

# 可吸附納米氣溶膠並具備其他附加功能的多層納米纖維過濾器

## Multilayer Nanofibre Filter - Nanoaerosols Capture and Added Functions

能有效過濾納米氣溶膠、轉化揮發性有機化合物以及殺滅細菌的低壓降過濾器

Low-pressure drop filter for effective nanoaerosol filtration, VOC conversion and bacteria killing



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由於柴油微粒、鐳射打印機顆粒、病毒和細菌等納米氣溶膠的體積細小，故容易進入人體的呼吸系統、血液循環系統、淋巴系統及神經系統，因而導致各種慢性疾病。

多層納米纖維過濾器由多個納米纖維薄層構成，當中每個纖維層均內置滲透性無紡布，能有效地吸附納米氣溶膠。此外，與把所有納米纖維置於單一纖維層相比，多層納米纖維過濾器的壓降相對較低。

納米纖維層還有其他附加功能：它能把氣態污染物轉化為無害物質，並能夠殺滅細菌。這些功能是傳統粗微纖維過濾器所無法實現的。

多層納米纖維過濾器能吸附300納米氣溶膠，效率遠高於傳統口罩；而其壓降亦遠低於單層納米纖維過濾器。  
Multilayer nanofibre filter has higher capture on 300 nm aerosols than face mask and much lower pressure drop than single-layer nanofibre filter.

300-nm particle (standard test condition)	
Face Mask (conventional)	28%
Nanomask (based on Multilayer NF Filter)	80%
*Same Breathability (pressure drop)	
90% efficiency for 300-nm particle (standard test condition)	
Multilayer NF Filter	1 unit pressure drop
Single-layer NF Filter	~ 3+ units pressure drop



與傳統口罩相比，納米材料能在低壓降的情況下提供高效保護。  
In comparing with Conventional Face Mask, Nanomask can provide high protection with low pressure drop.



納米纖維過濾器除可用於交通工具的客艙及室內空間外，還有許多其他應用範疇。  
Nanofibre Filter can be used for cabins, indoor spaces, and many other application areas

Due to the small sizes, nanoaerosols (diesel particulates, laser-printer particles; viruses; and small bacteria) can get into our respiratory, vascular, lymphatic and nervous systems, leading to various chronic diseases.

The multilayer nanofibre filter using multiple thin nanofibre layers, each supported by a permeable scrim material, attains high-capture efficiency of nanoaerosols. It also has a lower pressure drop compared to the case in which all nanofibres are packed in a single-layer.

By functionalising the nanofibre layer(s), gaseous pollutants can be converted to harmless substances while bacteria can be killed.

These functions cannot be achieved with conventional coarse microfibre filters.

專利編號: US Patent 8,523,971 專利申請編號及國家: US CIP 13/958,235, Germany 112010001912.6, PRC 201080031111.9, PCT PCT/CN2010/072514

### 特色與優點

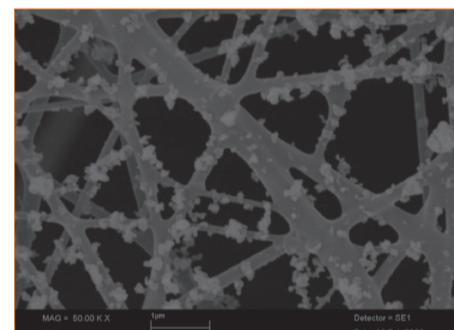
- 多層納米纖維過濾器具有較低的壓降
- 多層納米纖維過濾器比傳統微纖維過濾網更能有效地過濾納米污染物和病毒
- 每個納米纖維層可以有不同的附加功能，例如：
  - 在可見光（包括室內燈光）的照射下，TiO<sub>2</sub>複合納米纖維能把污染氣體（如揮發性有機化合物、NO等）轉化為無害物質
  - 沾濕後（例如遇到汗水時）的殼聚糖納米纖維能殺滅細菌

### 應用

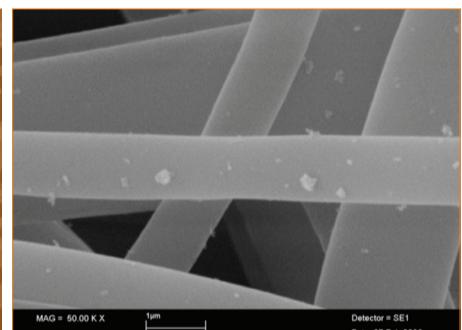
- 適合外科醫生及從事體力勞動的工人使用的口罩
- 在流行病爆發期間供公眾和醫護人員使用的呼吸器
- 適用於飛機、汽車、火車和輪船的客艙過濾器
- 禮堂、教室、體育館及辦公室等室內場所的通風過濾器

### 獎項

- 第42屆瑞士日內瓦國際發明展 -金獎 (2014年4月)
- 羅馬尼亞教育部特別獎 (2014年4月)



納米纖維過濾器能有效地吸附燃油微粒  
Nanofibre filter effectively trapping diesel dust



微纖維過濾器吸附燃油微粒的效果不佳  
Microfibre filter poorly trapping diesel dust

Patent No: US Patent 8,523,971 Patent Applications: US CIP 13/958,235, Germany 112010001912.6, PRC 201080031111.9, PCT PCT/CN2010/072514

### Special Features and Advantages

- The multilayer nanofibre filter has a low pressure drop.
- Nano-pollutants and viruses can be filtered by multilayer nanofibre filter far more effectively than conventional microfibre filter.
- Each nanofibre layer can have different added functions, for examples:
  - Layer(s) with TiO<sub>2</sub>-composite nanofibres under visual light (including room light) convert pollutant gases (Volatile Organic Compound, NO, etc.) to harmless substances, and
  - Chitosan nanofibres, when wetted (for example: sweat), kill bacteria

### Applications

- Face masks for surgeons, and workers who labour and sweat
- Respirators for the general public and care professionals under epidemics
- Cabin filters for airplanes, vehicles, trains and ships
- Ventilation filters for indoor areas (auditoriums, classrooms, gyms, offices, etc.)

### Awards

- Gold Medal – 42nd International Exhibition of Inventions of Geneva, Switzerland (April 2014)
- Special Merit Award from Romania Ministry of National Education (April 2014)

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