



NAFIGATE Corporation, a.s.  
Prosek Point, Building A  
Prosecká 851/64  
190 00 Prague 9  
+420 734 201 248  
info@nafigate.com  
www.nafigate.com

**NANO**<sup>®</sup>  
cleaner 

**NAFIGATE**<sup>®</sup>  
corporation 

# INTRODUCTION

Nano cleaner is a nanofibrous filter intended for air filtration in windows or doors. It is the result of 12 years of research and development of nanofibrous membranes for air filtration. It is a product that takes full advantage of the unique properties of nanofibers – especially the ability to create barriers that prevent penetration of even the smallest of objects such as bacteria, viruses, and dust particles.

Nanofibres are formed from nonwoven fabric with a pore size of about hundreds of nanometers. No outside pollution penetrates through these pores, but oxygen molecules are able to pass without difficulty because they are so small that they pass through nanofibers is no problem.

Thus, all external pollutants such as smog, dust particles, allergens, odor, viruses, or bacteria remain trapped on the Nano cleaner, and only clean air gets inside the room. At first glance, Nano cleaner looks just like an ordinary insect screen, but unlike those, it has filtering and insulating properties. This is particularly important in desert areas where Nano cleaner allows to have an open window without cold air escaping from the room. Nano cleaner filters also have excellent light transmittance.

## Nano cleaner and energy savings in buildings

Buildings consume 40 % of all electricity produced. Nano cleaner needs 0kwh of electricity to be operational and can thus contribute to achieving the Green Deal goal – to reduce energy consumption in buildings by 50 %.



## NANO CLEANER "BREATHE SAFELY"

## Nano cleaner and the improvement of the indoor environment

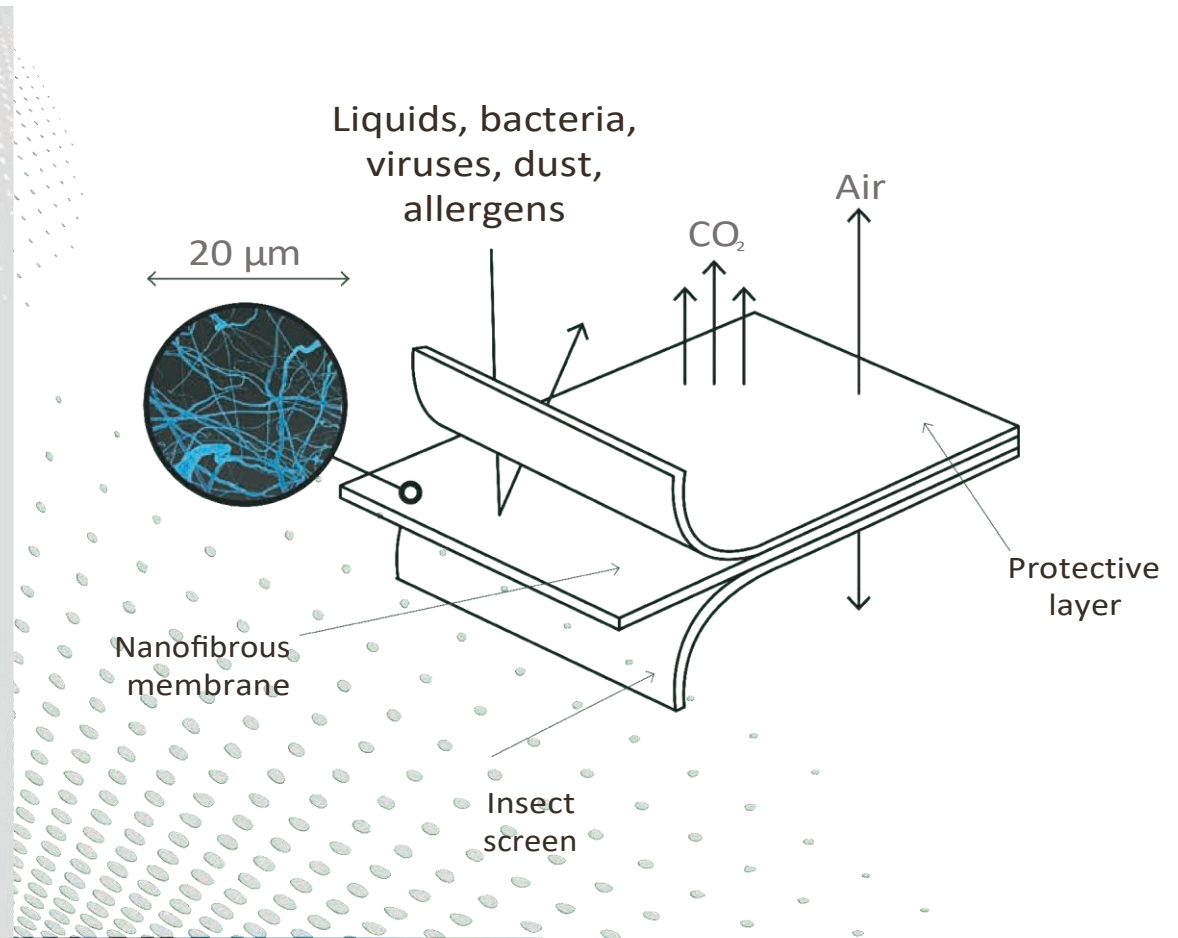
The goal is to improve the indoor environment inside buildings by 30 %. Nano cleaner allows for safe ventilation through an open window without the need to invest in recuperation units.

# UNIQUE KNOW-HOW

NANO CLEANER MANUFACTURING IS BASED ON TWO PATENTS:

1. Product patent – the essence of the invention resides in the composite structure – the insect screen as the base layer, the nanofibrous membrane, and the covering protective layer.
2. Manufacturing technology patent – i.e. the manufacturing process of how the product is manufactured.

Both patents are proof of the product's complete uniqueness and at the same time, they protect the unique 20-year know-how, which no one else can use.



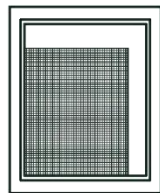
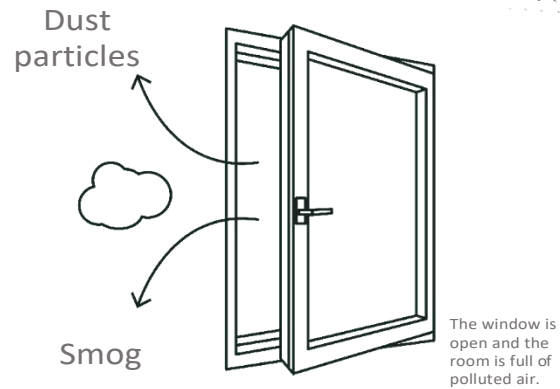
# NANOSPIDER TECHNOLOGY



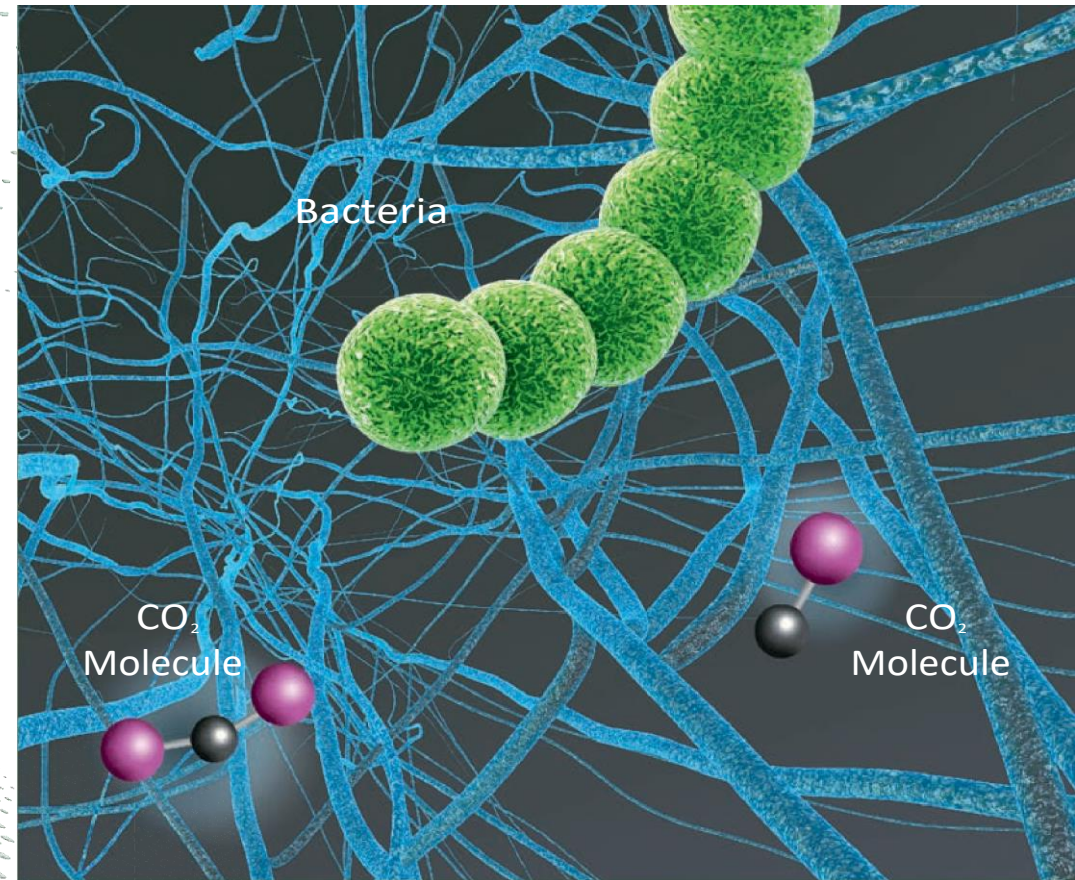
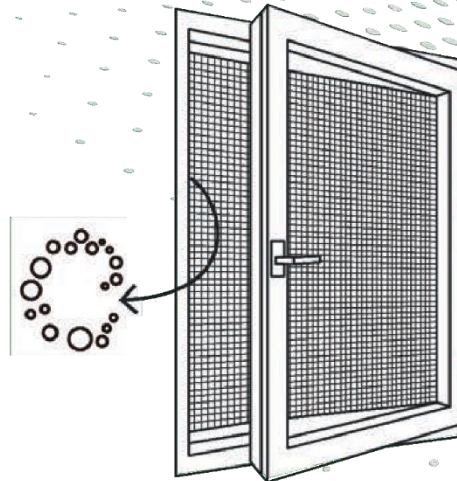
A great competitive advantage of NAFIGATE company is the detailed knowledge and control of Nanospider technology, which is the base for all of the NAFIGATE nanofibrous product development. Nanospider is the Czech unique patented technology of ELMARCO s.r.o., which operates on the principle of spinning from the free surface of a polymer solution in a strong electrostatic field without the use of nozzles. Thanks to this, Nanospider can produce most of all known organic and inorganic fibers with a thickness of only 100 nanometers. This technology is versatile and meets all the demanding requirements such as easy customizability of production parameters and flexibility of adjustability according to individual production needs.

## HOW NANO CLEANER WORKS?

The principle of the whole composite works is illustrated by the following diagram:



The window is open – after installing Nano cleaner screen. The room is full of fresh and clean air.



Nanofibres form a nonwoven fabric with a pore size of about hundreds of nanometers. No outside pollution penetrates through these pores, but oxygen molecules are able to pass without difficulty, because they are so small that they pass through nanofibers with no problem.

### CLEANING

To wash this material, it is recommended to use a mild pH - neutral detergent and water up to 30 °C, then gently wipe the screens with a microfiber glove and use low pressure water to wash or rinse if needed. We recommend cleaning the screens at least once a year.

# TYPES AND VARIANTS OF NANO CLEANER

## NANO CLEANER ULTRA

Parameters	Definition	Advantages
AIR PERMEABILITY	320 [l/m <sup>2</sup> /s @ 125 PA]	Excellent particle retention capability. Superb indoor air quality.
FILTRATION EFFICIENCY	99 % [2.5 µm particle @ 5.33 cm/s]	
TARGET GROUP	All living spaces. (Schools, offices, hospitals, households, etc) Heavily polluted countries. Dust storm and smog areas. Powder-Dust Industry etc.	

## NANOCLEANER OPTIMUM PLUS

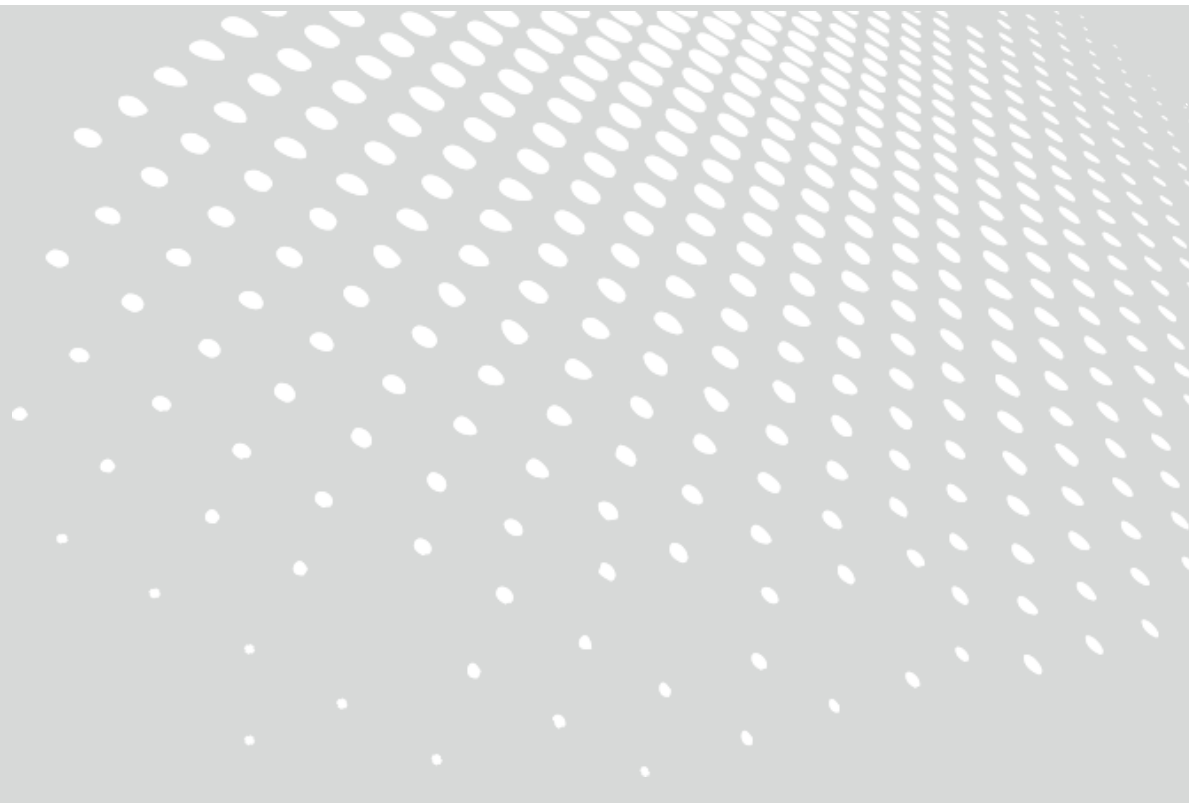
Parameters	Definition	Advantages
AIR PERMEABILITY	400 [l/m <sup>2</sup> /s @ 125 PA]	Very High particle retention capability. Very high indoor air quality.
FILTRATION EFFICIENCY	95 % [2.5 µm particle @ 5.33 cm/s]	
TARGET GROUP	All living spaces. (School, offices, hospital, house, etc) Dust storm and smog areas. Heavily polluted countries. Powder-Dust Industry etc.	

## NANO CLEANER OPTIMUM

Parameters	Definition	Advantages
AIR PERMEABILITY	500 [l/m <sup>2</sup> /s @ 125 PA]	High particle retention capability. High indoor air quality.
FILTRATION EFFICIENCY	91 % [2.5 µm particle @ 5.33 cm/s]	
TARGET GROUP	All living spaces. Highly Polluted countries. Dust storm and smog areas.	

## NANO CLEANER STANDARD

Parameters	Definition	Advantages
AIR PERMEABILITY	650 [l/m <sup>2</sup> /s @ 125 PA]	Optimum particle retention capability and high air flow. Good visibility through the screen.
FILTRATION EFFICIENCY	82 % [2.5 µm particle @ 5.33 cm/s]	
TARGET GROUP	All living spaces. Highly Polluted countries. Dust storm and smog areas.	



# TYPES AND VARIANTS OF ANTIMICROBIAL NANO CLEANER

## NANO CLEANER ULTRA

Parameters	Definition	Advantages
AIR PERMEABILITY	320 [l/m <sup>2</sup> /s @ 125 PA]	Excellent particle retention capability. Superb indoor air quality. Eliminate more than 95% of viruses, bacteria and mold present in the environment, in the early 90 minutes of use.
FILTRATION EFFICIENCY	99 % [2.5 µm particle @ 5.33 cm/s]	
TARGET GROUP	All living spaces. (Schools, offices, hospitals, households, etc) Heavily polluted countries. Dust storm and smog areas. Powder-Dust Industry etc.	

## NANOCLEANER OPTIMUM PLUS

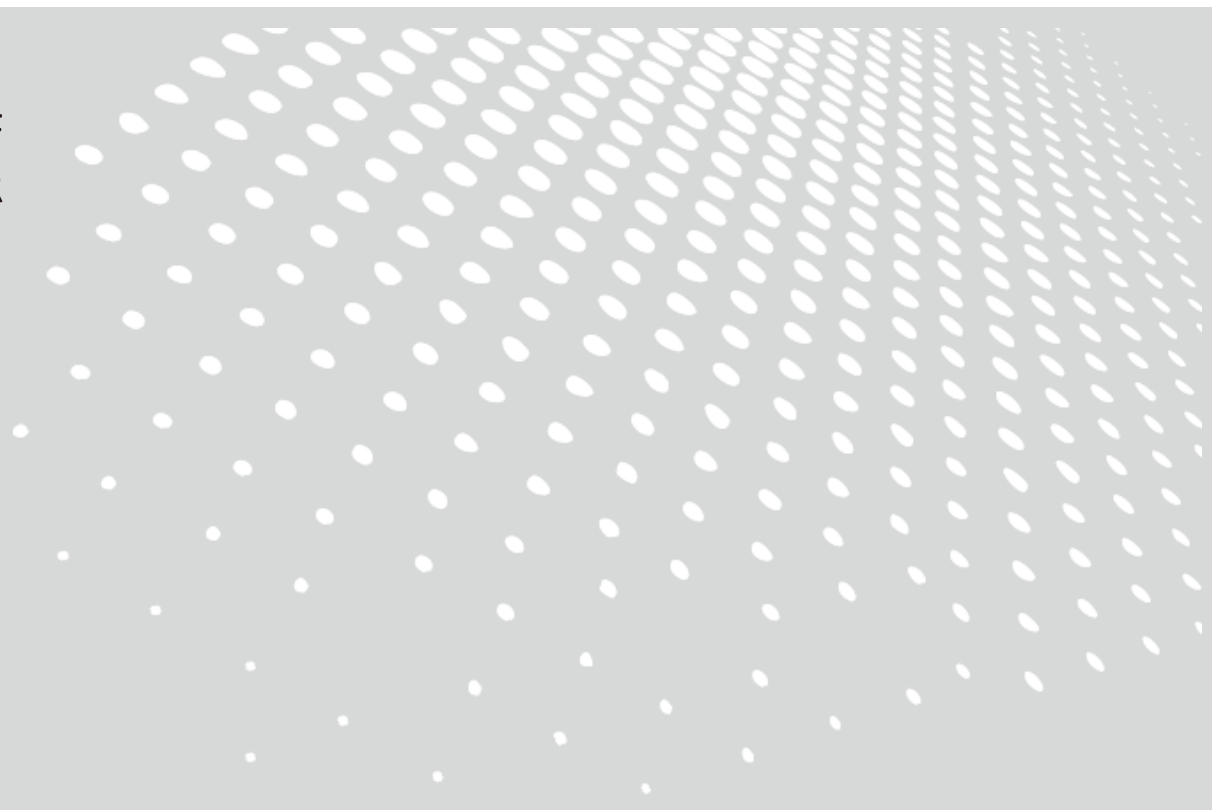
Parameters	Definition	Advantages
AIR PERMEABILITY	400 [l/m <sup>2</sup> /s @ 125 PA]	Very High particle retention capability. Very high indoor air quality. Eliminate more than 95% of viruses, bacteria and mold present in the environment, in the early 90 minutes of use.
FILTRATION EFFICIENCY	95 % [2.5 µm particle @ 5.33 cm/s]	
TARGET GROUP	All living spaces. (School, offices, hospital, house, etc) Dust storm and smog areas. Heavily polluted countries. Powder-Dust Industry etc.	

## NANO CLEANER OPTIMUM

Parameters	Definition	Advantages
AIR PERMEABILITY	500 [l/m <sup>2</sup> /s @ 125 PA]	High particle retention capability. High indoor air quality. Eliminate more than 95% of viruses, bacteria and mold present in the environment, in the early 90 minutes of use.
FILTRATION EFFICIENCY	91 % [2.5 µm particle @ 5.33 cm/s]	
TARGET GROUP	All living spaces. Highly Polluted countries. Dust storm and smog areas.	

## NANO CLEANER STANDARD

Parameters	Definition	Advantages
AIR PERMEABILITY	650 [l/m <sup>2</sup> /s @ 125 PA]	Optimum particle retention capability and high air flow. Good visibility through the screen. Eliminate more than 95% of viruses, bacteria and mold present in the environment, in the early 90 minutes of use.
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Window with conventional mosquito mesh

Window without mesh

Window with Nafigate  
**NANO CLEANER**

## FEATURES

- › Prevents air pollution (smog, dust, soot, pollen, and other particles that can damage the lungs) from entering into the indoor environment.
- › Excellent filtration properties capture particles PM 2,5 and even PM1. PM2.5 particles are the most dangerous ones due to their ability to irreversibly reside in the lungs. These particles can contain toxic substances but microorganisms as well.
- › Excellent light permeability. Maintains good transparency ~80%.
- › Blocks the strong wind while allowing sufficient air stream.
- › Windows can be opened even during colder and hot weather and rainfall. It can be used even in winter to prevent „sick building“ syndrome.
- › Acts as thermal insulation.
- › No energy consumption.
- › Nanomembrane window screen is hydrophobic, so water doesn't soak in, thus allowing filtering function even during rains.

## TECHNICAL INFORMATION ABOUT FABRICATION

### WINDOW SCREENS ARE PRODUCED IN SEVERAL STEPS:

1. First, a basic mesh is made of glass fibers with 300 µm in diameter with a defined grid.
2. The second step is the preparation of our unique nanofibrous web that is produced using the electrospinning process. Electrospinning is a fabrication process that uses an electric field to control the deposition of polymer fibers onto the target substrate. This electrostatic processing strategy is used to fabricate nonwoven fabrics with polymer fiber diameters ranging from several micrometers down to 100nm or less. The patented Nanospider™ technology is used to produce Nano cleaner - Nanofiber Window Screen. Nanofiber manufacturing machine – NANOSPIDER™ is a very complex device containing many peripherals. Manufacturing itself is very sensitive and must be set up very precisely for each specific product, therefore only trained operating staff may operate the Nanospider machine.
3. The third step is the lamination of nanofibrous PVDF material onto the base glass fiber mesh. This very specific way of fabrication is Nafigate's patented technology and is the best for maintaining and protecting the exceptional properties of nanofibers that absorb external air pollution. Mechanically robust Nano cleaner Sand Storm is developed for better mechanical durability of the nanofiber layer.

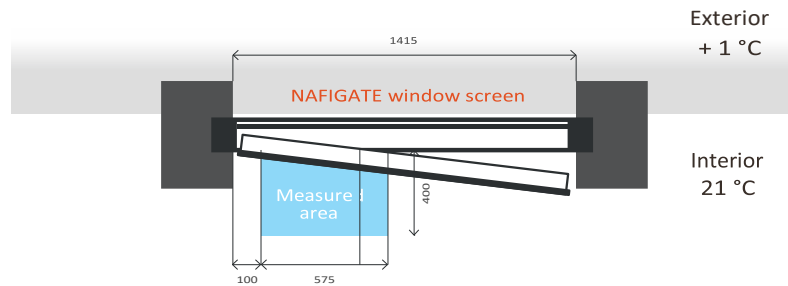
## NANOCLEANER IS DESIGNED FOR

- › Public Management – public and state administration that uses Nano cleaner as a component for the protection of specific target groups – like children, patients, public buildings – and installs it into buildings owned or managed by them.
- › Manufacturers of shading technology and windows – Nano cleaner is the new element in their offer.
- › Developers – Nano cleaner is a part of development projects.
- › Manufacturers of filtration materials for the home and business segment – Nano cleaner is a new product in their portfolio.

# TESTING

## AIRFLOW TEST

Nano cleaner window screen allows a better flow of fresh air into the room when it's windy, but at the same time, it prevents the effects of strong wind.



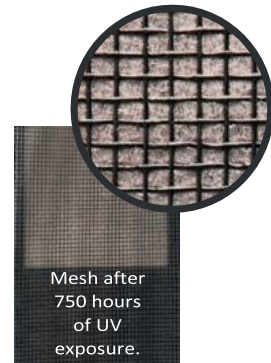
## THERMAL COMFORT TEST

Testing at an indoor temperature of 21 °C and an outdoor temperature of 1 °C Nano cleaner protects against cold weather conditions and maintains a pleasant climate in houses and offices.

Figurine with thermal sensors

## LIFETIME TEST

Testing with the accelerated aging device (QUV) allows measuring the influence of light and moisture on materials. Testing has shown a lifetime of 3 years without loss of properties.



## SAND STORM TEST

Testing with the wind of 20 m/s speed, using 3 sizes of sand grains. Excellent resistance against the effects of a sand storm.

# OTHER PRODUCTS USING NANOSPIDER TECHNOLOGY

## NANO BRANE

Le Nano Brane - water filtration membranes are among NAFIGATE products that are manufactured by using Nanospider technology.



## NANO CARTRIDGE

Another product of NAFIGATE using Nanospider technology is the Cartridge Filter.



# ACKNOWLEDGEMENT OF PROFESOR OLDŘICH JIRSÁK

Nano cleaner window screens have been developed and produced by NAFIGATE Corporation, a.s. using nanofiber based technology. Thanks to their unique patented production method, Nano cleaner window screens achieve the highest filtration capacity over three years of its lifetime.

Nano cleaner offers various nanofiber based window screen solutions for different conditions.



Prof. RNDr. Oldřich Jirsák, CSc.  
Inventor of Nanospider™ Technology

