems.

www.ximang.vn - www.cement.vn

Thank you for your attention!

Georg Rathwallner

Evonik Fibres GmbH

April 2015

EVONIK INDUSTRIES

www.ximang.vn - www.cement.vn