

Biocidal additives with **silver nanoparticles** for thermoplastic and chemically cured polymers

## POLYDEF Cu+

### TECHNICAL DATA SHEET

**POLYDEF Cu+** is a specially developed solution based on copper nanoparticles that provide antibacterial and antifungal properties. The presence of nanosilver in the protected polymer provides a biocidal effect by disrupting the normal functioning of the cell, which in turn leads to the death of microorganisms, contributing to the elimination of sources of unpleasant odors and extending the life of the material. The additive is environmentally friendly, does not change the physical properties of polymers and does not cause degradation of the protected material. The component provides long-term microbiological protection and increases the safety and attractiveness of the product. In addition, the nanoadditive is characterized by higher stability at high temperatures and high humidity in relation to traditionally used biocides.

#### Recommended dosage

To obtain microbiological protection, it is recommended to dose at the level of 0.1-0.3% by weight relative to the weight of the finished polymer composite.

#### Storage

Please note that copper-containing materials may be sensitive to electromagnetic fields. Insufficiently mixed product may cause some discoloration in the finished product, therefore it is the responsibility of the final component manufacturer to fully evaluate these under normal conditions of use.

#### Before use

As with all chemicals, read the MSDS before use. Please make sure you have the latest information before using this product. For more information, please contact us at [kontakt@smartnanotech.com.pl](mailto:kontakt@smartnanotech.com.pl)

**Copper** is an element characterized by very good thermal and electrical conductivity. As a pure substance, it is a malleable, corrosion-resistant and soft metal used, among others, for the production of electric wires, roofing and water supply systems and the construction of industrial machinery. For applications requiring greater strength, copper is a component of alloys such as bronze and brass. However, copper is not only characterized by very good mechanical properties, but also anti-fungal and anti-bacterial. For this reason, it is used, among others, in the production of ship hulls to protect them against algae and crustacean growth, and in the production of door handles and hospital equipment to reduce the risk of pathogen transmission. Thanks to modern technology, it has become possible to use copper nanoparticles in the fight against bacteria and fungi, which significantly reduces the cost of surface protection. The biocidal effect of copper is based on a wide range of distinct mechanisms, such as changing the three-dimensional structure of bacterial and viral proteins, interfering with the structure and function of enzymes, causing cell desiccation or damaging the respiratory chains of bacteria.

#### Basic properties of the POLYDEF Cu+

Physical state: solid, powder < 500 µm

Colour: grey

Silver particle shape: spherical

Silver content: 10.0%

Silver particle size: < 100 nm

Biocidal properties: yes

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### Structural analysis

In order to study the morphology of the **POLYDEF Cu+** additive based on silver particles, a scanning electron microscope (SEM) study was carried out.

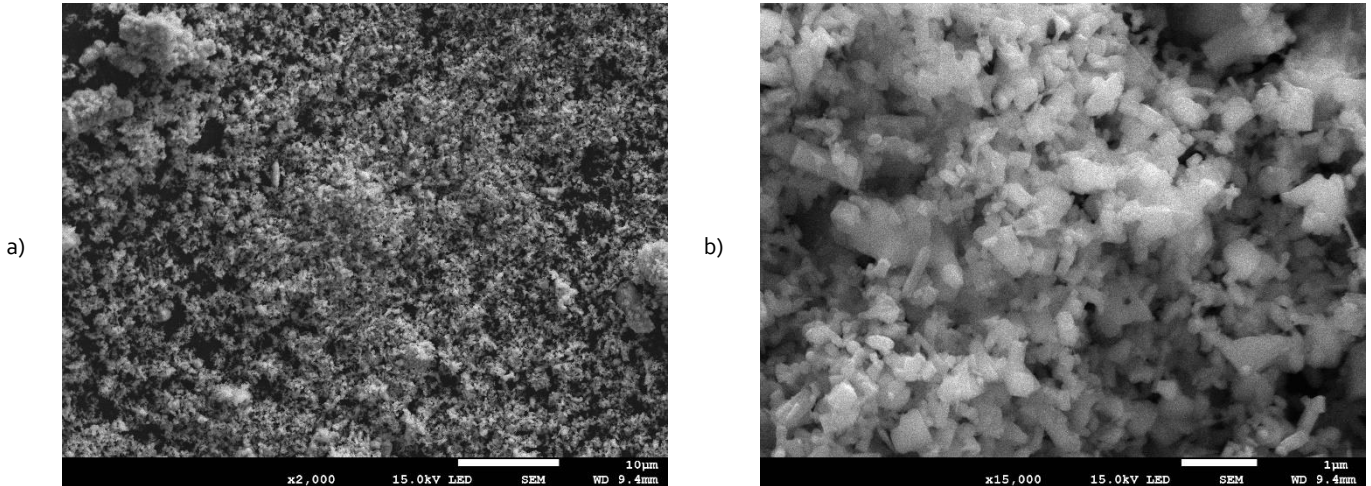


Fig. 1. Scanning electron microscope photos of the **POLYDEF Cu+** additive a) 2,000 times magnification, b) 15,00 times magnification

### Microbiological testing

The biocidal properties of the **POLYDEF Cu+** additive were analyzed to assess the activity of the obtained additives against bacteria and fungi. The microbiological activity of the developed powders was analyzed against *E. Coli* (ATCC 8739) and *S. Aureus* (ATCC 6538) bacteria representing strains of gram-negative and gram-positive bacteria, and against *C. Albicans* (ATCC 10231) as a representation of fungi. The analyzes were performed according to the suspension method, dedicated to the testing of powder additives. .

