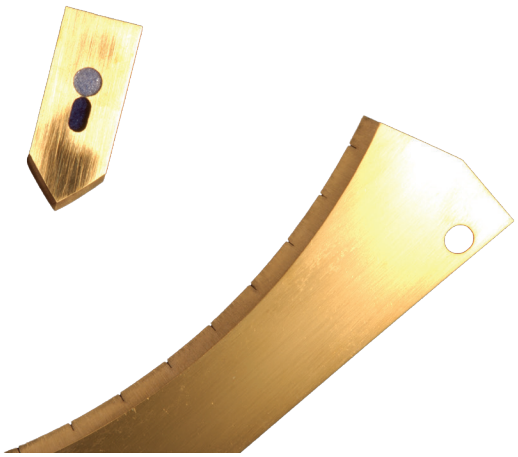
MAGNAPLATE
COATINGS ENGINEERED FOR YOUR SUCCESS

WHITE PAPER

Engineered Coatings Boost Throughput, Solve Problems in Packaging Applications

Keeping packaging equipment up and running is top priority for engineers and plant personnel. Faced with ever-increasing productivity benchmarks based on fast and efficient operation, packaging engineers must continually fight against issues such as sticking, premature wear, abrasion and corrosion. To eliminate these challenges, nano-engineered coatings are being used to protect machine components and solve performance problems in food, pharmaceutical and consumer goods packaging.

Specialized coatings permanently enhance the surface of metals and other substrates used in packaging equipment to solve wear, corrosion, lubrication and release problems. For example, sticking is a common problem plaguing equipment used to heat seal packages. As polyethylene film strips bond together to seal a package, sticking can arise from two sources — the melted material itself and adhesive glues — both of which can stick to sealing bars. Abrasive materials and dusty environments can make matters worse, leading to premature wear of machine components. Delicate materials and elaborate package designs complicate the situation even further. Magnaplate Corporation, a pioneer in surface enhancement coatings, continues to develop innovative product formulations to solve problems such as these, which frequently arise during high-speed packaging operations.



GOLDENEDGE® is used to keep cutting surfaces razor sharp and extend their useful life by as much as 20 times.

Depending on the application, coating families may be mixed and matched to achieve several design objectives. For example, a new antimicrobial coating technology called Polymer Coatings offer excellent non-stick, corrosion, and chemical resistance, while GoldenEdge is used to keep cutting surfaces razor sharp and extend their useful life by as much as 20 times. These technologies may be combined with — or used alongside — other proven coating families such as NEDOX®, TUFRAM®, PLASMADIZE® and others to meet specific packaging application requirements.

Synergistic Coatings, Simplified

Prior to diving into the challenges involved in high-speed packaging applications, it's important to have a basic understanding of how surface-enhancement coatings work. The premise behind engineered coatings is to enhance the surfaces of metals and other substrates, imparting performance attributes such as corrosion resistance, hardness and dry lubrication. Initially used in space applications, synergistic coatings from Magnaplate now transform inexpensive metal parts into chemical resistant, super-hard, dry-lubricated products that last longer, perform better and are more cost effective than components made of expensive and rare metals.

Coatings are applied to substrates in a multi-step system that begins with specialized cleaning processes. Next, applying a base coating using conversion, deposition, thermal spray or a mix of these techniques enhances the substrate's surface. The process then continues with a controlled infusion of various engineered nano-polymers or other dry-lubricating particles or metals. For example, on some metals, a hard layer of nickel alloy is deposited on the surface. The micro pores are enlarged, and polymer particles are then infused into the surface layer. A second-stage treatment ensures synergism and thorough integration into the top layer.

WHERE COATINGS FIND USE IN PACKAGING EQUIPMENT

Engineered coatings are used throughout the packaging industry to solve many issues associated with the operation of high-speed equipment, such as wear, abrasion, corrosion and release problems:

- Folding plates on wrapping equipment
- Aluminum and steel wear surfaces of strapping machinery
- Sealing head components of form-fill-seal machines
- Forming rolls and throats of vacuum-form packaging equipment
- Hoppers and chutes in stoppering machines
- Bagging chutes of packaging equipment
- Heat sealing and knife bars on sealing equipment
- Guides and sealing bars on binding and sealing machines
- Turntable holding plates on packaging equipment
- Skid plates and infeed surfaces of book trimming equipment
- Knives, blades, slitters, trimmers, cutting tool surfaces

The chief advantage of Magnaplate coatings versus other options, such as paint-on varieties, is that the particles in the Magnaplate coatings become an integral part of the substrate. Particles are mechanically bonded and the resulting new surface layer cannot chip, flake, peel or rub off. Because these coatings create metal surfaces with superior performance to both the original base metal and

the coatings themselves, these surface enhancements are said to be “synergistic”. Further, because the engineered surfaces either duplicate or surpass the performance characteristics traditionally provided by metals such as chromium, cobalt, cadmium and manganese, use of these expensive, scarce or environmentally hazardous materials can be reduced.

When selecting an engineered surface treatment, it is important to consult with your coating supplier early in the design process so that the most appropriate formula may be matched to the intended application. Several families of Magnaplate coating systems are available, each developed to protect a certain metal or group of metals or to solve a specific problem. As one example, the widely used NEDOX family is a nickel-alloy-based coating that protects most metals, including aluminum, against wear, corrosion, sticking and galling. Within the NEDOX family are many sub-varieties that employ various polymers to achieve different properties, such as enhanced hardness, superior mold release or excellent release at high temperatures. Similarly, the TUFRAM family of coatings for aluminum and aluminum alloys also features a range of specialized formulations depending on the intended use. The ability to customize product families by adding different polymers holds true across all Magnaplate coating families.

Specialized Coatings Enable Fast and Efficient Packaging Operations

Engineered coatings are used for a wide range of purposes across many industries and in various stages of production, design and packaging. For example, existing parts may be coated to improve wear and performance, damaged parts can be repaired, coated and returned to service, and newly fabricated parts are coated to provide optimal performance on new machinery. What should design engineers and those working in the MRO community be aware of when specifying coatings for packaging applications? Following are several of the most important criteria that packaging engineers should be familiar with.

First, surface hardness should be adequate to guarantee long service life for parts by protecting against wear, abrasion, corrosion, friction and galling. Be sure to ask your coating manufacturer if formulas comply with USDA and FDA codes where necessary, such as in certain food and drug packaging applications. Ease of cleanup is also important, as sanitary cleanup must be both thorough and simple to accomplish. Further, surfaces must be dense and non-porous to prevent mold and bacteria growth. Ask your supplier if antimicrobial formulations are available for extra insurance against microbes and fungus where needed.

Coated surfaces should also be non-stick to prevent product hang-up and ensure efficient substance release. In addition, coatings must not contaminate products and coated surfaces must be non-reactive to the atmosphere and potential spills. For best results, it’s important to discuss application requirements with your coating provider early in the design stage. Experts in material science will then be able to recommend the best combination of base materials and coating formulas to meet application needs.

Engineered Coatings Eliminate Packaging Problems

To see how engineered coatings can maximize throughput and minimize downtime by solving specific issues, let’s take a look at a few examples from the packaging industry. The following case studies employ various Magnaplate coating families to solve a host of packaging problems:

Corrosion — An ice cream factory needs to protect the turntable holding plates used to transport ice cream containers during packaging operations.

> *Problem:* Caustic cleaning solutions were causing aluminum machine parts to pit and corrode. Further, sanitary cleanup was a time-consuming process due to spent solutions that need to be properly disposed of.
>
> *Solution:* TUFRAM was applied to the holding plates, preventing corrosion and facilitating fast and easy cleanup by creamery personnel.

Sticky Products — A cereal manufacturer requires fast and efficient product flow to increase throughput of cereal boxes.

> *Problem:* A fruity sugar coating on cereal was sticking to a chute, causing grains to backup onto conveyors during transfer to packaging lines and necessitating a lengthy sanitation process.
>
> *Solution:* NEDOX was applied to the chute, easing product flow and minimizing cleanup time.

Sticking During Sealing — One packager needed to boost sealing speeds while using hot-melt adhesives, while another manufacturer needed to streamline heat-sealing of polyethylene bags.

Problem: For the first packager, hot-melt adhesives were sticking to guides on a binding machine, slowing packaging operations; the second packager encountered sealing bars that were frequently sticking during heat-sealing of polyethylene bags.

Solution: Guides and sealing bars were coated with PLASMADIZE, preventing adhesive buildup on the guides, eliminating sticking on heat sealing bars and increasing abrasion resistance.

Abrasion — A facial tissue manufacturer requires smooth, high-speed wrapping and folding operations to produce attractive polyethylene overwraps on finished packages.

Problem: Skewed overwraps, unsightly bubbles and out-of-square labels resulted from abrasive attack on machine surfaces, caused by microscopic paper dust particles carried along by polyethylene sheets. The wrapping machine's aluminum bottom plates, plus underfold and side-folding plates, were major problem areas.

Solution: Magnaplate HCR® was applied to all machinery wear surfaces, fortifying aluminum parts with an ultra-hard, corrosion resistant and non-stick surface, and leading to attractive and trouble-free tissue packages.

Abrasive Wear — A leading diaper manufacturer needed to increase packaging speeds, which had been slowed by problems with worn product chutes.

Problem: Premature wear issues were plaguing an aluminum arm used to push diapers into a stainless steel chute for final bagging. As the arm scraped against the chute's sides and bottom, material was deposited onto the equipment. These material remnants created friction, causing slower packaging speeds.

Solution: The company's packaging engineer reduced the arm size and had Magnaplate apply PLASMADIZE to the chute's bottom and sides, quickly resolving wear and friction problems and restoring packaging output.

Magnaplate HCR® fortifies aluminum parts with an ultra-hard, corrosion resistant and non-stick surface.

Mold Release — A contract packaging company in the pharmaceutical industry produces thermoformed plastic sheets with multiple cavities for individual tablets, capsules and caplets. After the cavities are filled and sealed with foil, sheets are cut into strips and packaged for sale or use as drug samples, hospital doses and clinical study packages.

Problem: Films tend to stick to aluminum tooling after thermoforming. Because each sheet of thermoformed film contains numerous cavities, if just one cavity is ruined because tooling sticks to it and tears it, the entire sheet must be discarded.

Solution: Magnaplate's NEDOX coating provides a dry lubricating property that solves the problem by creating a dense, non-porous surface, which also eliminates potential growth of mold and bacteria.

Friction — A packaging equipment supplier to the pharmaceutical industry makes extensive use of Magnaplate coatings to improve wear characteristics, reduce friction and provide inert surfaces where chemically active material might contact equipment components. One application involves a filler designed to handle irregular containers; its reciprocating head is timed to move with the conveyor belt so that the filling nozzle can enter, fill and leave the container without touching it.

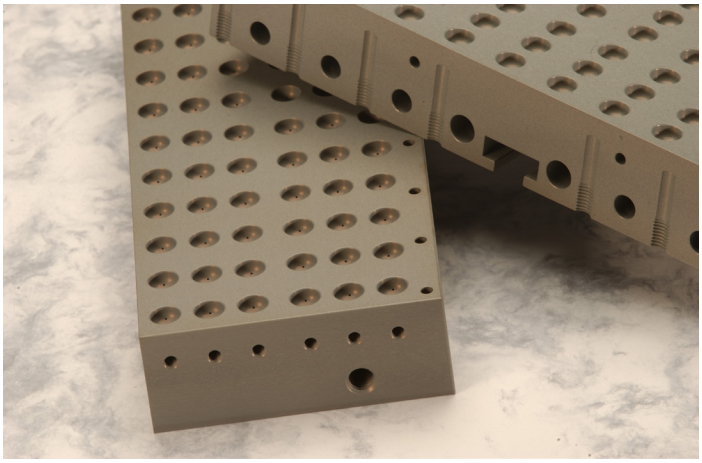
Problem: The packaging OEM wanted to use aluminum for the filler heads, but was not able to because of friction and wear issues.

Solution: General Magnaplate applied a TUFRAM coating that allows the aluminum heads to withstand the friction created by its moving parts.

Speed — A packaging equipment manufacturer supplies a variety of pharmaceutical companies with vertical and horizontal form-fill-seal machines for pouch packaging of viscous and aqueous liquid products, tablets, pre-moistened applicators and sterilizable hospital disposables in sealed and peel-open pouches.

Problem: The machines feature sealing head components and other key parts susceptible to corrosion, wear and mold release issues.

Solution: Parts are coated with a variety of Magnaplate coatings to increase operating speeds without excessive part wear.



Sticking, Chemicals — A manufacturer needs to protect a three-piece mold that thermoforms blisters from PVC/PVDC laminates in form-fill-seal machines.

Problem: The three-piece mold was facing issues with difficult mold release and exposure to chemical fumes.

Solution: Magnaplate HCR provides the desired non-stick properties and resistance to hydrogen chloride fumes given off by the laminate in the pre-heat station.

Engineered coatings easily solve these issues and many others commonly experienced in the packaging industry.

COATING FAMILIES PROTECT PACKAGING EQUIPMENT

Did you know that 99% of all packaging operations occur at temperatures below 450°F? Magnaplate's coating families easily handle the heat, facilitating high-speed operation in a wide range of packaging applications. Each family is available in several formulations to meet specific objectives, and many comply with USDA and FDA codes:

TUFRAM® — Gives aluminum parts a harder-than-steel, permanently dry-lubricated surface that resists corrosion, abrasion and galling. The smooth, slippery surface provides superior mold release, eliminating sticking and product hang-up.

Magnaplate HCR® — Coatings exhibit exceptionally high corrosion resistance, as well as ultra-high hardness for imparting superior wear resistance to aluminum machine components.

NEDOX® — Protects most base metals, including aluminum and titanium, against abrasion, corrosion and static buildup. Outperforms and outwears chrome and stainless steel, and offers excellent mold release and easy cleanup without the use of caustic chemicals or bleaches.

Plasmadize TNS® — Coatings solve "sticky substance" problems often encountered while using adhesives. Designed to act as a release system for all types of metal parts that come in contact with adhesives. Excellent for use in glue machines and box-building applications.

PLASMADIZE® — Provides corrosion and wear resistance for all metals; unsurpassed by conventional thermal sprays. More ductile than chrome plate, PLASMADIZE may be applied in the field to protect or restore all types of parts. Excellent for sliding applications, such as product chutes and carousels.

GOLDENEDGE® — When applied to blades, knives, and other cutting tools, its thickness is controlled to within micro-inches to prevent dulling. Creates a dense, ultra-hard surface that keeps edges as sharp as when they were first honed, extending blade life by up to 20 times.

Magnaplate HMF® — Imparts optimum wear performance to aluminum, steel, stainless steel, copper and other alloys. HMF creates an ultra-hard surface with a mirror-smooth microfinish. It has the lowest COF obtainable from any non-burnished metal coating system. Appearance is identical to chrome plate.