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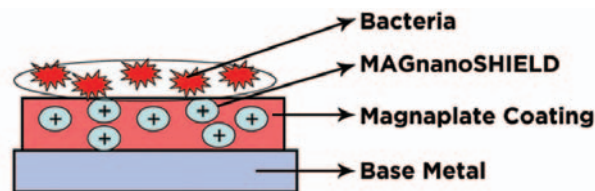
Antimicrobial Technology Enhances Metal Coatings

General Magnaplate adds microbe resistance to its surface-enhancement coatings.

By **Bhavin Parekh**, R&D Manager

Antimicrobial materials based on metal complexes have become an effective weapon in the war against the deadly microbes that cause food-borne illnesses, hospital infections and contaminated drugs. Yet these antimicrobial materials have shown a limited ability to deliver microbe resistance as part of a comprehensive surface enhancement treatment—**until now**.

A new proprietary antimicrobial coating technology from General Magnaplate eliminates this limitation by offering microbe resistance in conjunction with other beneficial surface properties. Called MAGnanoSHIELD™, this new coating technology can be



incorporated into many of General Magnaplate's proven surface-enhancement coatings. So it's now possible to specify a single coating that not only resists microbe growth but also provides protection against friction, wear, moisture, chemical exposures and more.

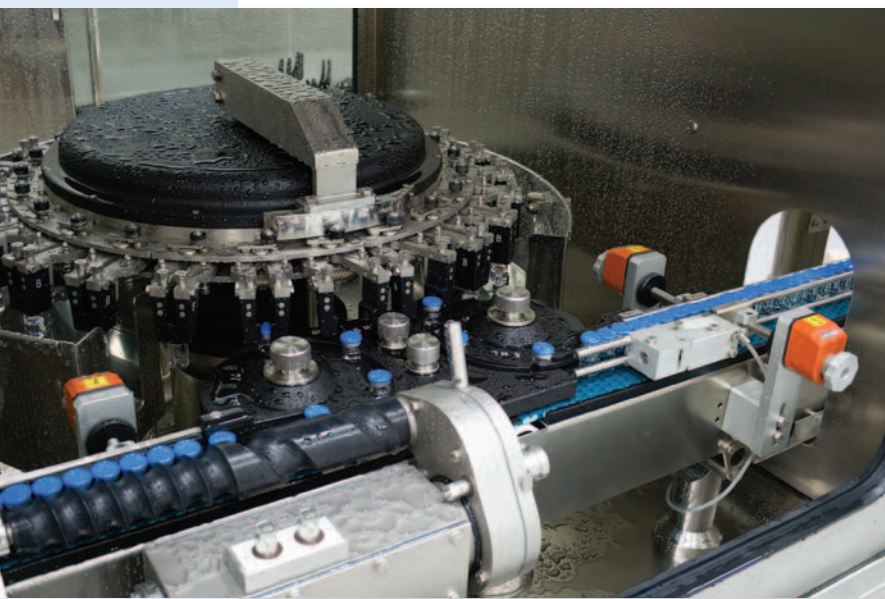
And because MAGnanoSHIELD is incorporated within Magnaplate's existing wear-resistant coatings, it also offers durability and substrate compatibility that earlier antimicrobial materials could not achieve.

Here's a closer look at this new antimicrobial treatment, its effectiveness and some of the most promising applications.

Nanotechnology Fights Germs

While the majority of antimicrobial materials today are based on generic formulations of a metal complex, MAGnanoSHIELD employs a proprietary metallic antimicrobial agent.

Incorporated as a nanoscale dispersion within a polymer base, MAGnanoSHIELD inhibits the growth of microbes by interfering with DNA replication, damaging cell walls, altering cell membrane permeability or combining with





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bacterial proteins in ways that disrupt normal cell functions (See Figure 1). These biological disruption mechanisms are well known and not unique to MAGnanoSHIELD's active ingredient.

What does make our new antimicrobial technology unique is that it can be implemented as part of a more broadly useful coating. For example, MAGnanoSHIELD has been successfully combined with our Nedox[®] coating for use on any non-ferrous and ferrous alloys. It has also been combined with our Tufram[®] coating for use on aluminum. It is also compatible with our other coating technologies.

This ability to combine MAGnanoSHIELD with other coating technologies adds microbe resistance to the long list of surface-enhancing properties we offer.

Highly Effective

MAGnanoSHIELD has been subjected to extensive third-party testing by Antimicrobial Testing Laboratories LLC. The test results show that it kills microbes on different types of metal surfaces even when implemented as part of broader coating system.

In bacteria testing with a widely used test standard from Japan (JIS Z 2801), MAGnanoSHIELD killed 99.9999 % of staphylococcus aureus, E. coli and L. monocytogenes on metal surfaces. The results document MAGnanoSHIELD's efficacy when implemented as part of Nedox and Tufram coatings (see Tables 1 and 2).

Application Examples

Food Processing

- Cookie Dies
- Pasta Equipment
- Dough Blades
- Chutes
- Molds
- Augers
- Mixing Troughs
- Hoppers
- Formers

Pharmaceutical

- Pill Chutes
- Fill Tubes
- Pill Shoes
- Fill Plates
- Freeze Dry Equipment
- Fill Box
- Capsule Indexing
- Tamping Pins
- Dosing Discs
- Segment Blocks

Medical Diagnostics

- Carousels
- Sample Platforms
- Chute Guides
- Dilution Wells
- Centrifuges

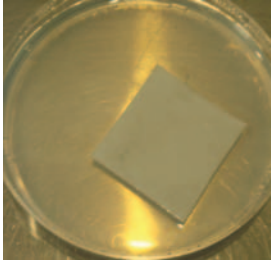
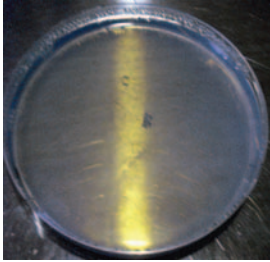
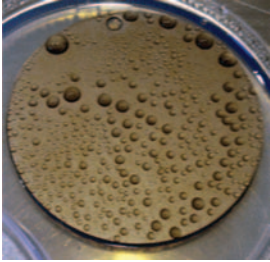
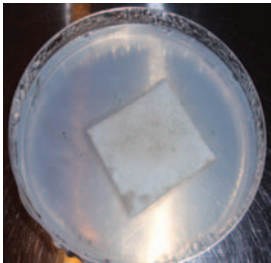
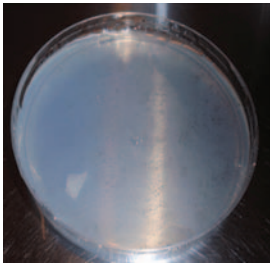
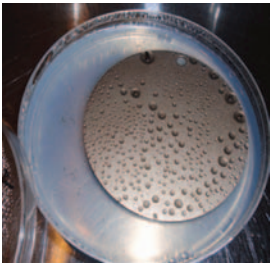
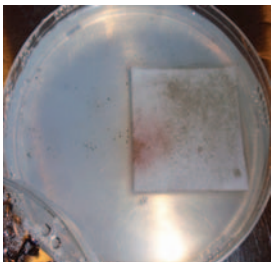
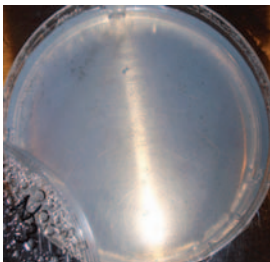


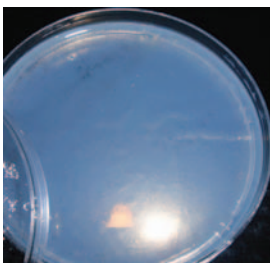
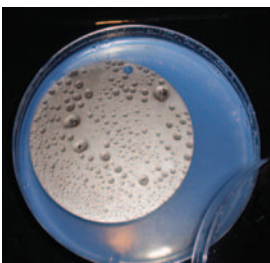
Packaging

- Weigh Scales
- Seal Jaws
- Side and End Rails



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Anti-fungal Results

| | Positive Control | Negative Control | MAGnanoSHIELD |
|--------|---|--|---|
| Day 0 |  |  |  |
| Day 14 |  |  |  |
| Day 21 |  |  |  |
| Day 28 |  |  |  |
| | Growth | Growth | No Growth |

Fights Mold Too

In addition to bacteria, MAGnanoSHIELD was also evaluated for its ability to resist fungus growth. Testing was conducted in accordance with ASTM G21, a standard for determining the resistance of synthetic polymers to fungi.

Samples of MAGnanoSHIELD in a Nedox coating were inoculated with *Gliocladium virens* ATCC 9645, *Aspergillus niger* ATCC 9642, *Penicillium pinophilum* ATCC 11797, *Chaetomium globosum* ATCC 6205 and *Aureobasidium pollulans* ATCC 15233. The samples were then scored for fungus growth at regular intervals. The result: no visible fungi growth even after 28 days.



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It's worth noting that the bacteria testing accounts for the effects of wear. Test samples subjected to 50,000 taber abrasion cycles retained their antimicrobial properties—largely because the antimicrobial agent is implemented within coatings known for their abrasion resistance.

Promising Applications

MAGnanoSHIELD has successfully been incorporated into coatings that offer low coefficient of friction (< 0.2), hydrophobicity (> 120°) and wear and abrasion resistance.

Because it works as an integral part of a broader surface-enhancement coating, MAGnanoSHIELD opens up new application possibilities wherever micro-organisms are just part of the problem. These applications are prominent in, but not limited to, the following industries:

- **Medical.** The benefits of imparting antimicrobial properties to medical devices, healthcare equipment and imaging machines are obvious. What's less obvious is that many of these medical applications can additionally benefit from treatments that make them hydrophobic, and thus easier to clean.

- **Pharmaceutical.** As with medical applications, microbe resistance and cleanliness are of paramount importance wherever pharmaceuticals are involved. Pharmaceutical manufacturing and packaging machines, which have their share of rotating and sliding components, can also benefit from the increased wear resistance and low friction provided by surface-enhancement coatings.
- **Food and beverage.** From farm to table, MAGnanoSHIELD offers many opportunities to increase food safety while improving the surface characteristics of harvesting, handling, processing and packaging equipment. Food preparation surfaces, including cookware, are another good fit for MAGnanoSHIELD.

For more information on MAGnanoSHIELD and the full range of coatings it works with, visit www.magnaplate.com.

For more information on General Magnaplate please visit: www.magnaplate.com or Tel: +1 908 862 6200 or claim your FREE friction calculation tool CD at: http://www.magnaplate.com/literature/friction_cd.shtml



Antimicrobial Coatings On The Rise

A study from Global Industry Analysts Inc. predicts that the market for antimicrobial coatings will grow at a double digit pace in the coming years, reaching nearly \$980 million in the United States alone by 2015.



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Anti-microbial Test Results (Nedox® SF-2)

| Micro organism | Sample | Contact Time | CFU/Coupon | R value |
|--------------------------------|---|---------------------|---|---------|
| E coli 11229 | Stainless Steel | 0 hours 24 hours | 2.50 x 10 ⁵ | N/A |
| | MAGnanoSHIELD | 0 hours 24 hours | 2.35 x 10 ⁵ < 5 | >6.19 |
| | MAGnanoSHIELD (1,000 abrasion cycles) | 0 hours 24 hours | 3.00 x 10 ⁵ < 5 | >5.62 |
| | MAGnanoSHIELD (10,000 abrasion cycles) | 0 hours 24 hours | 2.60 x 10 ⁴ < 5 | >4.02 |
| S. aureus 6538 | Stainless Steel | 0 hours 24 hours | 2.50 x 10 ⁵ | N/A |
| | MAGnanoSHIELD | 0 hours 24 hours | 1.51 x 10 ⁵ < 5 | >4.60 |
| | MAGnanoSHIELD (1,000 abrasion cycles) | 0 hours 24 hours | 7.55 x 10 ⁴ < 5 | >4.09 |
| | MAGnanoSHIELD (10,000 abrasion cycles) | 0 hours 24 hours | 3.05 x 10 ⁴ < 5 | >3.85 |
| | MAGnanoSHIELD (50,000 abrasion cycles) | 0 hours 24 hours | 3.05 x 10 ⁴ 4.5 x 10 ¹ | 3.59 |
| L. mono- cytogenes 15313 | ATL control | 0 hours 24 hours | 1 x 10 ⁵ 5 x 10 ⁵ | N/A |
| | MAGnanoSHIELD | 0 hours 24 hours | 1.05 x 10 ⁵ < 5 | >5.0 |

Anti-microbial Test Results (Tuftram® HO)

| | | | | |
|-------------------|--|---------------------|--|-------|
| E coli 11229 | ATL 0.075 | 0 hours 24 hours | 4.50 x 10 ⁴ 5.75 x 10 ⁶ | N/A |
| | ATL 0.4 | 0 hours 24 hours | 1.68 x 10 ⁵ 1.21 x 10 ⁷ | N/A |
| | MAGnanoSHIELD | 0 hours 24 hours | 1.36 x 10 ⁵ < 5 | >6.38 |
| | MAGnanoSHIELD (1,000 abrasion cycles) | 0 hours 24 hours | 3.60 x 10 ⁴ < 5 | >6.06 |
| S. aureus 6538 | ATL 0.075 | 0 hours 24 hours | 5.70 x 10 ⁴ 3.46 x 10 ⁵ | N/A |
| | ATL 0.4 | 0 hours 24 hours | 1.49 x 10 ⁵ 3.70 x 10 ⁶ | N/A |
| | MAGnanoSHIELD | 0 hours 24 hours | 2.54 x 10 ⁵ < 5 | >5.87 |
| | MAGnanoSHIELD (1,000 abrasion cycles) | 0 hours 24 hours | 7.85 x 10 ⁴ < 5 | >4.84 |

Antimicrobial data showed that MAGnanoSHIELD, when coated on METALS, can reduce the level of bacteria up to 99.9999%. **Note:** R values > 2 are antimicrobial