



**ACTIVE**<sup>TM</sup>  
CLEAN AIR & ANTIBACTERIAL CERAMIC

FOR A NEW ECO-ACTIVE ARCHITECTURE





WHAT IS

PHOTOCATALYSIS

ACTIVE Clean Air & Antibacterial Ceramic™ is a PHOTOCATALYTIC<sup>1</sup> material on the new frontier of ECOACTIVE materials.

### What is photocatalysis?

**Catalysis** (from the Greek verb καταλύειν: to break, dissolve) is a chemical phenomenon altering the speed of a chemical reaction. **Photocatalysis** is therefore a natural phenomenon in which a substance, i.e. **photocatalyst**, uses the action of light (natural or artificial) to modify the speed of a chemical reaction (often speeding it up and making it much more powerful). Photocatalysis implies that in the presence of air (and therefore humidity)

and light a powerful oxidative process is triggered leading to decomposition of organic and inorganic pollutants that come into contact with photocatalytic surfaces. In greater detail, the functioning of this process is based on the easiest facts of nature. Photocatalysis is like the well-known process of chlorophyll photosynthesis, transforming substances considered harmful to man.

WHAT IS

PHOTOCATALYSIS

<sup>1</sup>The University of Milan, **Chemistry Physics and Electrochemistry Department**, on 11-30-2010, certified the photocatalytic activity of

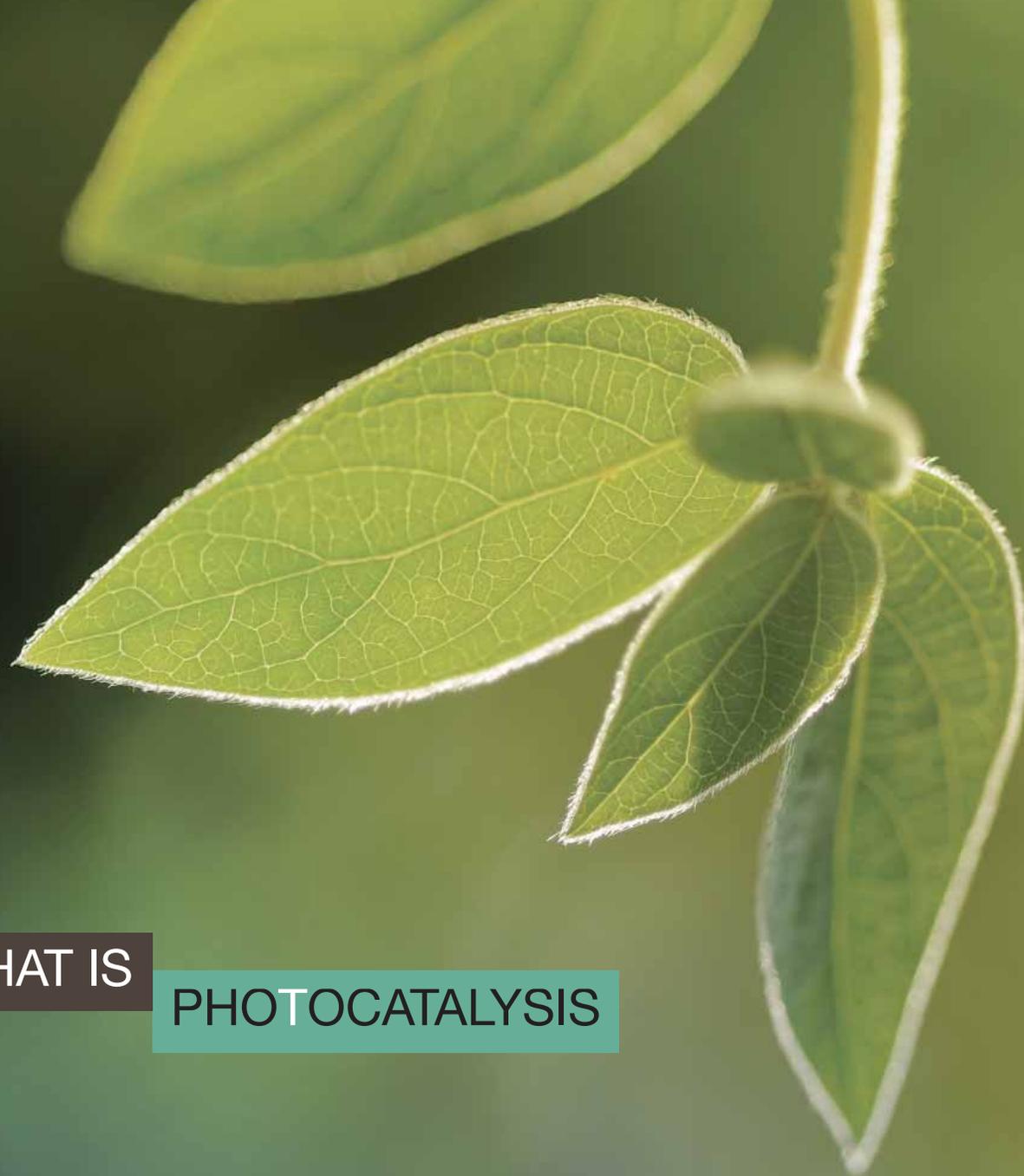


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Active slabs; see *"Report sulle prove di degradazione di soluzioni acquose di blu di metilene (norma ISO 10678) con piastrella White Ground Active Società*

*GranitiFiandre S.p.A."* and *"Report sulle prove di degradazione di soluzioni acquose di blu di metilene (norma ISO 10678) con piastrella Orosei Active Società Iris Ceramica S.p.A."*.

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The photocatalyst in ACTIVE Clean Air & Antibacterial Ceramic™ is Titanium Dioxide (TiO<sub>2</sub>) in the form of micrometric particles fixed at high temperatures. The micrometric (not nanometric) dimensions of the TiO<sub>2</sub> employed excludes all risks to human health and to the environment during the process of manufacture, application and final use. The photocatalyst activates and accelerates the reaction, but its particles are not directly involved, so that it does not get consumed in the oxidation

TITANIUM

DIOXIDE





process: oxidation, in fact, involves only the substances present in the air for decomposing pollutants into substances not harmful for human health. For this reason, the action of titanium dioxide remains unaltered over time. Fixing of  $\text{TiO}_2$  onto ACTIVE Clean Air & Antibacterial Ceramic™ slabs at high temperatures also makes the surface of the slabs highly resistant to scratching due to tread, even in case of intense traffic, guaranteeing a long-lasting photocatalytic effect.

# HOW PHOTOCATALYSIS<sup>2</sup>

## FIGHTS POLLUTION

Light and oxygen in the air, in contact with  $\text{TiO}_2$ , trigger a chemical reaction resulting in decomposition of organic and inorganic substances present in the atmosphere. The principal substances responsible for pollution are **nitrogen oxides** ( $\text{NO}_x$ ), **particulate matter** ( $\text{PM}_{10}$ ) and **VOCs** (Volatile Organic Compounds).

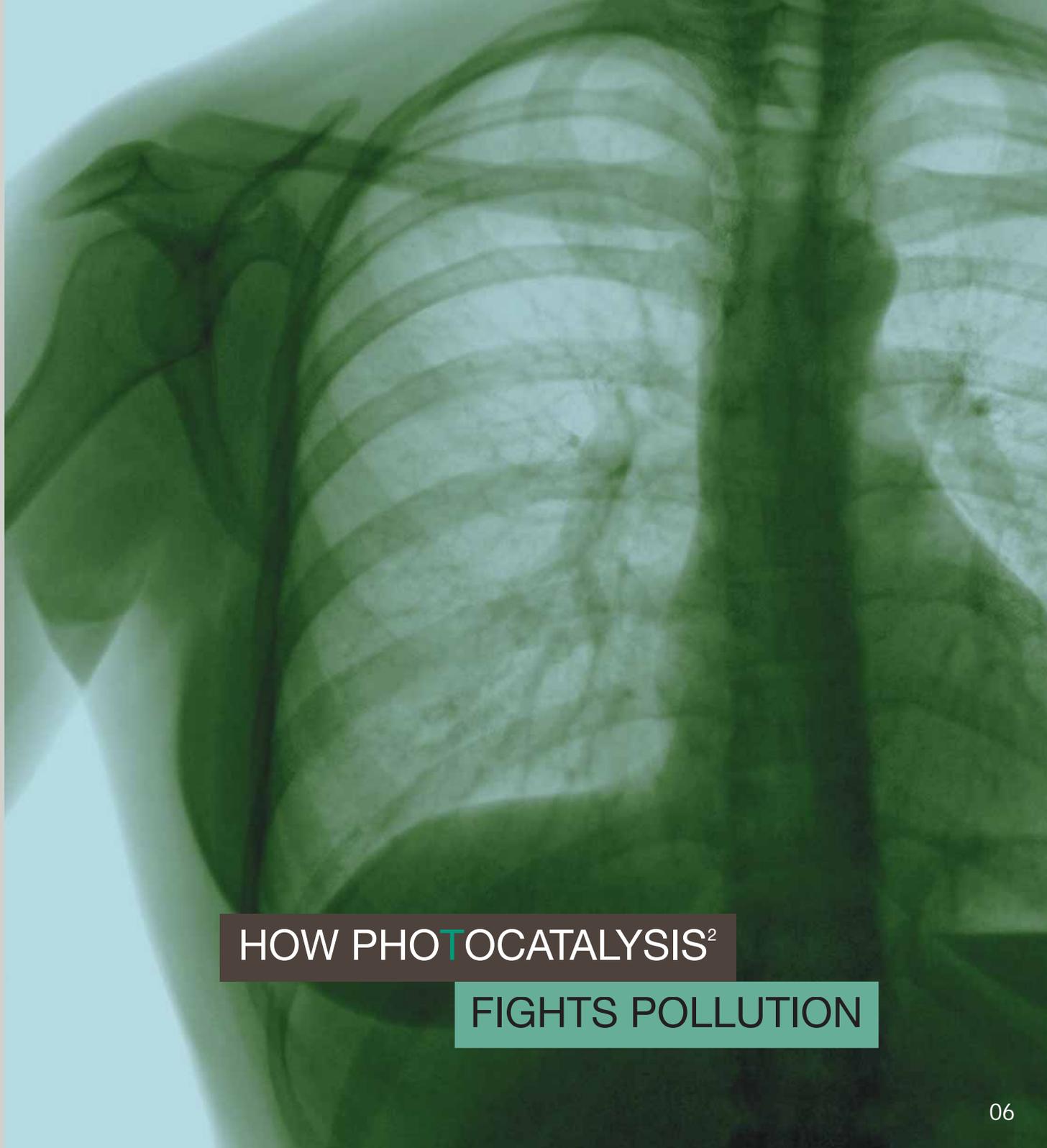
Nitrogen dioxide is formed in the atmosphere out of the nitrogen oxide produced primarily by burning fossil fuels, as for example in car engines. The World Health Organisation says that nitrogen dioxide is very harmful for the health: long-term exposure can compromise the functioning of lungs and increase the risk of respiratory pathologies. Nitrogen dioxide is in fact irritating to the mucous membranes



and can contribute to various alterations of lung functioning, chronic bronchitis, asthma and pulmonary emphysema. Long-term exposure even to low concentrations, drastically decreases the lungs defences, increasing the risk of respiratory infections.

The effects of nitrogen dioxide appear hours after exposure, so that people do not normally realise that their problems are due to the polluting air they have been breathing.

The term “Particulate Matter” refers to all particulates suspended in the air with an aerodynamic diameter of less than 10 thousandths of a millimetre. The primary sources of PM<sub>10</sub> are to be found in human activities: **combustion processes** (including those in internal combustion engines, heating systems, numerous industrial activities, incinerators and thermoelectric power plants), wear on tyres, brakes and asphalt. A large part of the PM<sub>10</sub> in the atmosphere is the product of transformation of certain gases into liquid or solid particles (**nitrogen** and **sulphur compounds**) emitted by human activities.



HOW PHOTOCATALYSIS<sup>2</sup>

FIGHTS POLLUTION

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## FIGHTS POLLUTION

Because of their small size, these pollutants can penetrate the respiratory system beyond the larynx. Pathologies caused by pollution from particulates include asthma, cardio-pulmonary infections and compromised lung functioning.

The term Volatile Organic Compounds (VOCs) refers to a series of substances in liquid or vaporous form with a boiling point ranging between a minimum of 50-100 °C and a maximum of 240-260 °C. The term “volatile” indicates the capacity of these chemical substances to evaporate easily at ambient temperature. More than 300 compounds are included in this category. Urban VOCs are produced almost exclusively by combustion in motor vehicles,





coal-fired power plants, incineration and evaporation of solvents and fuels. VOCs are also generated by the use of cleaning products, paints, pesticides, glues and adhesives, printers and photocopiers, tobacco smoke, etc. The photocatalysis process triggered by  $\text{TiO}_2$  in **ACTIVE Clean Air & Antibacterial Ceramic™** slabs breaks down many of the pollutants and toxic substances listed above and transforms them into innocuous compounds such as nitrates, sulphates and carbonates. The final result is a significant reduction in toxic pollutants produced by automobiles, factories, home heating systems and other sources. The result is an improvement in the environment and the quality of the air we breathe, offering clear benefits for human health.

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<sup>2</sup>The University of Milan, **Chemistry Physics and Electrochemistry Department**, on 11-30-2010, certified the efficacy of Active slabs in

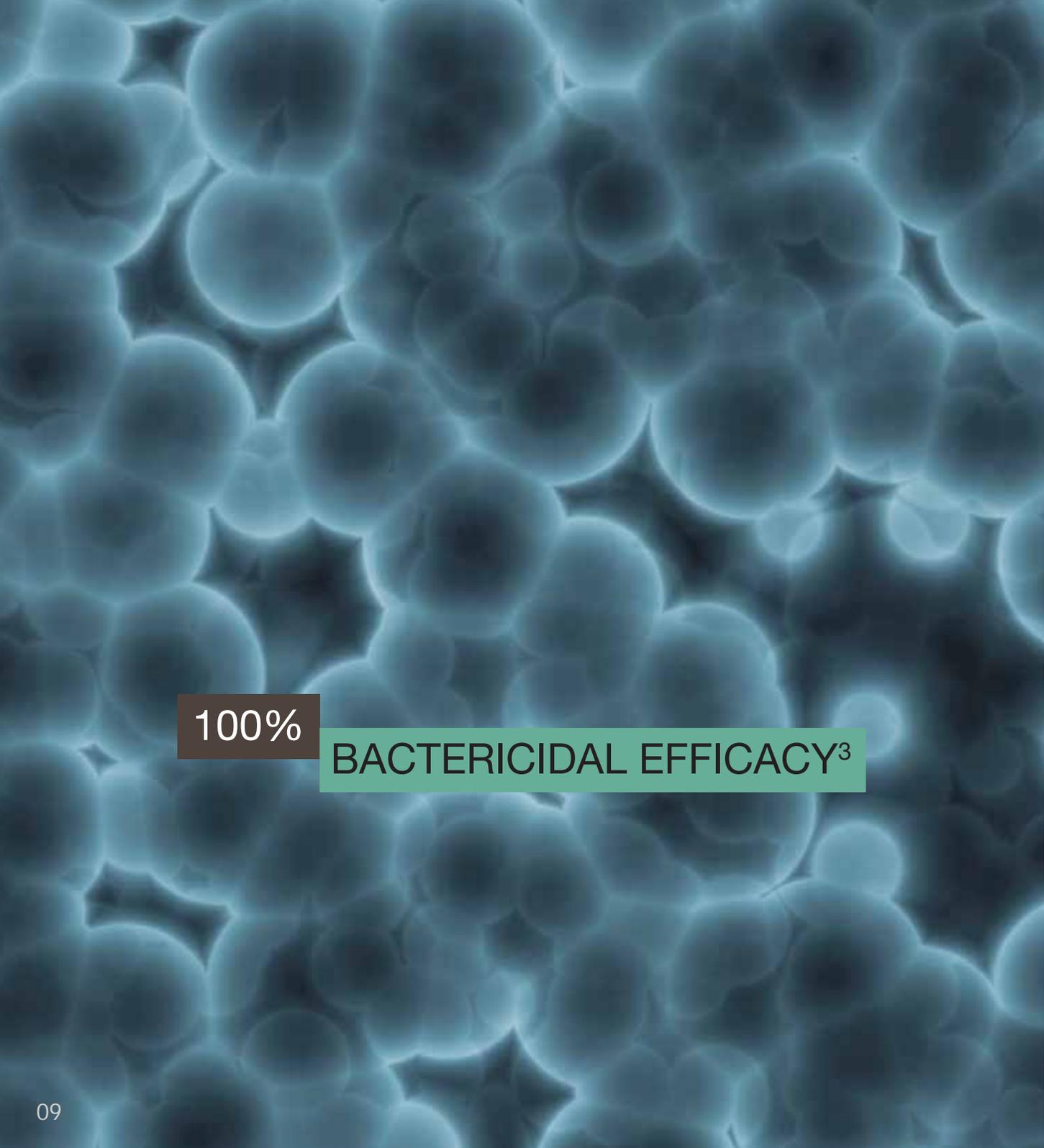


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the reduction of  $\text{NO}_x$ , see "Report sulle prove di abbattimento di  $\text{NO}_x$  dall'aria con piastrella White Ground Active Società GranitiFiandre S.p.A." and "Report sulle prove di abbattimento di  $\text{NO}_x$  dall'aria con piastrella Orosei Active Società Iris Ceramica S.p.A.".

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100%

BACTERICIDAL EFFICACY<sup>3</sup>

The powerful oxidising force of the photocatalytic action of ACTIVE Clean Air & Antibacterial Ceramic™ permits the elimination of bacteria (according to standard ISO 27447), including a number of species which are particularly hazardous to human health: escherichia coli, staphylococcus aureus, klebsiella pneumoniae.

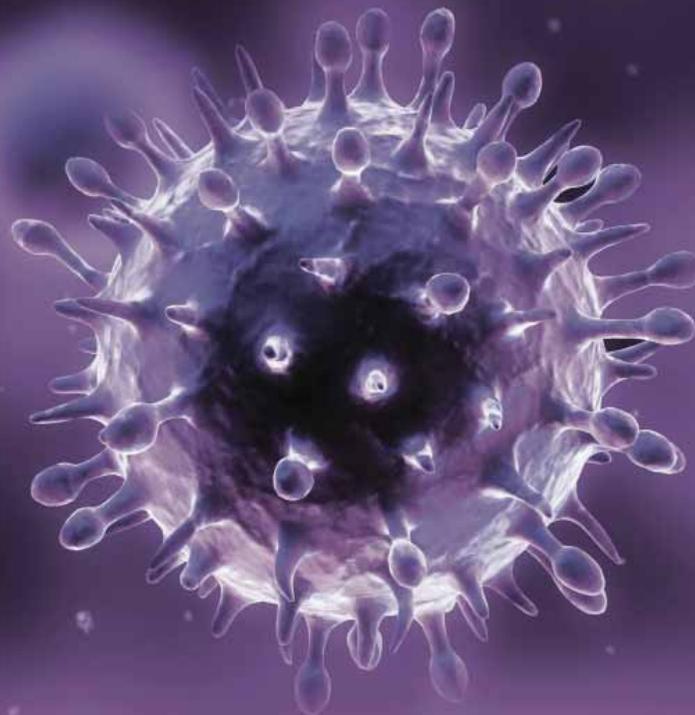
Escherichia coli is a bacterium which can cause food poisoning with vomiting, diarrhea, abdominal cramps and even intestinal haemorrhage. It can also cause meningitis, peritonitis, septicemia and pneumonia and is often the culprit in urinary tract infections.

Staphylococcus aureus causes infections of the skin, the respiratory system, the urinary apparatus, the skeleton and the central nervous system.



100%

BACTERICIDAL EFFICACY<sup>3</sup>



*Klebsiella pneumoniae* can cause bacterial pneumonia as well as urinary tract infections and frequently lives and multiplies in hospitals and clinics. Photocatalysis does not actually kill bacteria cells but decomposes them by irreparably damaging the cell walls so that they die. ACTIVE Clean Air & Antibacterial Ceramic™ eliminates the 100% of those bacteria.

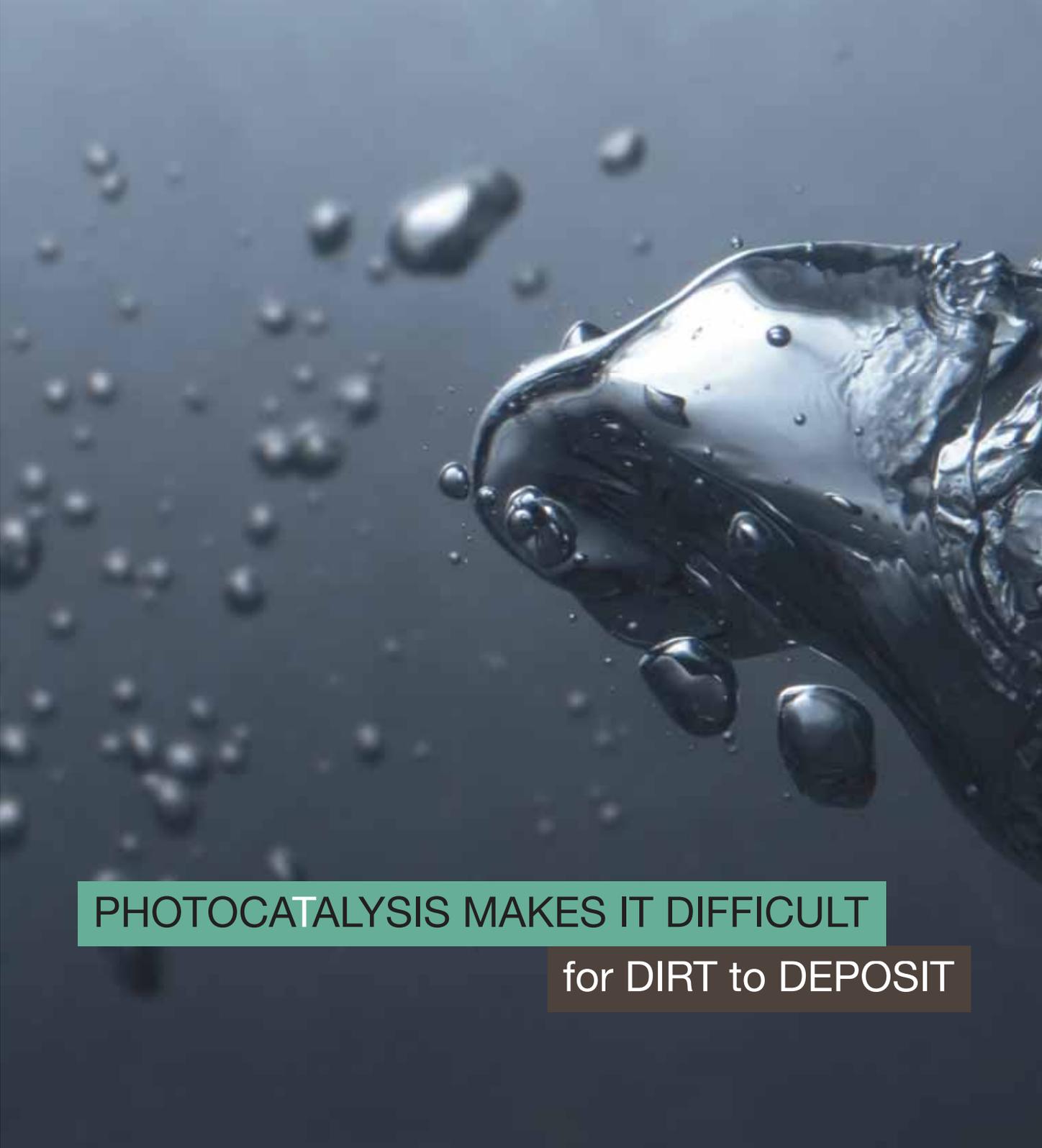
<sup>3</sup> **Artest S.r.l.**, on 9-8-2010, issued to GranitiFiandre for the product White Ground the ISO 27447 certificate: "*Fine ceramics (advanced ceramic, advanced technical ceramics) Test method for antibacterial activity of semiconducting photocatalytic materials*".

**Tile Council of North America**, on 1-27-2011, issued to Graniti Fiandre for the product White Ground the certificate "*Test method for antibacterial activity of semiconducting photocatalytic materials - Film adhesion method*".

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The photocatalytic activity of  $\text{TiO}_2$  in **ACTIVE Clean Air & Antibacterial Ceramic™** slabs has a dual effect on dirt which deposits on floors and walls every day (dust, organic residues, etc):

1. hydrophilia: the term **hydrophilia** refers to the physical properties of materials or individual chemical units (such as molecules) in terms of bonding with water. In the broader sense, it also refers to the ability of certain materials to absorb or retain water within themselves or on their surfaces.



PHOTOCATALYSIS MAKES IT DIFFICULT

for DIRT to DEPOSIT



Titanium dioxide has the property of attracting and retaining H<sub>2</sub>O molecules (moisture) naturally present in the air on the surfaces of the slabs to which it is applied, creating a situation in which it becomes very difficult for dirt to attach itself to surfaces. This makes easier to remove dirt by reducing the need for use of cleaning products (which are themselves pollutants).

2. Organic dirt undergoes the same process of degradation as pollutants and bacteria.

Any building exposed to the daily aggression of pollutants in the air, especially in the city, will undergo alteration of its surfaces almost immediately.

Photocatalysis acts by decomposing and therefore eliminating organic molecules and so indirectly permits reduction of the visible effect of dirt, often simply dust.

For the above mentioned reasons, ordinary rain is enough to remove dirt from the exterior walls of buildings covered with ACTIVE Clean Air & Antibacterial Ceramic™ slabs and preserve the walls over the years, reducing maintenance costs and pollution caused by the use of cleaning products.

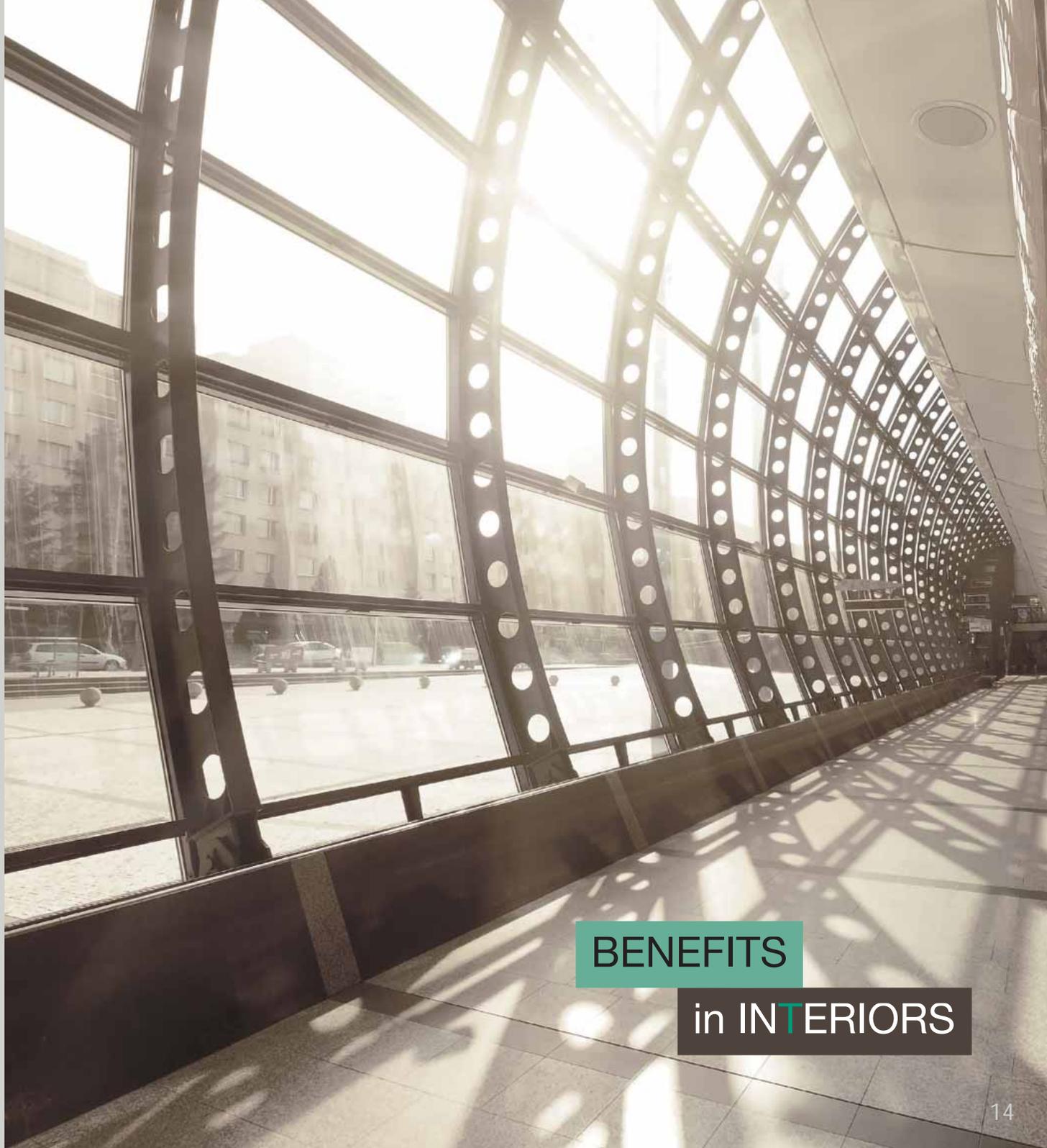
**BENEFITS**

on **EXTERIORS**

The composition of the air inside buildings is basically the same as outdoors, but the quantities and types of contaminants are different. In addition to pollutants coming in from outside, there are others generated inside buildings: emissions from heating and air conditioning systems, cooking, etc. To these we must add, in some cases, the well-known effects of second-hand cigarette smoke.

**ACTIVE Clean Air & Antibacterial Ceramic™** floor and wall slabs inside buildings will, when exposed to natural or artificial light, break down some of the dirt and nicotine residues. In addition, the imperceptible film of moisture on the slabs prevents dirt from attaching itself to the slabs, so that it is easier to remove.

The odours caused by dirt (bacteria, food and/or cooking residues, cigarette smoke) are broken down and reduced, as they are organic molecules oxidised by the process of photocatalysis.



**BENEFITS**

in **INTERIORS**



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