



## Antibacterial Compound

### **Opportunity Statement**

There has been increasing public concern over the rise in bacterial infections, particularly with the increasing prevalence of antibiotic-resistant strains. Antibacterial materials help to prevent the growth of bacteria, mold and fungi on the surface of a product. This can help inhibit the growth of bacteria such as Staphylococcus Aureus and E-coli. There are two major classes of antibacterial material:

#### **1. Dissolving-out inorganic**

Metals containing inorganic antimicrobials use metal ions as their active biocidal agent, and they remain in-situ once incorporated into the polymer matrix. The most commonly used metal ion is silver; others include copper and zinc. Silver is a naturally occurring element proven to be effective in inhibiting the growth of many types of microbes. Data show that silver exhibits a very low toxicity for humans and animals, and is highly regarded for its antimicrobial properties.

The metal ions are usually bound within a delivery system that stabilizes them, allowing their incorporation into the polymer, and then releases them through a process of ion exchange at the polymer's surface. The metal ions remain stored within the polymer and are continuously made available over the lifetime of the particular finished product. They are gaining greater recognition, constrained primarily by their high cost.

#### **2. Photo-catalysis**

Photocatalysis is a photochemical reaction triggered by a catalyst that becomes activated when exposed to certain wavelengths of light. The reaction creates oxidizing agents that are useful in breaking down organic molecules on the product surface.

The photocatalysis-type antibacterial material has the advantages of low cost, no toxicity and moderate reaction conditions. More recent developments include zinc or titanium whiskers, nano-titanium dioxide, nano-zinc oxide and tetrapod zinc oxide (T-ZnO) whiskers.

Antibacterial additives have a wide range of applications including their incorporation in a wide variety of polymers and plastics, medical products, textiles, construction materials, paint coatings and consumer products.

## Antibacterial Compound

### Problem

The silver-containing compounds tend to be quite expensive and will oxidize quickly when exposed to ultraviolet (UV) light. The photocatalysis-based compounds are less expensive but have a relatively short antibacterial effectiveness and are only activated in a narrow UV band.

***Therefore, there is a need for a solution that addresses the high cost and quick oxidation of the silver-containing compounds and the inferior performance of the low-cost, photocatalysis-based products.***

### **360ip Partner's Solution**

The 360ip partner's invention introduces rare-earth elements into the T-ZnO whisker crystal structure. An additional energy band is produced in the T-ZnO crystal whisker, which broadens its spectrum response range, thereby improving the effective utilization ratio of visible light and greatly increasing the catalysis efficiency of catalyst. In addition, rare-earth elements serve as a dispersing agent capable of causing T-ZnO whiskers to be more evenly dispersed and suspended in the product, thus improving its antibacterial performance. The antibacterial agent is a powder comprised of one or more of the following: lanthanum, holmium, cerium, yttrium, praseodymium, gadolinium, dysprosium or europium.

Tests have shown the antibacterial properties of the rare earth-doped T-ZnO whiskers greatly exceed that of the traditional T-ZnO whiskers material while retaining the same desirable whisker mechanical properties. Long-term laboratory testing has also shown polymers containing the rare earth-doped T-ZnO whiskers have remained antibacterial active for over one year. In addition, compared to alternative antibacterial materials, the partner's compound provides the following advantages:

- Less costly and less toxic alternative to silver-based materials
- No discoloration of light-colored resins, unlike silver, which can be easily converted to black silver oxide and cause discoloration
- Can perform antibiosis without UV light catalysis, unlike conventional T-ZnO materials
- No secondary pollution, unlike organic antibacterial agents

### Summary

360ip's partner has developed a superior antibacterial additive based on rare earth-doped T-ZnO whiskers that combines the antibacterial performance of silver-containing products with the low cost of T-ZnO whiskers-based technology. Polymers containing the product have shown excellent antibacterial properties exceeding one year.

***360ip is seeking interested parties for licensing, further development and commercialization of this technology-based solution.***

For additional information, contact: [licensing@360ip.com](mailto:licensing@360ip.com)

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