

HJS SMF® - Technology

Filtration Technology for Air Pollution Control (APC)



12th International VERT Forum 2022

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March, 24th 2022

Think about tomorrow.

HJS
Emission Technology

Agenda

- HJS brief introduction
- Background
- SMF® basic characteristics
- Manufacturing process SMF®
- SMF® Material Specifications
- Variation in designs
- Application Areas
- Summary



Hubertus Borgmeier
HJS International Sales Manager



HJS Profile, Site and Core Competences

- Number of employees 450, family business
- Wide range of emission control technologies
- Specialist in diesel exhaust aftertreatment
- High competence in research and development
- Flexible manufacturing structures and capacities

HJS Business Areas

OEM

INNOVATION RIGHT FROM THE START



HJS provides comprehensive emission solutions for integrated powertrain concepts based on 40 years of experience.

Upgrading Solutions

SUSTAINABLY CLEAN OVER A LIFETIME



HJS systems bring existing vehicles to the most modern emission level.

Aftermarket

QUALITY. AT ALL TIMES.



HJS offers OEM quality exhaust components for workshops and independent aftermarket retailers.

Motorsport and Tuning

VERANTWORTUNG ÜBERS ZIEL HINAUS



Performance pur: Das Motorsport- und Tuningprogramm von HJS.

New Business Area

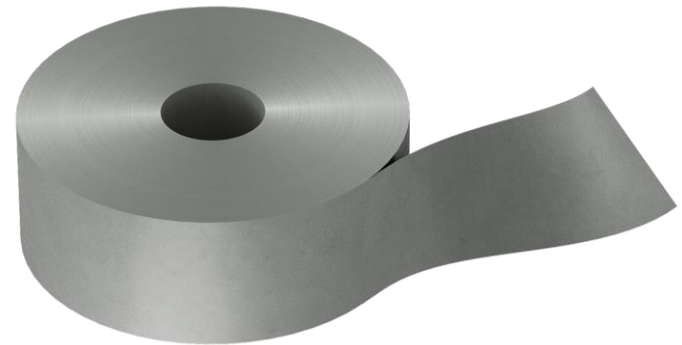
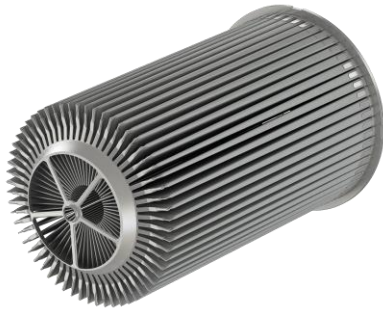
Air Pollution Control (APC)



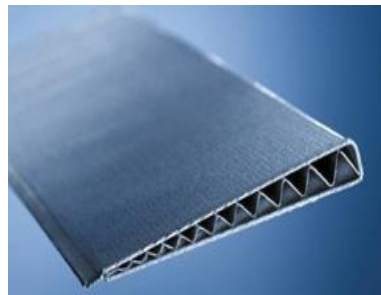
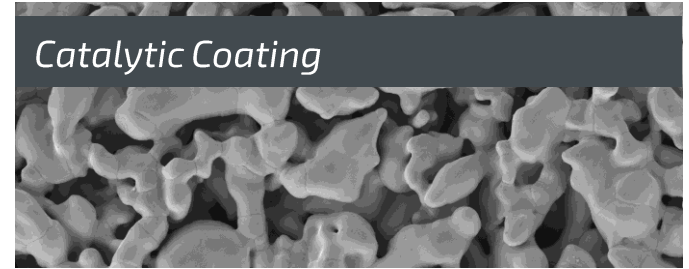
Background

- Currently also the industry remains a significant source of pollutant worldwide
- Aftertreatment technology for combustion engines is only a small part of the whole filtration market
- HJS has over 20 years experience with Sintered Metal Technology SMF® within this business
- Based on the Capabilities and Experiences in metal processing and production we would like to expand our business to the field of industrial filtration

SMF® - Designs Today



SMF® Basic Characteristics



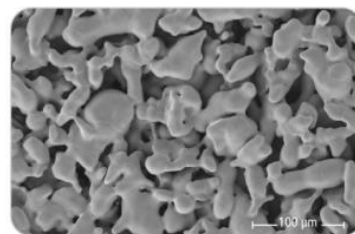
SMF® Manufacturing process



Step 1: For further processing the high alloy metal powder is mixed with a binder



Step 2: The pourable powder mix is applied to reinforcing expanded metal



Step 3: After the sintering process the powder particles are bonded with each other and the expanded metal



Step 4: SMF® medium is sintered in two steps and is available for further processing on coils with 170 m material length

Metal – powder & binder

Metal – powder
& expanded metal

Sintered, porous
structure

Filter – material
approx. 0,4 mm

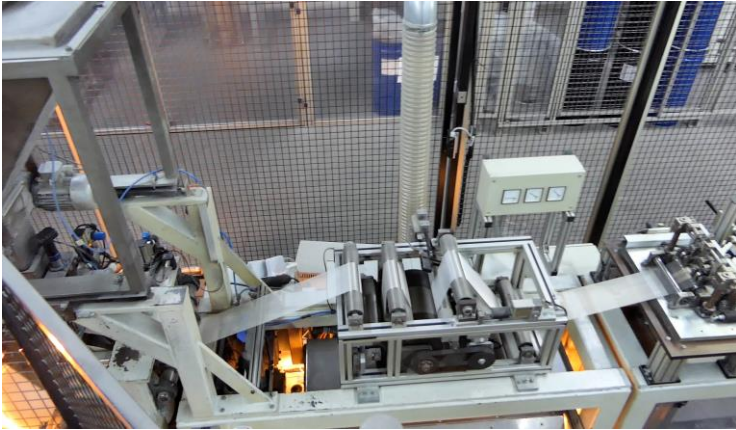
Coating

All dimensions of SMF could be coated by HJS.

Pt or Pd loadings up to 3 g/m² are available.

Further active surfaces with other coatings can be developed

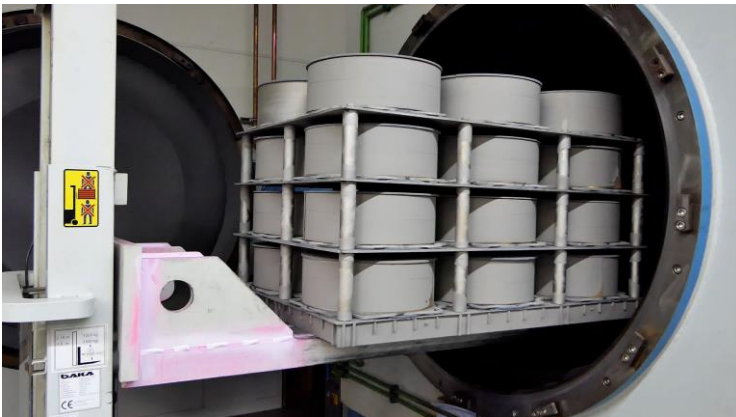
SMF® Manufacturing process



Expanded metal (calibration)



Powder coating (Funnel)

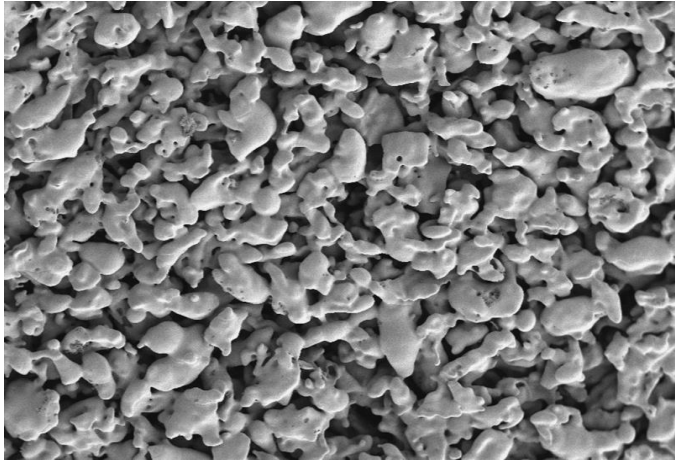


Sinter process

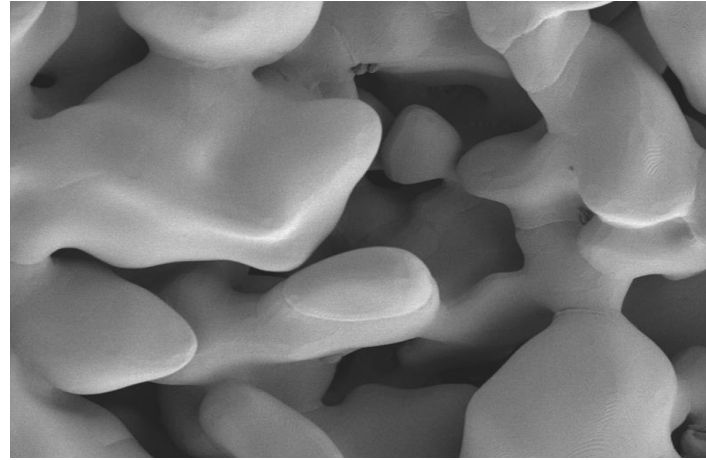


Industrial manufacturing (Roboter line)

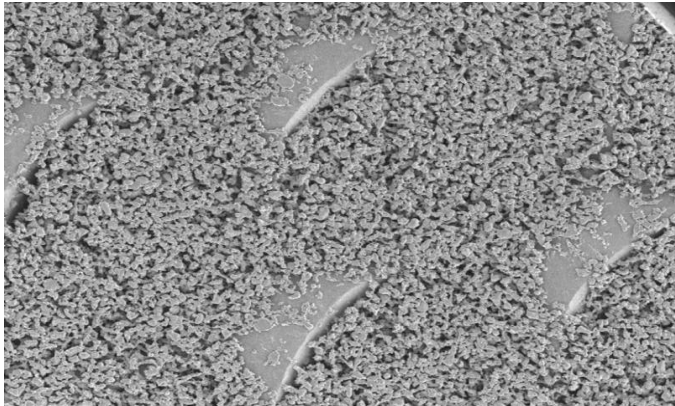
Material Characteristics SMF®



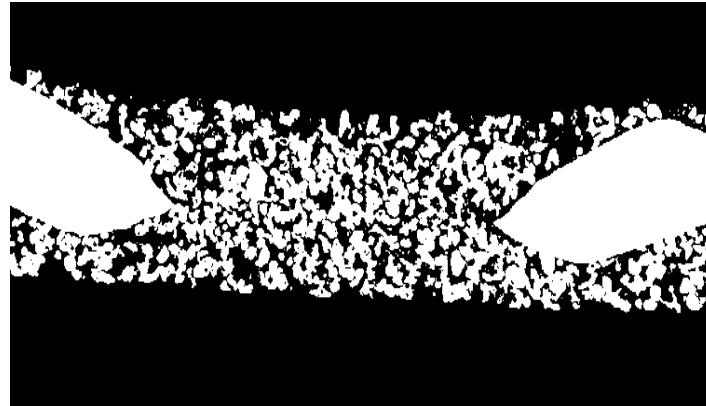
SEM-Picture, Flow in side



Micrograph, SMF®-sheet cut (equal pore sizes)



SEM-Picture, flow direction out side (back view)



SEM-Picture, Detail (Powder filled gaps)

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SMF® Material Specifications

Parameter	Unit	Value	Test Method
Weight	g/m ² g/inch ²	1650 / 1.1	
Thickness	mm / inch	0.38 / 0.015	
Porosity	%	45	
Alloy		310S / 1.4845*	
Air permeability	l/ dm ² min	20	ISO 4022
@ 200 Pa			
Bubble Point	mbar	35	ISO 2942 Isopropanol
Conductivity @ 20°C/ 70°F	S/m*	0.5 x 10 ⁶	
Operating temperature	°C / °F	450/ 840 (air, 50% rel. hum)	
Peak Temperature	°C / °F	800 / 1500	

*316 L as prototype, others on request

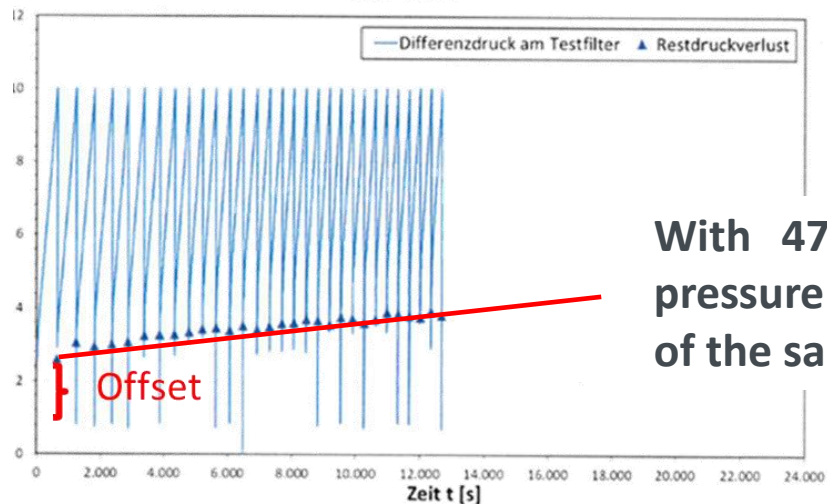
*Siemens per meter

SMF® Material Specification and properties

Gas filtration

Filtration Parameters Air				
Parameter	Unit	Value SMF	Test Method	Comment
Efficiency	%	99.996	ISO 5011	Dust PTI fine acc. ISO 12103-1, A2
Efficiency	%	99,94	VDI 3926	Dust Pural NF
Δp @ 3,3cm/s, clean	Pa	260	VDI 3926	Dust Pural NF
Δp @ 3,3cm/s, after 30 cycles	-	+ 47%	VDI 3926	Dust Pural NF
Efficiency ISO ePM1 (80% - 95% anal. F9 EN779)	%	85% @ 4,0cm/s	ISO 16890 (sheet test up to Δp 450 Pa)	conditioning in 2/30 cycles acc. VDI3926

Zeitlicher Verlauf von Differenzdruck und Restdruckverlust
SMF-Filter

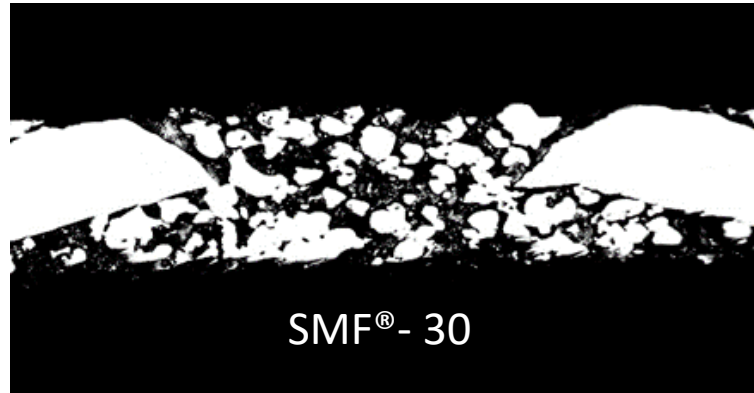
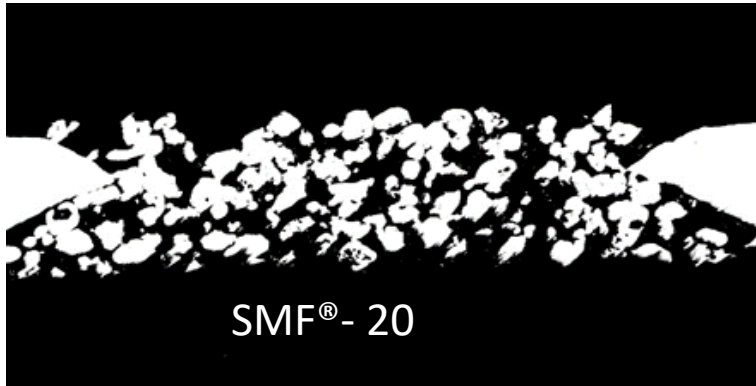
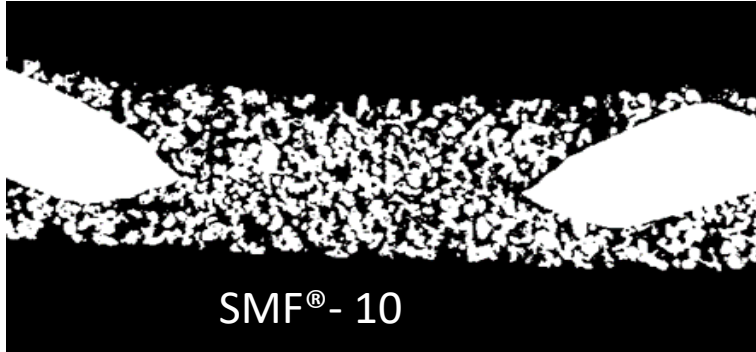


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SMF® Media Variants - Development

Coarser SMF®



SMF media were produced from coarser 316 L stainless steel:

The SMF® material can be adapted via adjustments of the powder metallurgy process in three steps from 45% to 50% porosity.

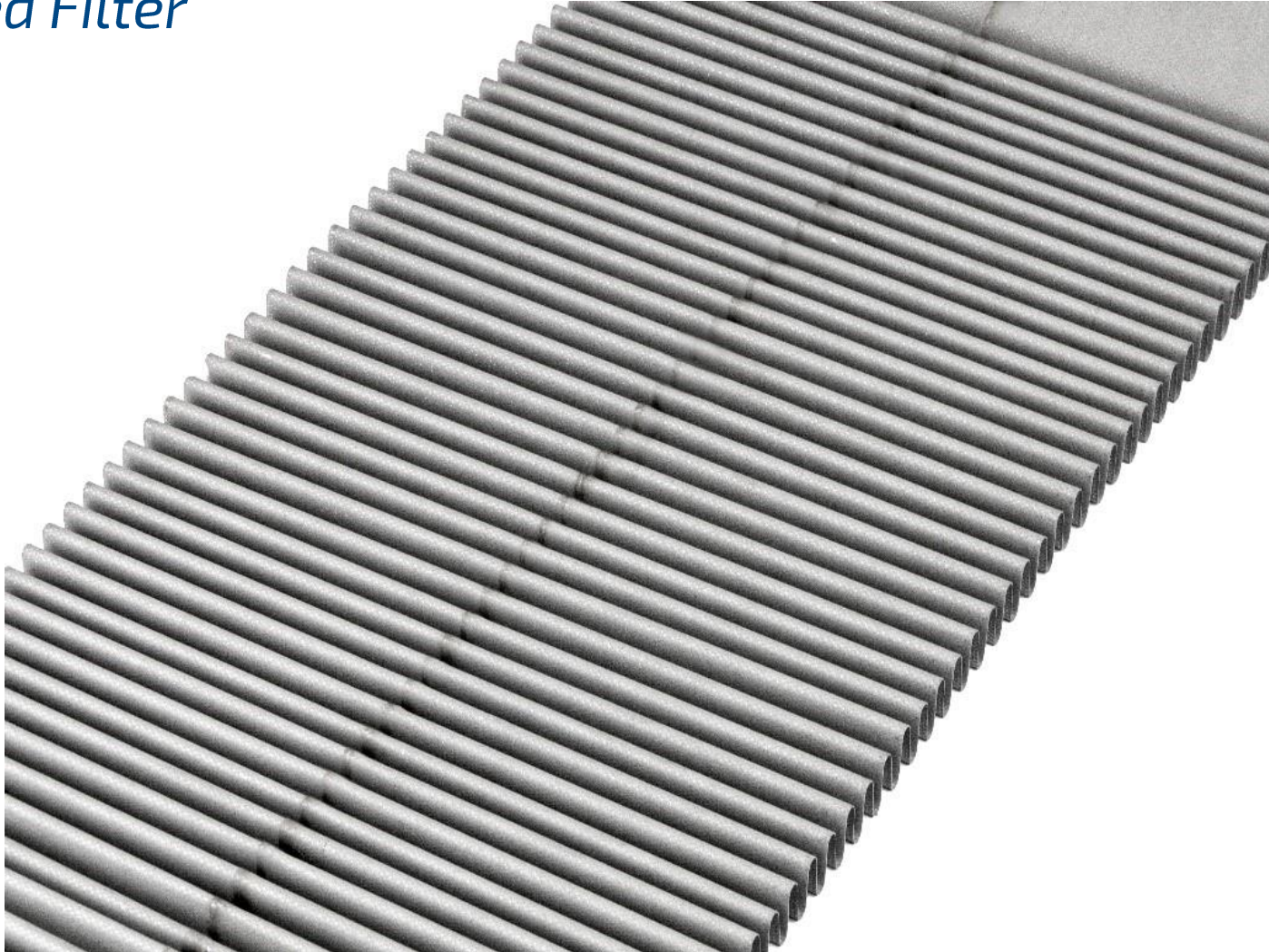
As a result the permeability increases from 20 to 130 l/dm²/min.

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SMF® Variation Design

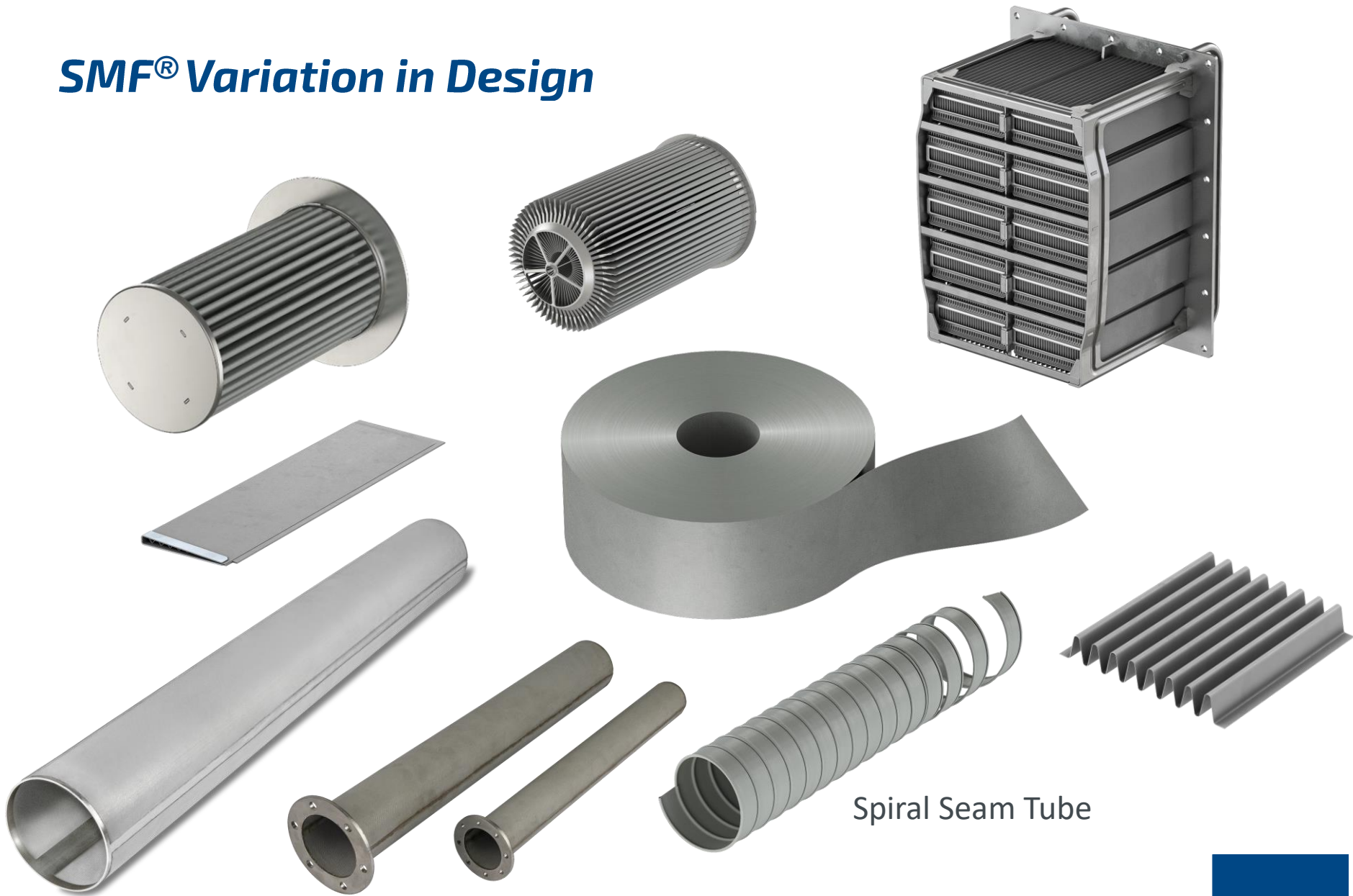
Pleated Filter



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SMF® Variation in Design



Spiral Seam Tube

Variations in Design

SMF® Filter candles for Gas Filtration (standards)

Diameter 130 mm

SMF® Candle

Module length 1000mm



Diameter 160 mm

SMF® Candle

Module length 1500mm



Various Diameters

SMF® Spiral Seam Tube

Concept, length up to 10 m



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Application Areas

Hot Gas Filtration for industrial wood combustion plants

SWISS Project XyloClean III

The new **XyloClean III** study will focus on validating bag filter technology for wood combustion plants > 50 kW, defining an automatic cleaning system to ensure filtration quality and long-term performance, and finally resuming field trials.

Within the framework of this project, the characteristics of the newly designed SMF filter elements will also be studied at **HEIG-VD** at Yverdon-les-Bains (CH).



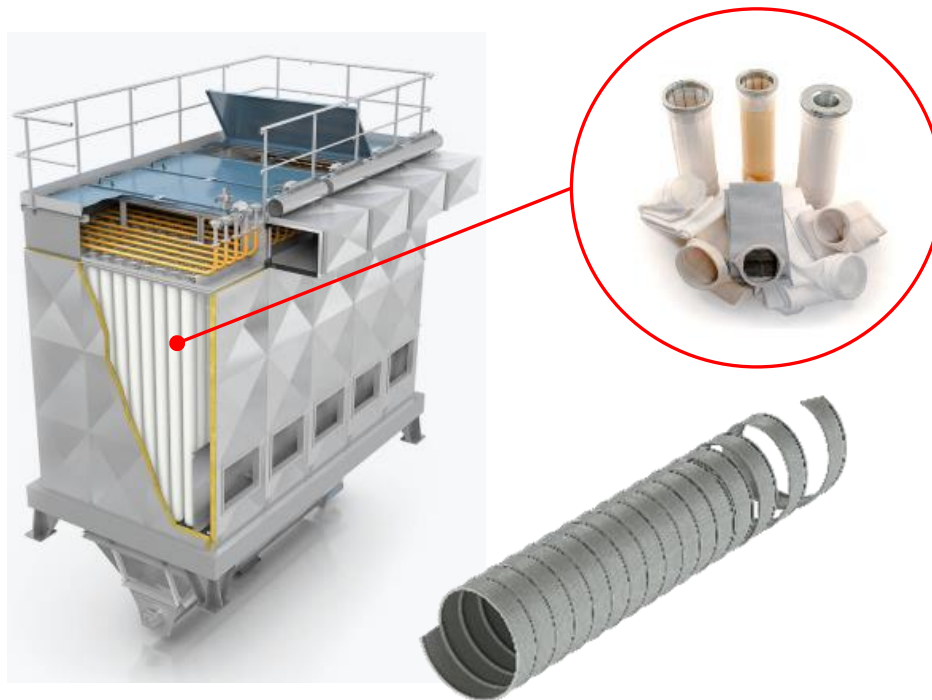
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Application Areas

Hot Gas Filtration for Cement and Lime Industry

The cement and lime industry is one of the most emission-intensive industrial processes. Due to the high inherent stability and strength of the SMF material, existing fabric filters can be replaced by SMF filter candles.



Application Requirements:

- Hi filtration efficiency of the filter media
- High air permeability @ acceptable Δp
- Surface filtration w/ good back pulsing behavior
- Temperature resistance $>350^{\circ}\text{C}$ (400°C)
- Backwards compatibility of filter elements; i.e. geometric fit
 - OD: $\varnothing 120\text{mm} \dots 200\text{mm}$
 - Length: $3.000\text{mm} \dots 9.000\text{mm}$
- High mechanical / dynamic stability & wear resistance
- Applicability of catalytic coating
- Pleatability provides additional benefits → e.g. footprint reduction

Summary and Advantages SMF®

- Metalband material available up to 170 m
- Reduced thickness 0,4 mm
- Surface filtration with narrow defined cut-off
- Backflushable in air and liquids
- Can be cleaned in-situ (in the process)
- Cleanable gas filter at temperatures up to 450°C
- Temperature shock resistant | durability ca. 800°C
- Conductive filter material
- Pleatable and combinable with further media
- High flexibility in element design
- Catalytic properties through coating (functional surfaces)

Technical Brochure

HJS Industrial Filtration



Innovation through Experience HJS Sintered Metal Technology

www.hjs.com/uk

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SMF®
Sintered filter media (SMF®) have a peak production of 300.000 known advantages of this sharp separation efficiency at industrial applications, like hot gas,

sintered metal in which a previously sintered stainless steel powder is sintered and supported by an

expanded metal carrier. This results in a mechanically and thermally highly stable filter medium, which can be pleated similar to paper or synthetic filter media.

The SMF® base material is manufactured on a highly automated continuous production line and comes as a quasi-endless strip, wrapped on a coil. In a subsequent step the material, which has been qualified for hot gas and exhaust filtration can be processed into filter elements typical for aforementioned applications.

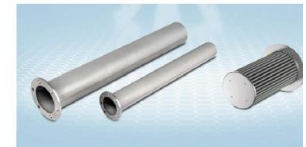
HJS Sintered Metal Technology

- Sintered metal band material for flexible mass production
- Flexible metal forming and design via pleating, cutting, folding and gluing
- Highest filtration efficiency
- Reduced thickness of only 0.4 mm
- Backflushable in air and liquids
- Durability up to 450 °C
- Coatable and conductive surface

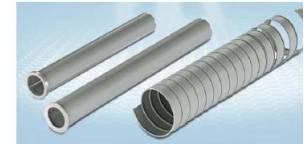


Parameter	Unit	Value SMF®	Test Method
Weight	g/m²	3000	
Thickness	mm	0.38	
Porosity	%	45	
Alloy		316L/304B5	
Air permeability @ 200 Pa	l/min	20	ISO 4022
Bubble Point	mbar	36	
Conductivity	S/m	6.5 x 10⁻⁴	
Operating temperature	°C	450 (air, 50% rel. hum.)	
Peak temperature	°C	800	

SMF®-Liquid Filtration
SMF® serial material has subsequently been qualified in the multi-pass test recognized in the hydraulic and process filtration industry in order to obtain a meaningful classification of the SMF® serial material. These tests have been performed in the very well-equipped new development centre of BOLLFILTER in Karpis, Germany. The average results of these multi-pass tests according to ISO 16889 carried out on several discs with a diameter of 125 mm:



SMF®-Hot Gas Filtration
To meet the specific requirements in air pollution control applications, the SMF® serial media has been adapted and qualified at a renowned test institute according to the test standards relevant for APC. The tests, which were carried out according to VDI 3026 and ISO 16899 standards, using 125 mm diameter flat sheet probes, show a 99 filtration efficiency (according to old EN778).



SMF® target segments & applications Air Pollution Control

Industries across the globe produce an ever increasing amount of harmful emissions of dust, smoke, and aerosols which further contributes to greenhouse gases and global warming. New environmental regulations will require filter manufacturers to provide new and inventive solutions to address this.

The cement industry is responding to an increasing world demand, however, it's one of the most emission-intensive industrial processes. The manufacturing process generates huge air volumes of up to 1,000,000 m³/h to move and collect the cement dust which is cleaned in large filter bag houses.

HJS Sintered Metal Filter Technology (SMF®) offers very specific material advantages which will serve as a growth platform. Due to the high inherent stability and strength of the SMF® material, welding fabric filters can be replaced by modular filter cartridge elements. Tests have proven the high filter efficiency and cleanliness of SMF®.

In contrast to the current filters used, filtration with SMF® can take place at up to 450 °C in continuous operation. This results in an immense reduction of the energy requirement (E₀₃) that would normally be necessary for cooling the exhaust gas. In addition, the material offers the possibility of a catalytic coating, e.g. for the reduction of harmful carbon monoxides.

The SMF® filter material is currently being mass-produced on highly automated production lines.



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What we are aiming for:



Thanks for you Attention !



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