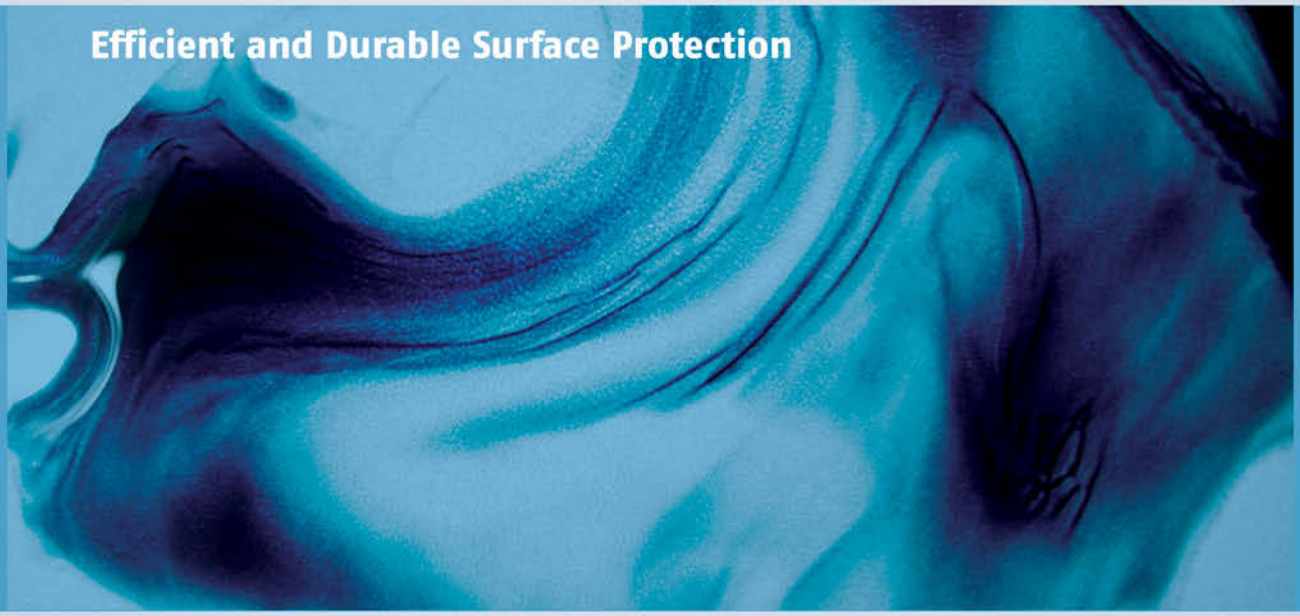
BactiBlock®
Antimicrobial Additives

Efficient and Durable Surface Protection



BACTIBLOCK
BY nanobiomatters

Product description
BactiBlock® Antimicrobial Additives

BactiBlock® is an antimicrobial additive for polymer-based raw materials.

The proprietary and patented BactiBlock® technology is based on silver-functionalized clay that creates a naturally sourced and highly efficient antimicrobial product. The additive prevents the growth of bacteria, mold, fungus and other microorganisms, which also makes BactiBlock® a powerful tool against odors and stains.

The active ingredient in BactiBlock® is ionic silver, a naturally occurring element with a well-known antimicrobial spectrum, as well as being widely recognized as safe for human contact.

Why silver? Silver is a broad-range antimicrobial agent that has been proven effective against most harmful microorganisms present in everyday life, such as *E.coli*, *Legionella*, *Pseudomonas*, *Salmonella*, *S. aureus*, *Aspergillus niger* among others.

Ionic silver is a multi-site antimicrobial, which is an advantage compared to many organic solutions that only offer 1-site functionality. The ionic silver not only disrupts folic acid synthesis, but it also disrupts protein synthesis, inhibits DNA synthesis, disrupts electron transport and interferes with cell wall synthesis.

Testing of antimicrobial activity

Nanobiomatters has an internal state-of-the-art antimicrobial laboratory prepared for:

- Antimicrobial testing (e.g. *E.coli*, *S.aureus*)
- Antifungal testing (e.g. *Aspergillus niger*)

Petri dish containing a film with antimicrobial BactiBlock®, inhibited bacterial (E. coli) growth on the film

The antimicrobial activity of materials containing BactiBlock® is typically tested using the following standard:

JIS Z 2801 (ISO 22196:2007) for bacteria.
ISO 846 for fungi.

The Nanobiomatters test facility is very versatile and routinely carry out other industry specific tests such as ASTM E2149, SIAA and NCCLS.

Engineered Clay + Silver Synergies

The most innovative aspect of the BactiBlock® additive is that purified and modified phyllosilicate clay is used as performance-enhancing carrier of the silver antimicrobial agent. This creates strong synergies between the two materials, especially in terms of:

ADVANTAGES

Efficiency (Cost)	Dispersability	Speed (Fast acting)	Durability

Bactiblock® Efficiency and Dispersion · *Do more with less*

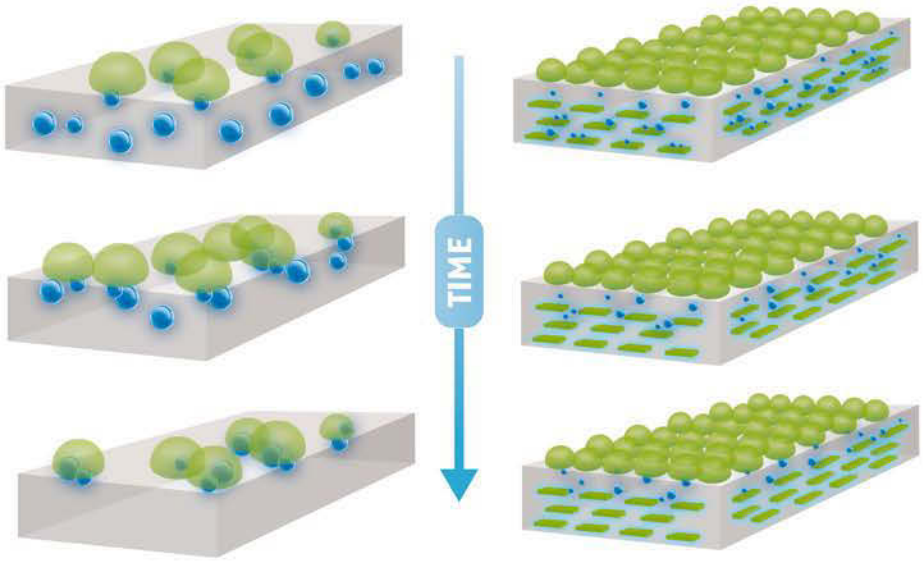
During the proprietary production process, ionic silver is linked to the clay surface, obtaining a uniform distribution of the active species within the additive. Furthermore, the chemical modification of the additive ensures easy dispersion in polymer systems with no effect on rheology, which means that generally no process change is required. The combination of dispersion mechanisms maximizes antimicrobial efficiency with a minimum amount of silver and creates a homogenous protection of the polymer material.

Bactiblock® Durability · *The longer lasting solution*

The silver species linked to the clay platelets are released to the surface of the protected material at a controlled rate. This ensures a more uniform and long term antimicrobial effect, compared to additives with the active species readily available in the polymer.

BactiBlock® is therefore ideally suited for long term applications and although durability in most cases depends on wear and environmental conditions (temperature and humidity), the antimicrobial performance can be expected to endure for several years.

High dispersion and durable, homogenous protection



Product Grades

The BactiBlock® range is versatile and includes products that are compatible with a wide range of polymers. New solutions are continuously being developed for additional systems. The product is delivered as a micronized powder, dispersion or a masterbatch.

The major component of each BactiBlock® grade is functionalized clay, combined with a low concentration of antimicrobial agent. The specific levels of each component can be tuned to achieve the desired performance. Final concentration of the total additive package is highly dependent on product design and target properties.

BactiBlock® grades and recommended dosing*:

	101 R1.43	101 R1.47	101 S1.19	101 R4.47
THERMOSETS				
Epoxy based	1.5–3%	1.5–3%	0.5–1.5%	0.5–1.5%
Polyester based	1.5–3%	1.5–3%	0.5-1.5%	0.5-1.5%
THERMOPLASTICS				
Polypropylene	1-3%	1-3%	0.75-2.5%	0.75-2.5%
Polyethylene	1-3%	1-3%	0.75-2%	0.75-2%
Polystyrene	1-3%	1-3%	0.5-2%	0.5-2%
PA	1-3%	1-3%		0.75-2%
PVC	0.5-2%	0.5-2%		0.25-1%
PHB	1-2%	1-2%	1-2%	1-2%
ELASTOMERS				
EVA	1-2.5%			0.5-1.5%
COATINGS/PAINTS				
Solvent Based	0.25-1%**	0.25-1%**	0.25-1%	
Water Based	0.25-1%**	0.25-1%**	0.25-1%	
Powder Coatings	1-3%	1-3%	0.5-1.5%	0,5-1,5%

* New solutions are continuously being developed for additional systems. Please contact Nanobiomatters for information on your specific system.
** Also available in aqueous or solvent based gel with 22–33% additive for improved dispersion and handling.

BactiBlock® Applications

Because silver is considered not to be harmful to humans, animals or plants, antimicrobial BactiBlock® can be used in a wide range of applications where hygiene, odor control and stain resistance are main objectives.

Due to the high versatility, durability and efficiency of the product, applications are found in a wide range of sectors:

Construction (paints, coatings, ventilation systems, flooring, ceramics , countertops, etc.)

Office Accessories (furniture, pens, staplers, etc.)

Electronics (hardware, castings, coatings, etc.)

Apparel & Sports (textiles, shoe soles, mats, etc.)

Healthcare (personal care and medical devices)

Food (packaging, coatings, processing, storage, etc.)

About Nanobiomatters

NanoBioMatters is a material science company specialized in engineered clay-based additives.

Our mission is to create additives that maximize the performance of materials through unique, sustainable and cost effective clay dispersion and functionalization technology.

NanoBioMatters proprietary technology is based on naturally sourced clays, which are refined, purified and surface modified to ensure uniform dispersion and compatibility with a variety of polymer systems. The modification technology includes the addition of active functionalities and the creation novel and highly efficient products, such as antimicrobial or antioxidant additives.

The major advantage of working with highly dispersed clay additives compared to traditional additives is that it enables the enhancement of specific target properties without compromising the inherently positive properties of the original material.

NanoBioMatters production facilities have a 2500 metric ton/year additive capacity and 4000 metric ton/year master batch capacity supported by state-of-the-art laboratories for analysis and development of clay based additives in plastics.

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BactiBlock® Efficiency and Durability

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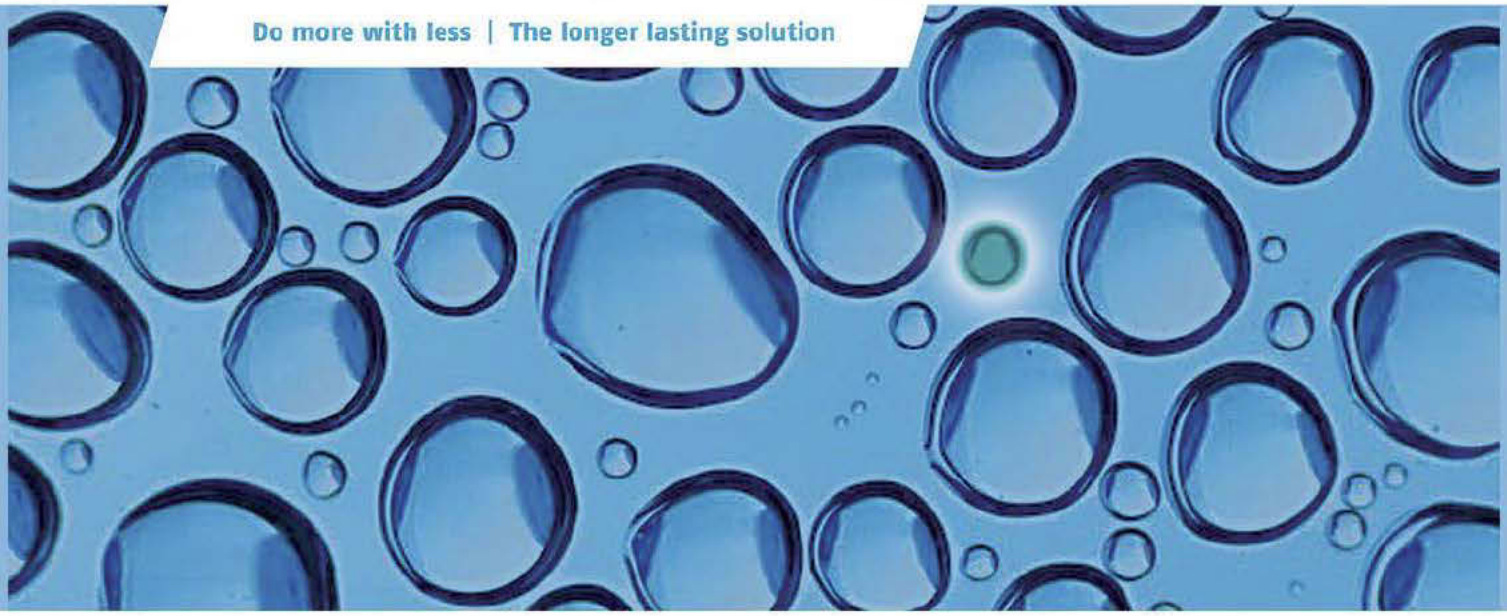

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