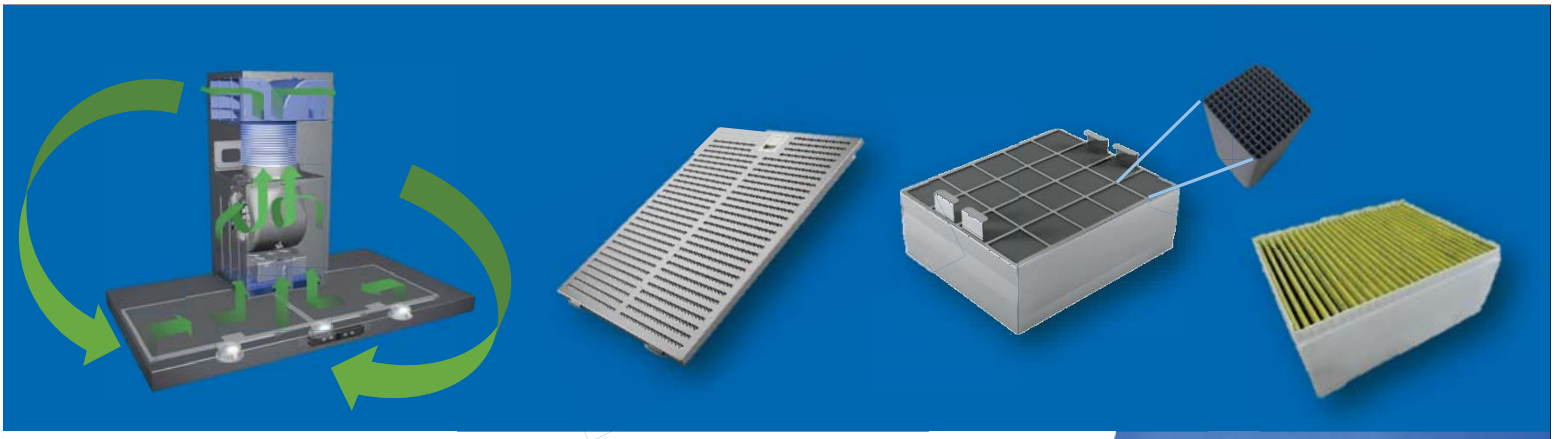

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Recirculating cooker hoods – possibilities and challenges

Urban Home Ventilation Workshop Oslo / 6th May 2020

M. Oberhomburg / BSH Home Appliances

Mission for Ventilation

Design

Hoods with a harmonic design, integrated into the kitchen and the living environment.

Function

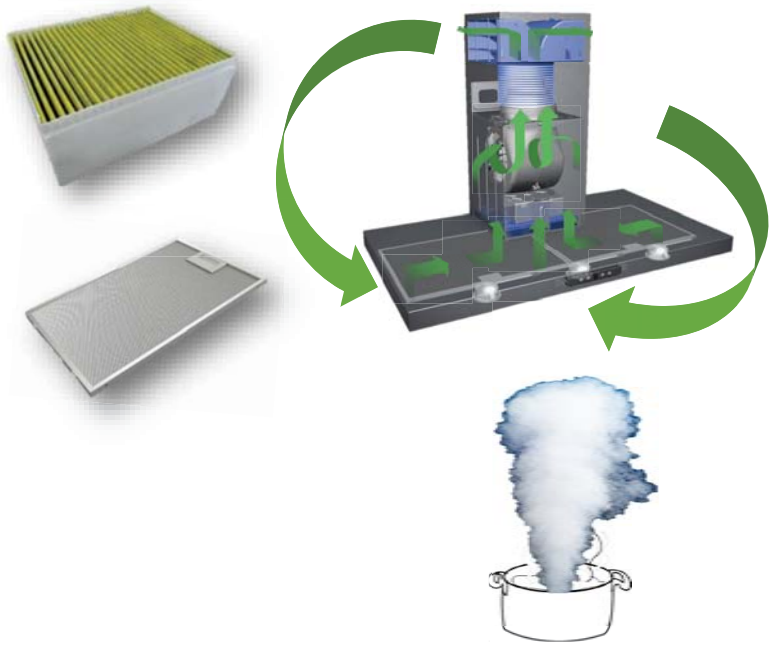
Low noise level for a quiet surrounding and without compromise on performance.

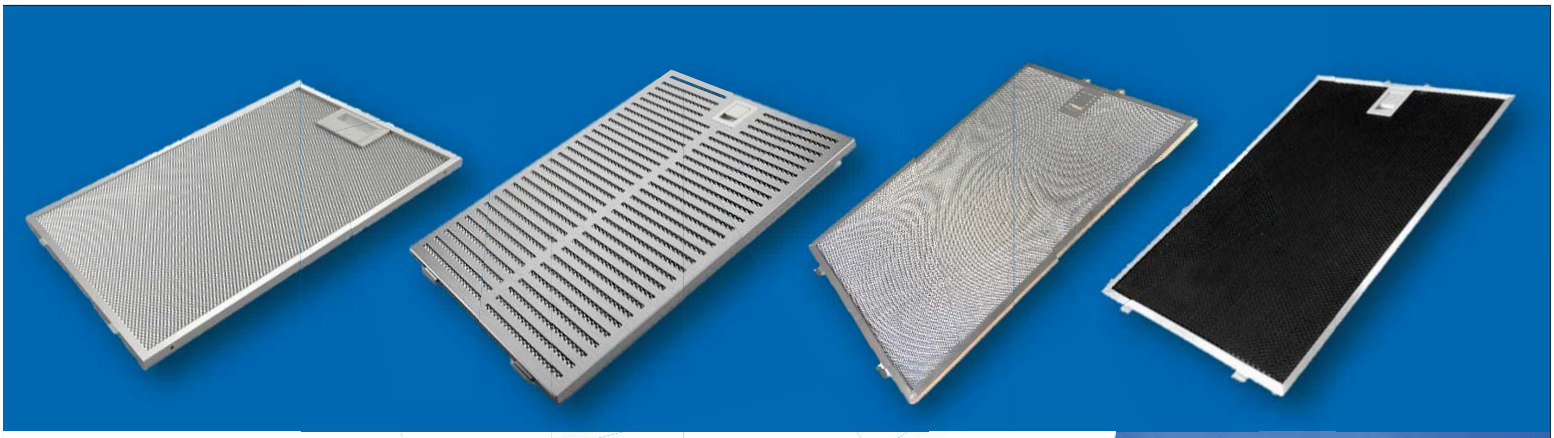
Air Quality

Pure air in kitchen environment for customer. (grease and odour)

Content

1. Grease Filter
2. Odour Filter
3. Catch Rate
4. Conclusion





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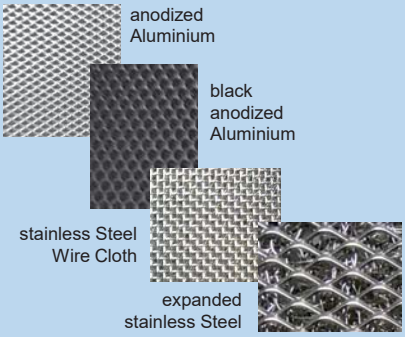
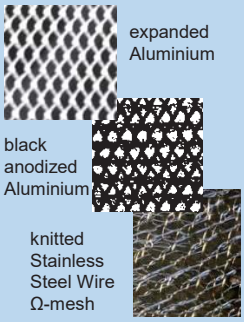
Recirculating cooker hoods – possibilities and challenges

1st step: Grease Filter

Mesh Grease Filter

User Experience | Performance

Handle	Frame	Exterior Layer	Interior Layer
	 Alu. extruded (8x8)  Steel Roll form. (8x8)	 anodized Aluminium; black anodized Aluminium; stainless Steel Wire Cloth; expanded stainless Steel	 expanded Aluminium; black anodized Aluminium; knitted Stainless Steel Wire Ω-mesh

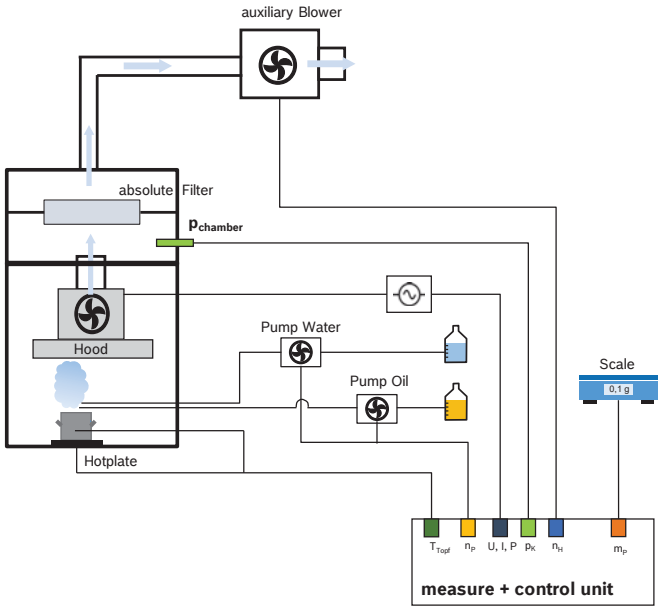
Measurement Method: DIN EN 61591 – Grease Filtering Efficiency / GFE

Measurement of weight increase after test

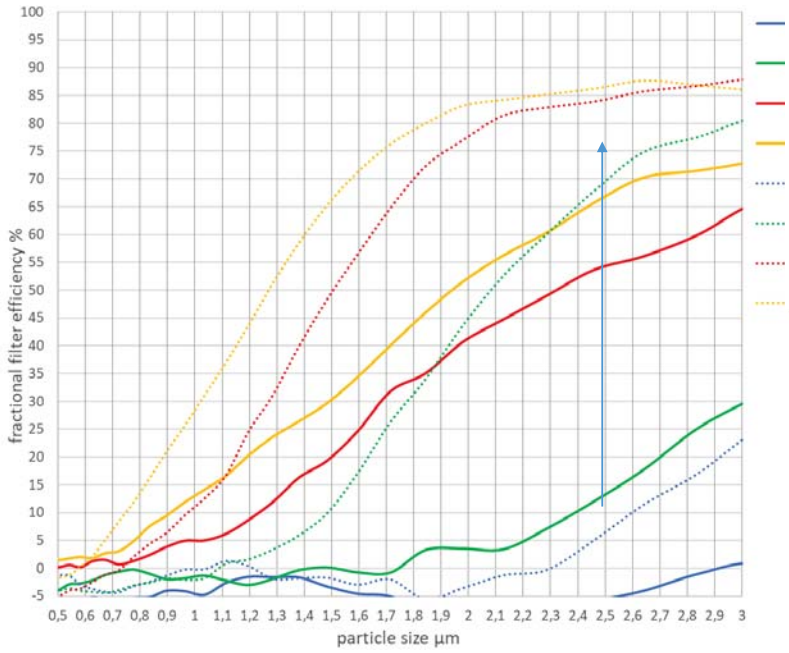
- Filter
- Hood
- 99.99 % absolute filter /Exhaust

$$GFE = \frac{Filter}{Filter + Hood + Exhaust}$$

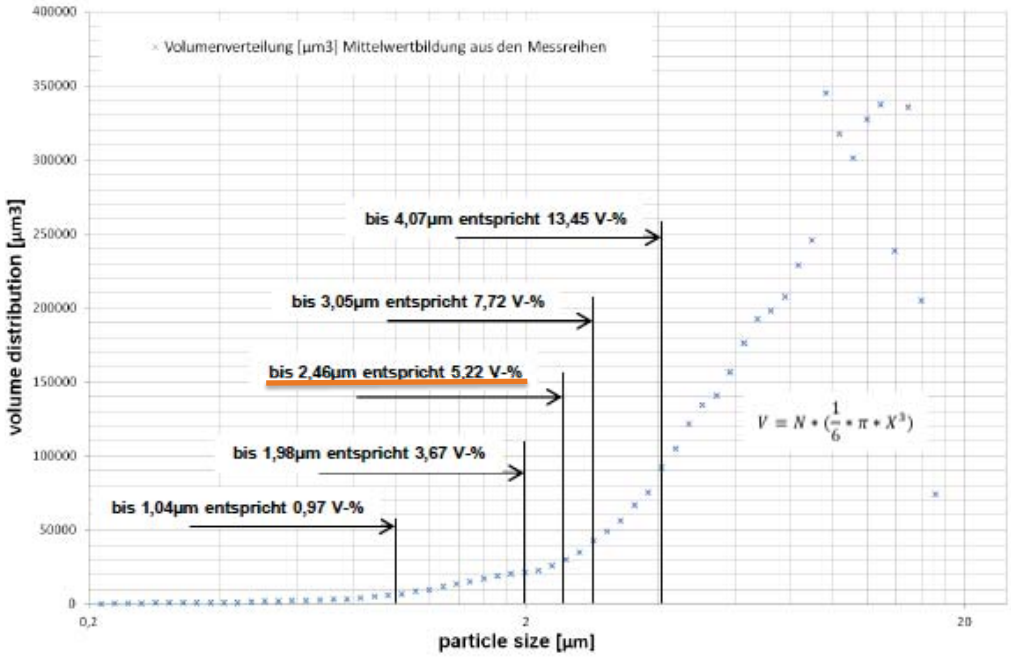
GFE [%]	GFE class
95 - 100	A
90 - 95	B
85 - 90	
80 - 85	C
75 - 80	
70 - 75	D
65 - 70	
60 - 65	E
55 - 60	
50 - 55	F
45 - 50	
40 - 45	
35 - 40	G
30 - 35	
< 30	



Grease Filter Efficiency with Particle size



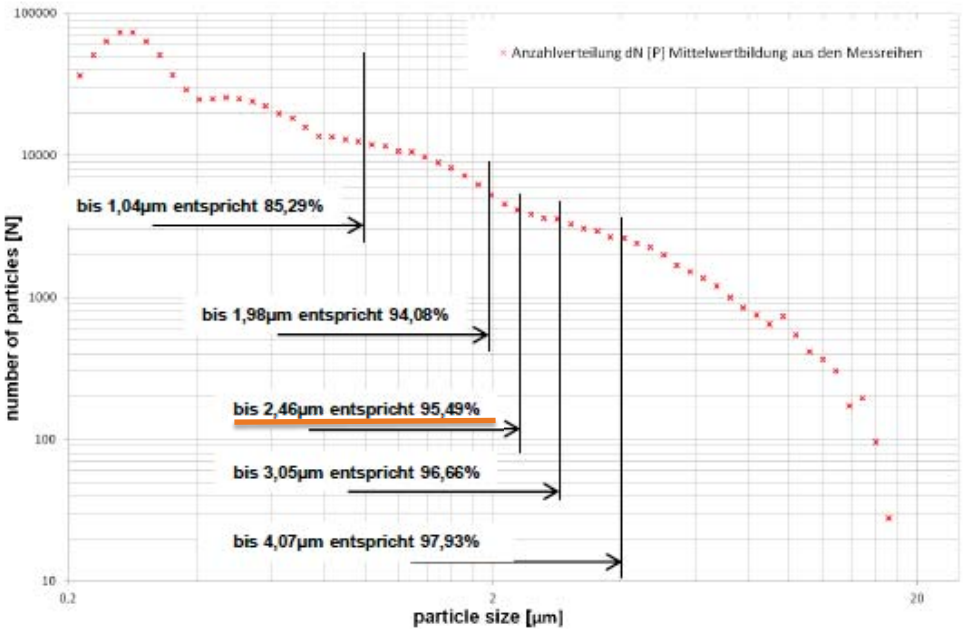
Volume/Mass Particle Distribution measured with Norm Conditions DIN EN 61591



=> Particles smaller 2,5 µm correspond to 5,5% of particle mass

X [µm] (0.2µm bis einschließlich:)	Volumenanteil [%]
1,04	0,97
1,98	3,67
2,46	5,22
3,05	7,72
4,07	13,45
5,05	20,58
5,83	26,45
7,24	37,62
8,36	46,22
9,65	57,88
11,15	70,07
13,83	87,88
15,97	98,54

Particle Size Distribution measured with Norm Conditions DIN EN 61591



=> Particles smaller 2,5 µm represent more than 95% of particle amount

X [µm] (0.2µm bis einschließlich:)	Anteil d. Partikelanzahl [%]
1,04	85,29
1,98	94,08
2,46	95,49
3,05	96,66
4,07	97,93
5,05	98,67
5,83	99,03
7,24	99,43
8,36	99,61
9,65	99,76
11,15	99,87
13,83	99,96
15,97	99,997

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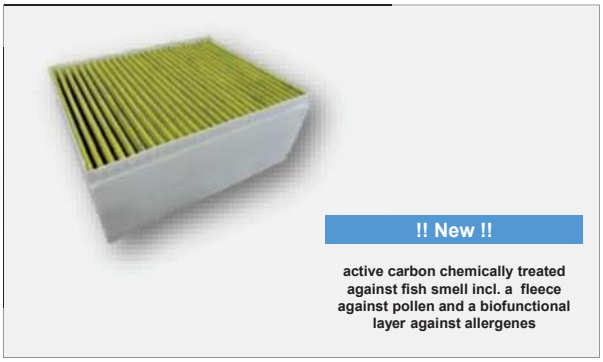
Recirculating cooker hoods – possibilities and challenges

2nd step: Odour Filter

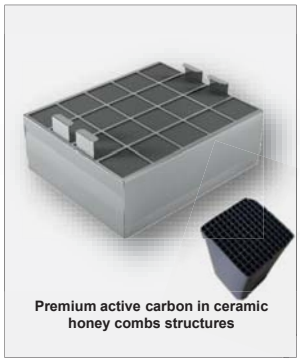
Recirculation Filter Portfolio – Region Europe

Active carbon chemically treated against fish smell



!! New !!

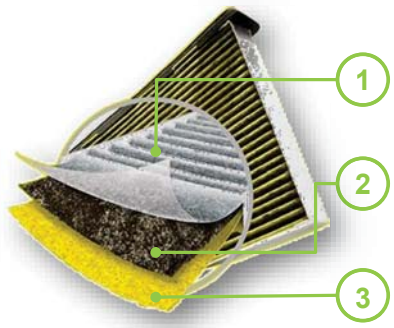
active carbon chemically treated against fish smell incl. a fleece against pollen and a biofunctional layer against allergenes



Premium active carbon in ceramic honey combs structures

"Starter Set" with Foam	Clean Air → Clean Air Plus	Regenerative
Smell Reduction: <<90%	Smell Reduction: >90%	Smell Reduction: 80 - 90%
6 Months Use	12 Months Use	10 Years Use
1st Cost →		

Clean Air Plus



1 **Carrier layer**
Filters Particles and Pollen (>10µm) *>99%*
Filter Class: ePM$_{10}$ 70%

2 **Activated carbon layer**
Eliminates odor *>90%*
Especially treated against fish smell

3 **Bio-functional layer**
Natural polyphenols inactivates allergens *>99%*

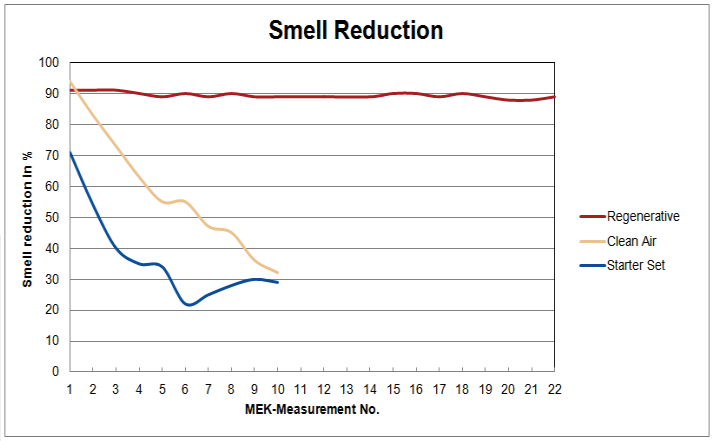
Odour Filter Clean Air Plus
with Bio-functional layer

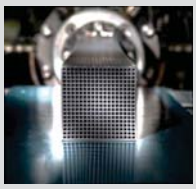
- Odour Reduction (MEK) > 90 %
- Anti-Fish-Function: special impregnation against fish smell

Anti-Pollen-Function:

+ **air floating pollens are withdrawn by the filter**
+ **in filter captured allergens are deactivated**

Honeycombs Technology ⟶ high potential for Recirculation Filter



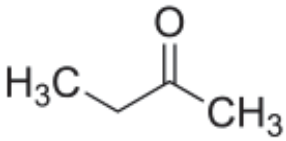


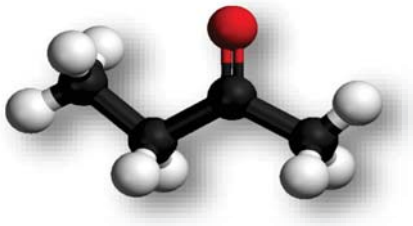
- Charcoal-Ceramic-Honeycombs
- Regeneration in Oven at 200°C
- Same performance after regeneration
- Lifetime of filter 10 years

Odor Reduction Efficiency Measurement with “MEK” (DIN EN 61591)

MEK is representing VOC (volatile organic compounds C_xH_y)

MEK / Butanone / C_4H_8O





other names:

- Methylethylketone
- Ethylmethylketone
- 2-Butanone
- Butan-2-on
- Methylpropanon
- Methylacetone

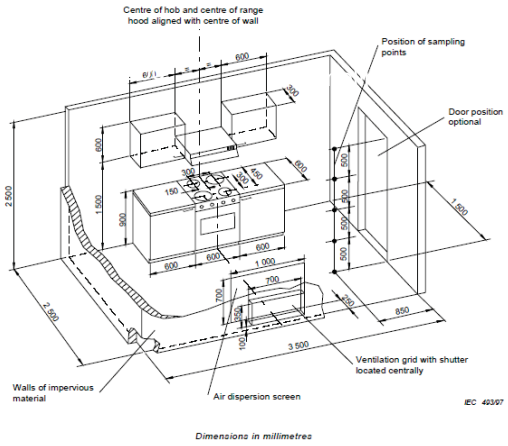
Measurement Methode: DIN EN 61591 – Odour Filter

Odour extraction measurement quantifies the performance in odour extraction of a hood **based on Methylethylketone / MEK**

C1: MEK concentration (ppm) without odour filter

C2: MEK concentration (ppm) with odour filter

$$GR = \frac{C1 - C2}{C1}$$

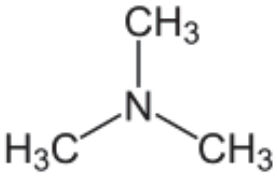


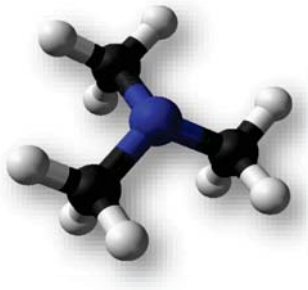
Dimensions in millimetres

Odor Reduction Efficiency Measurement with “TMA” (not standardized)

=> TMA as representative molecule for “fish smell”

TMA / Trimethylamine / C_3H_9N





other names:

- *N*,*N*-Dimethylmethaneamine
- TMA (ambiguous)
- NMe_3
- Fagin

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Recirculating cooker hoods – possibilities and challenges

3. Catch Rate Evaluation

Visual Catch Rate Evaluation / Example

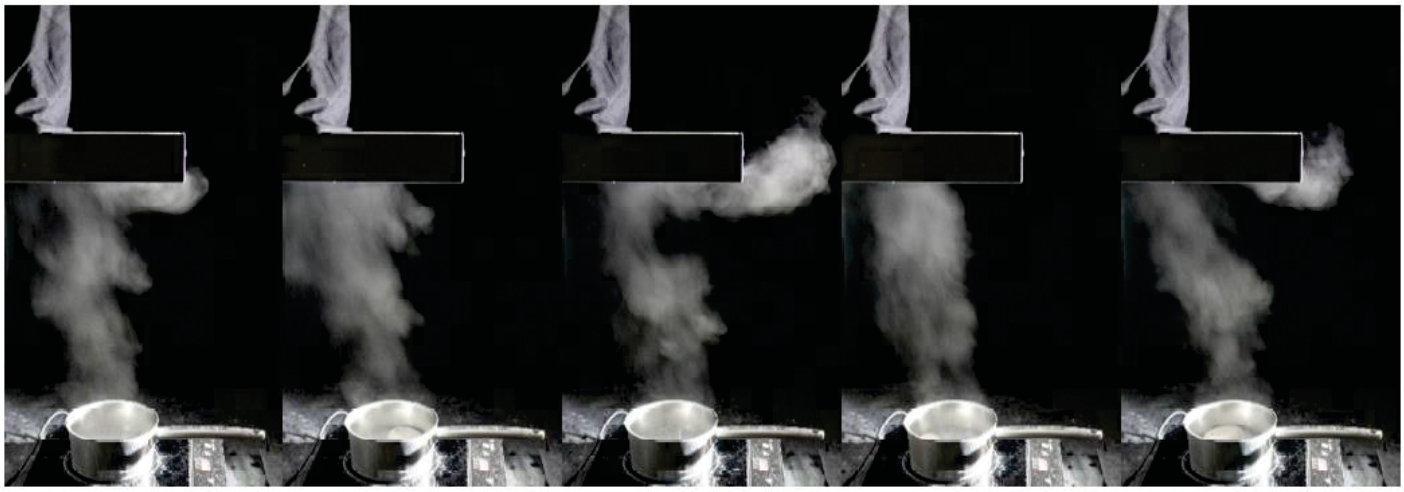
Passivhaus Institut

IHD SCIENCE BY EXPERTS

iTG

Naber ...inspiriert!

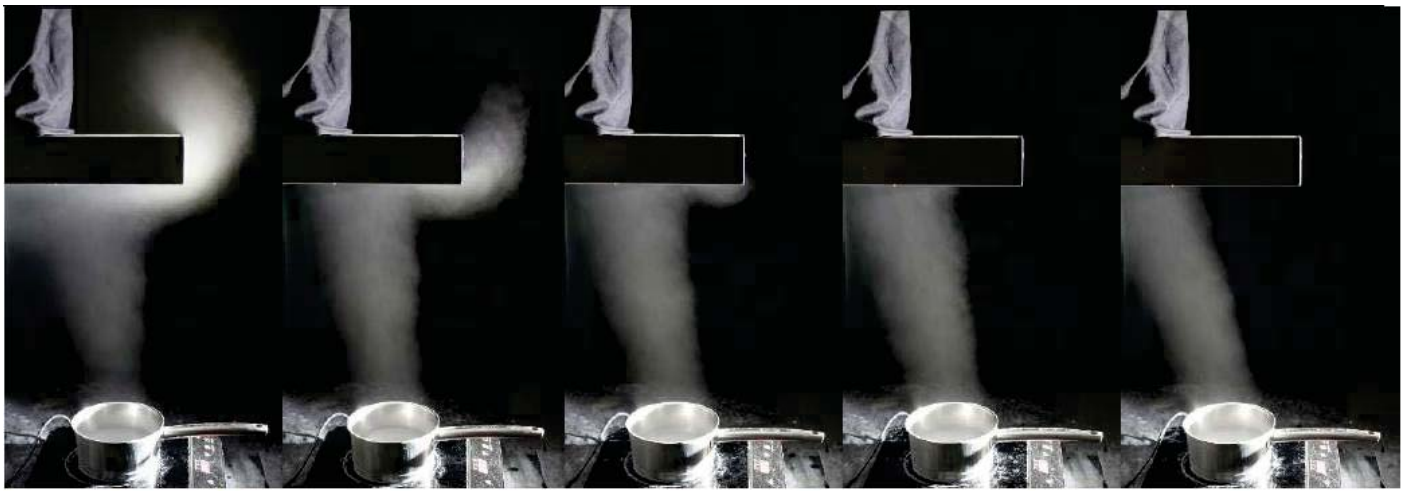
5 shots out of time row of 50 / Power Level 2



Visual Catch Rate Evaluation / Example

Average Value out of 50 Shots

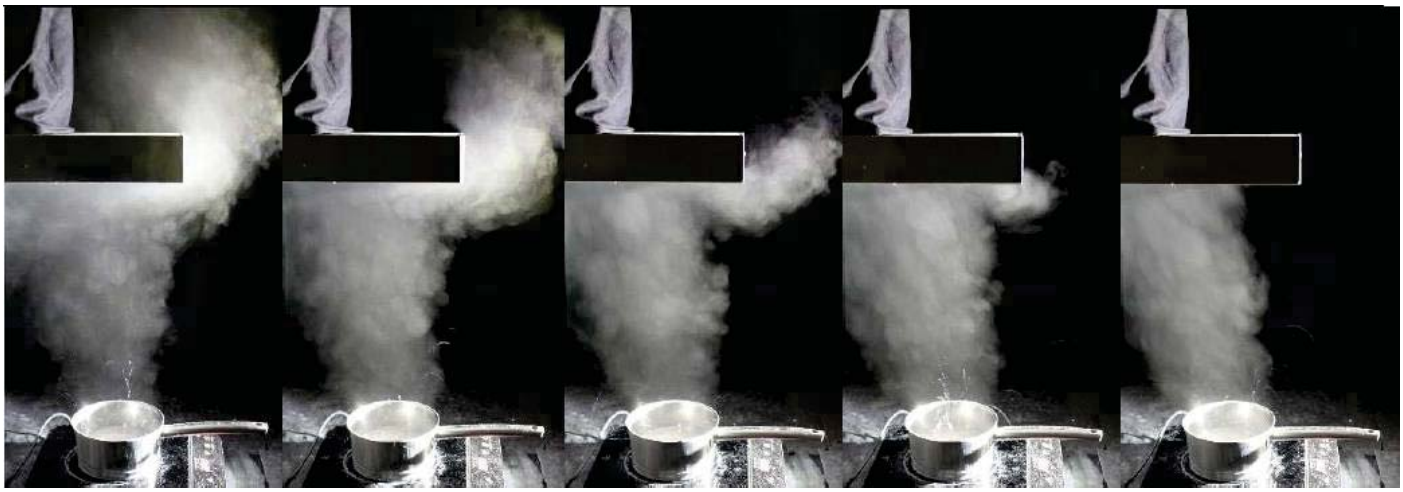
OFF | Level 1 | Level 2 | Level 3 | Level 4



Visual Catch Rate Evaluation / Example

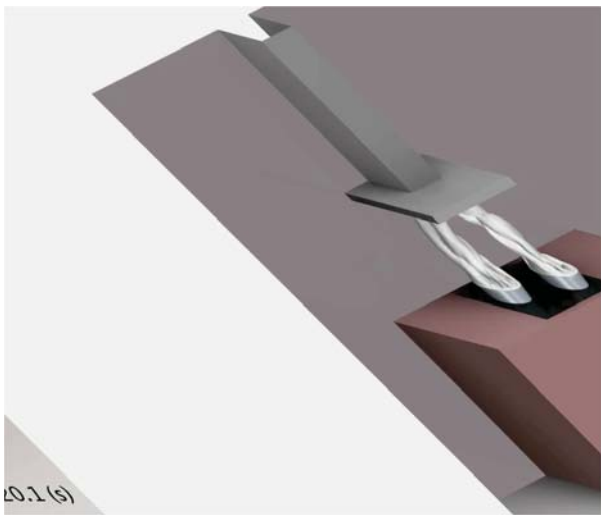
Worst Case out of 50 Shots for different power levels

OFF | Level 1 | Level 2 | Level 3 | Level 4

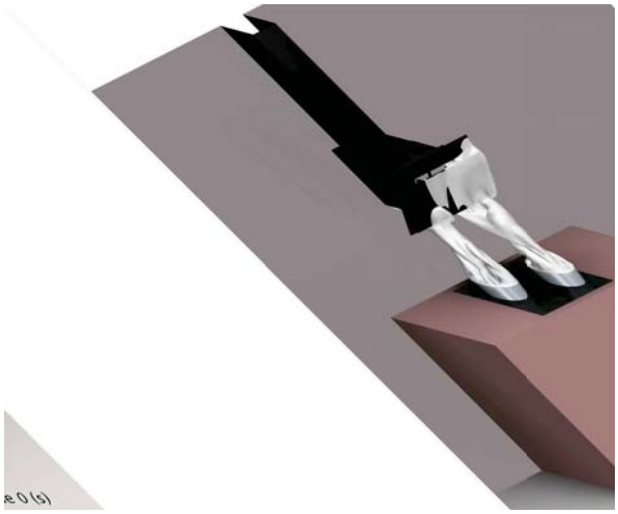


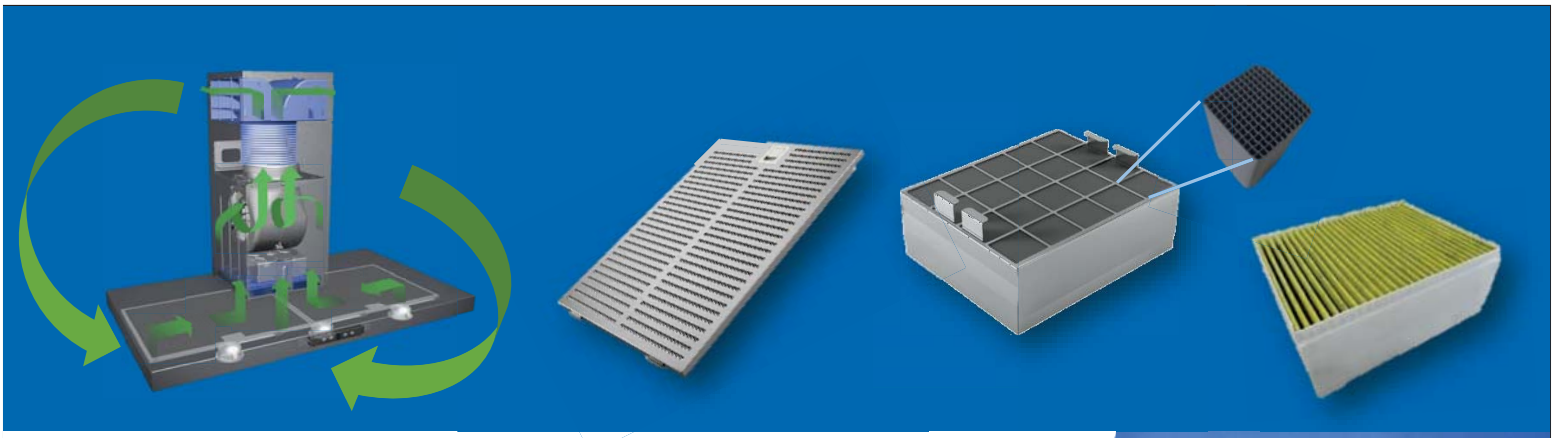
Numerical Catch Rate Simulations with Water Vapour

Box Hood 440 m^3/h | 100% / 100%



Inclined Hood 400 m^3/h | 100% / 96%





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4. Conclusion

Summary

1. **Grease Filter**
   Expanded aluminum mesh filters can reach good level of grease capturing efficiency, but is not working as “fine dust” filter. **It is Important to “protect” the charcoal filter.**

2. **Odour Filter**
   Big variation of performance can be found in the market (depending on amount and quality of charcoal), but **odour reduction rate bigger 90% is possible**. Regular replacement or regeneration is needed for keeping good performance. Can work as pollen filter.

3. **Catch Rate**
   Very **important** for overall performance, but **difficult to measure**.
   Additionally it **depends** a lot on kitchen design and **ambient air flow**.

4. **Conclusion** =>

The Main Opportunities & Challenges

OPPORTUNITIES

Recirculation = no loss of heated air via the cooker hood

Facilitates kitchen and ventilation planning

A technology revolution in the last decade has raised recirculation to high performance level

CHALLENGES

Requires extra maintenance to change/regenerate carbon filters

Great variety of performance from excellent to almost useless products on the market

Does not remove all emitted particles


Thank You!