

High-tech “synergistic” coatings solve release, wear, and corrosion problems encountered in mold and die applications

Magnaplate surface enhancement technologies greatly improve mold release characteristics, extend wear life, eliminate corrosion, and boost production capabilities.

Whether your manufacturing operation calls for something as unusual as molding faces for CPR training dummies or as difficult as blow molding PET plastic beverage containers, getting the job done fast and efficiently is not always easy. Problems cause costly downtime, slow production, erode profits, and even lose valued customers.

Demanding Challenges

Whenever molds are used, the most demanding challenge is quick release of the product being molded. This is complicated when corrosion causes pitting and deformation of molds, or when wear erodes and roughens mold surfaces. Products hang up. Cleanup becomes a headache and production suffers. Molds must be replaced long before intended.

Working with dies entails challenges, too. Reducing accelerated die wear is perhaps the biggest, followed closely by the need to eliminate corrosion, increase output and eliminate sticking, clogging and product buildup.

General Magnaplate’s “synergistic” metal surface enhancement coatings can make production more efficient and cost-effective.

Coatings with a Difference

Magnaplate-applied “synergistic” surface enhancement coatings represent a major advance beyond traditional coating technologies. They are created in multi-step systems that start with a series of specialized cleaning treatments. The substrate’s surface is enhanced by conversion, deposition

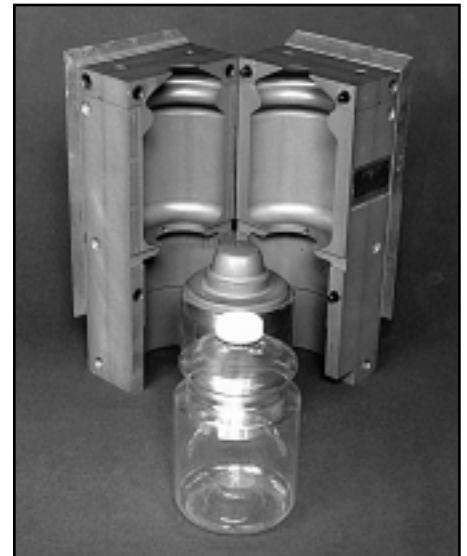
or thermal spray — or a blend-matrix of all three — depending on the requirements. The process continues with a controlled infusion of engineered polymers or other dry-lubricating particles and/or metals. The particles are mechanically bonded and locked in by a proprietary process; they become a permanent, integral part of the new surface.

These multi-step surface enhancements create sealed metal surfaces with hardness and density that match or surpass expensive, scarce metals or alloys. The treated surfaces will not chip, flake, peel or rub off. Dry lubrication not only protects parts from corrosion and wear but also reduces undesired heat generated by friction. Dense, tight, non-porous coatings are non-contaminating and make cleanup of equipment and parts environmentally responsible through elimination of harmful caustics and/or acid sanitation steps.

It Started in Space

Initially developed to solve problems of wear, galling and corrosion encountered by metal components used in America’s space program, these super-hard, high-tech coatings are now being used to enhance the performance of molds and dies. Their wear and corrosion resistant, non-stick properties improve mold release and extend die wear. They make production equipment run more smoothly and cleaning more efficient.

A few of the many mold and die applications where challenges have been met by Magnaplate coatings are described here.



Ultra-precise, highly polished male (steel) and female (aluminum) molds are used to produce crystal-clear PET bottles at Johnson Controls. Both of the metals are protected against corrosion and wear by Magnaplate coatings, which also assure quick, easy mold release.

Preventing Wear, Pitting and Release Problems with PET Plastic Injection Molds

Johnson Controls specializes in distinctively styled, recyclable injection blow molded PET (polyethylene terephthalate) food and beverage containers ranging in size from 12 to 64 ounces.

Key to the process are ultra-precise, highly polished male and female molds utilized in stretch-blowmolding. Most mold assemblies used at Johnson Controls combine stainless steel and aluminum. Moisture condensation was causing corrosive attack on both the stainless and aluminum molds. Galvanic corrosion caused by the interface of dissimilar metals aggravated the problem. The result was pitting of the precise, polished mold surfaces, degrading the



(Left) Lining up closed stack of Scheidl Manufacturing epoxy/glass plies on TUFRAM® coated aluminum platens. Beneath each platen are plies of the next stack. Shiny surface is the next platen. (Right) Assembled stack in the press. Cure cycle: from room temperature to 350°F, remaining at that temperature under 6,000 lbs. psi for 90 minutes. It is then cooled. Fluctuating cycle temperature range creates problems for aluminum platens and molds.

clarity of the PET containers.

In addition, extensive wear caused by constant abrasion between plastic and metal molds during the molding cycle intensified the pitting. This led to the need for excessively frequent mold repolishing. It also significantly shortened mold life and increased both labor costs and costly quality control monitoring.

As if those problems weren't a sufficient challenge, mold release of the finished containers was also severely impeded.

"We looked for the answer," reports Project Engineer Tod Eberle, "in a protective coating that could shield the dissimilar metal mold components from corrosion and from chemical and abrasive wear attack."

After trying a variety of conventional protective coatings unsuccessfully, Eberle turned to General Magnaplate's NEDOX® process to treat the steel mold components and to TUFRAM® to treat the aluminum.

"We're now experiencing less corrosive wear than normal," says Eberle, "and less galvanic corrosion at the steel/aluminum interfaces. Most important, we are turning out clearer, higher-quality products."

Coating Solves Problems in Molding and Curing of Plastic Laminates

Scheidl Manufacturing Company specializes in layups of reinforced plastic laminates which are molded and cured to create structural components. In one case, they used aluminum molds to produce a disk for a front end cap for a McDonnell Douglas missile container.

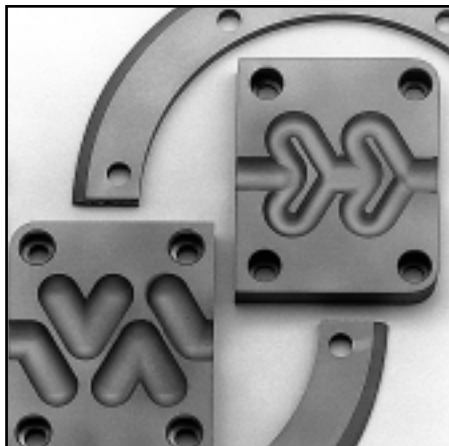
As Ben Buemi, Staff Engineer for Scheidl observes, "These molds can lead to a multitude of problems,

depending on size, molding process and procedures, and on which reinforced plastic you are laying up."

The softness of the aluminum molds, combined with the abrasiveness of the epoxy/glass laminate, necessitated frequent platen and mold replacement. Achieving smooth, easy, snag-free mold release added to the cost. In addition, the constant cleaning of the molds and platens made the job extraordinarily labor intensive.

The solution was to treat the molds with a TUFRAM coating that produced a harder-than-steel, continuously lubricated surface that will not rub off, chip, peel, or delaminate.

Buemi reports the permanent dry lubrication of the treated molds, along with their new-found resistance to abrasive wear and chipping, solved the problems and allowed Scheidl to maintain and utilize its aluminum molds cost-efficiently.



Two-part urethane mixing chambers, treated with a PLASMADIZE® coating, are protected against erosion caused by resins and beads constantly being poured into the chambers. Uniform coating thickness assures excellent mold definition. Very low coefficient of friction permits easy release from the mold without spraying or additives. Cleanup is quick and easy too.

Solving Mold Release Problem Avoids Burn-Through of Bent Sanitary Tubing

Sani-Tech's Sani-Pro Tubing Bender is an electrically heated, thermostatically controlled unit that bends small-bore plastic tubing.

The Bender was intermittently burning through the specialized, sanitary plastic tubing while it was being bent. Sani-Tech troubleshooters identified the problem; heat was being created by the inadequate and irregular release of the tubing from the aluminum dies.



Sani-Tech's tube bending system consists of two primary components: the Sani-Pro Bender that quickly and evenly heats the sanitary tubing, and the Sani-Form, which allows 45°, 90°, and 180° bends to be formed. Keys to consistent bending are Sani-Pro's aluminum molds, which are treated with Magnaplate HCR®.

Conventional release agents were tried. Some failed to release plastic from the aluminum molds. Others either couldn't withstand the high temperatures or meet sanitary specs.

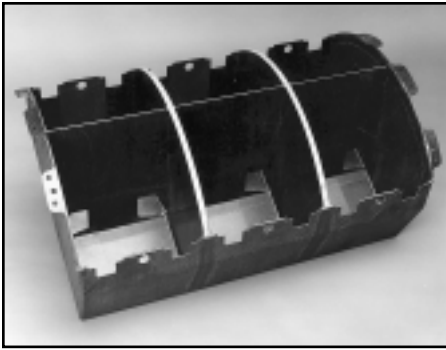
The solution was to treat the molds with a Magnaplate HCR® coating, which produces a surface that is harder than case-hardened steel and cannot be nicked, scratched, or flaked by ordinary means.

"Now," reports Sani-Tech's president, P. R. DuPont Sr., "the heated plastic tubing lifts off like the proverbial water from a duck's back."

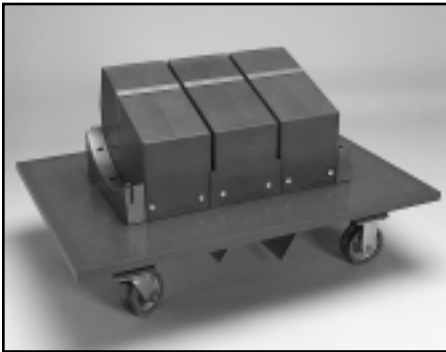
Four Problems With Molding of Helicopter Components Solved by Magnaplate Coating

Cure molding of the hybrid carbon/Kevlar laminate payload dispenser module for the US Army's McDonnell Douglas Apache helicopter was hitting several snags.

The problems started with the structure and composition of the pay-



This hybrid carbon/Kevlar laminated component consists of six deep, zero-draft compartments segregated by internal walls and bulkheads. Demanding specs call for strict performance requirements and tight tolerances.

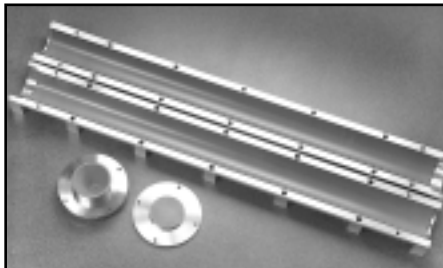


View of assembled cure mold (without caul plates) for the Apache's payload module. After oven curing, it is now possible to detach the laminate swiftly and easily without tearing.

load dispenser module — a container for housing missile ordnance. The basic material used is a 0.1" thick hybrid carbon/Kevlar laminate. Two of the module walls are 0.4" thick rigid foam sandwich structures, made primarily from carbon fabric.

The module is "mission-critical," and must meet demanding performance standards and tight tolerances.

Four molding problems were immediately evident: 1) difficulty in achieving quick and non-binding release from the aluminum module mold, 2) destructive, life-shortening



A PLASMADIZE® coating protects this aluminum mold assembly, used in making ceramic parts, against the highly erosive and abrasive action of the ceramic slurry. The coating also provides the mold assembly with superior mold release.

wear on the base plate and the soft aluminum molds caused by friction, 3) high labor and time costs incurred in the frequent cleaning and preparation of mold surfaces caused by composite residues, and 4) the inability to achieve smooth, easy, snag-free and damage-free mold release.

McDonnell Douglas had successfully employed Magnaplate technology to solve performance problems in a host of other aerospace and defense applications, so they again turned to the surface enhancement pioneer.

MAGNAPLATE HCR was selected as the solution and is now applied to the cure molds, producing a controllable harder-than-chrome-plated-steel surface — up to an equivalent of Rc 70. In accordance with FTMS 141, Method 6192, Cs/17, the wheel-weight loss is 4 mg or less after 10,000 cycles — a performance ten times better than test parameters required for hard-coat anodize on aluminum.

The HCR impregnation on the mold provides a smooth, slippery surface with permanent lubricity. Tests show that static friction actually decreases with load. The static coefficient of friction (0.05) is also lower than the dynamic coefficient. The problem of stick-slip — in which higher breakaway friction causes undesirable vibrations — is also eliminated.

Release of the composite from the aluminum module molds is now swift and free of hangups, even in tight areas with small radii. According to Project Manager Kevin L. Obrachta, "You can sheet it off with your hands." Production has become much more efficient, with mold life greatly enhanced. Labor and time costs for maintenance are greatly reduced.

Fan Manufacturer Cleans Up Injection Molding Problems

A manufacturer of small oscillating fans injection molded their plastic bases, motor housings and small components. Production suffered because of consistent sticking problems with the steel molds. Downtime was excessive, as was the labor to clean up between molding stages.

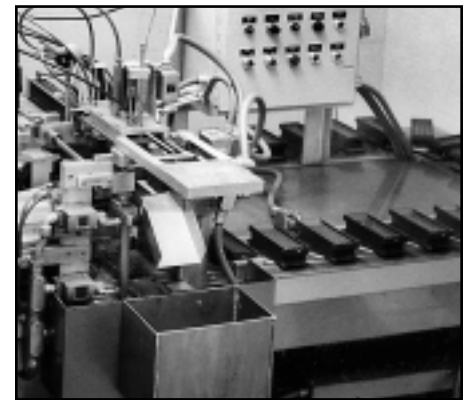
The solution was to treat the molds with NEDOX. As a result, sticking problems were completely eliminated and mold clean-up significantly reduced, for a profitable boost in production.

Drinking Straw Maker Meets Major Molding Challenge

The extremely thin walls of plastic drinking straws make them especially difficult to mold properly.

One straw manufacturer achieved success by searching out a surface treatment for the molds that would stand up to the daily wear and tear of operations while also providing superior lubricity.

The coating selected was PLASMADIZE®, which provided both wear resistance and lubricity. Scrap rates have been drastically reduced and mold cleanup is a snap.

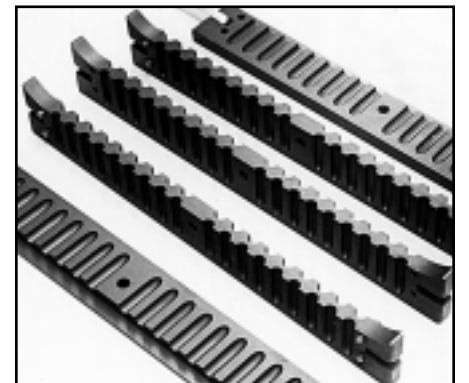


In the high-speed operation of this suppository molding machine manufactured by A. Cavalla, mold release must be fast and complete. Special TUFRAM® coatings for the aluminum cavity molds prevent hang-up, pitting and excessive wear.

Suppository Mold Hangups Solved by Synergistic Coating

A. Cavalla, Inc. builds machines for molding and bottling 175,000 glycerine suppositories during each 8-hour shift without any mold hang-ups, thanks to treatment with TUFRAM.

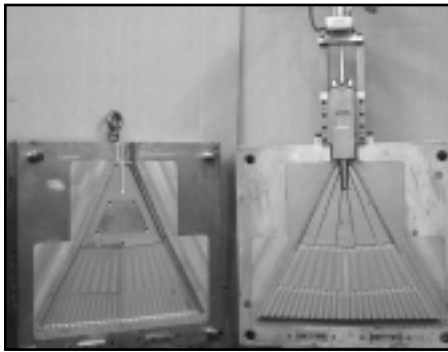
Cavalla's engineers report that Magnaplate-treated metal mold sur-



High-speed lipstick molding requires fast and complete mold release. TUFRAM® coatings on these Cavella molds prevent wall pitting and wear. Coating also permits quick and easy cleanup of lipstick residue.

faces enhanced production by allowing the metal to resist erosion and produce longer die life. The NEDOX coating provides a permanent dry lubricating surface which aids in mold release and eliminates corrosion and pitting problems. Improved heat transfer aids in the cooling of the molds.

Cavalla also manufactures molds for lipstick, eye-shadow, mascara, deodorant sticks and stick cologne. Magnaplate coatings are also specified for use on molds for these products, not just to enhance performance, but because the coatings are FDA-compliant and USDA-approved.



After treatment with TUFGRAM, Supreme Die & Mold's aluminum molds featured levels of hardness and wear resistance greater than that of case-hardened steel. The permanent lubricity imparted by the coating also added superior mold release properties.

Maker of Plastic Rakes Prevents Abrasion and Premature Erosion of the Design Imbedded in the Mold

Abrasive wear on aircraft aluminum molds used by Supreme Die & Mold to produce plastic garden rakes became an important and potentially costly problem. The complex configuration of the rake-head molds also tended to impede easy release of the plastic tool head from the mold.

Reports Martin Mitchell, the president of Supreme, "We needed a coating to toughen the surface and provide added wear resistance, while imparting the release properties we required."

The solution was Magnaplate's TUFGRAM, a synergistic coating that gives aluminum greater erosion resistance than case-hardened steel or hard chromium plate. Equally important to Supreme, the coating created a permanent, dry-lubricated surface on the mold.

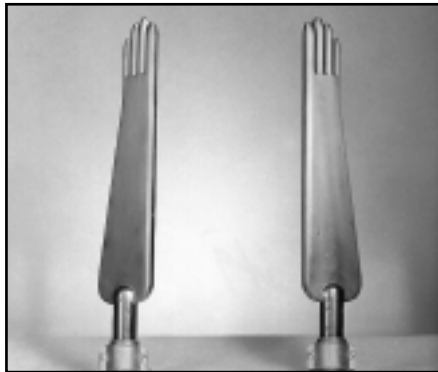
"The improved mold release

properties," says Mitchell, "certainly represent a great aid to productivity. But from a cost standpoint, elimination of abrasive wear on our molds has far greater impact on our bottom line. To date, we've had no signs at all of wear."

Doubling the Wear Life of "Laying Off" Glove Molds

In the manufacture of cloth and leather gloves by Curtin-Hebert Company, a key component is the nickel-plated and bronzed "laying off" form or mold. Electrically heated and thermostatically controlled, the forms stretch, mold and shape the gloves.

The stretching and pulling cause heavy surface wear on the molds, especially at the fingertip areas. Working life of the molds was short, and frequent replating was required.

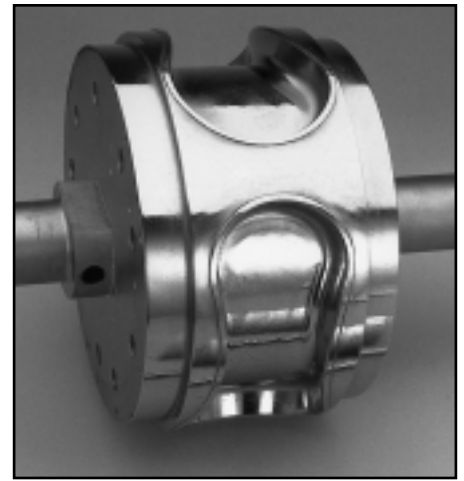


Glove "laying off" forms like these made by Curtin-Hebert, must withstand years of heating and cooling. The NEDOX® coating applied to the forms improves surface wear and heat distribution. The coating's high degree of lubricity speeds the pressing operation.

Application of a NEDOX coating doubled the working life of Curtin-Hebert molds. Other benefits have been achieved, too. The excellent lubricity of the coating along with its good heat distribution improve the "laying off" process because leather and cloth gloves can be pulled on and off the forms faster. The coated surface also resists glove oil and dirt buildup so the forms stay clean and require only minimal care.

FDA-Compliant Coating Replaces Hard Chrome Plating on Sanitary Napkin Mold

When a major personal products manufacturer introduced its feminine sanitary pads, Magnaplate played a vital role that continues today. Magnaplate's engineers recommend-



An FDA/USDA/NSF/AgriCanada-compliant Magnaplate HMF™ coating on sanitary napkin dies outperforms and outlasts chrome plating. It also avoids the potential health and environmental hazards associated with chrome.

ed using its Magnaplate HMF™ coating for the molds that form the pad's multi-web matrix. The coating clearly out-performs conventional hard chrome plating in many ways.

The coated surfaces exhibit excellent release properties at high temperatures while meeting codes for drug and food contact. Resistance to abrasion, erosion and corrosion is superior. A bonus is the avoidance of potential health and environmental problems associated with chrome.

Preventing Sticking and Wear of Rotary Cookie Molds

Nabisco suffered excessive downtime because wet cookie batter was sticking in the impressions of brass cookie molding rolls. Also, as the engraving in the expensive rolls wore away due to the continuous abrasion by the dough, the identifying pattern embossed on each cookie became dimmer and dimmer.



Like the bronze forming rolls used in making cookies for people, these dog biscuit forming rolls need a surface that is non-stick and resistant to abrasion from the batter. Both characteristics are provided by a NEDOX® enhancement coating.



Brass rolls for molding cookies on a high-speed production line at Nabisco were coated with a NEDOX® "synergistic" coating to give longer life to the expensive rotary molds, to prevent dough hang-up by providing mold release, and to make the molds easy to clean.

A quick but long-term solution was needed. Nabisco's engineers turned to Magnaplate. A USDA, FDA, NSF, and AgriCanada-compliant NEDOX coating was applied that hardened the surfaces of the brass rolls and provided them with critical wear resistance. The patented coating also gave roll surfaces anti-stick, anti-corrosion performance that prevents hangup of the wet batter.

Substantial savings were achieved by reducing production downtime required to clean the rotary molds, and by extending their life cycles.

Safety Mask Manufacturer Solves Mold Release Problem

One of the nation's largest producers of safety equipment faced a severe production problem; safety masks produced from a thin, fibrous material were sticking to their molds. Production came to a virtual halt with downtime levels at an all-time high.

Application of a TUFAM coating to the mating surfaces produced a slick release surface that eliminated the production and downtime problems.

Coating Outperforms Anodizing and Chrome Plating in Molding of Plastic "Lumber"

A manufacturer of 12" wide tongue-and-groove plastic, molded to imitate the rough textured grain of lumber, experienced problems when it used conventional hard anodize and hard chrome treatment on the lumber

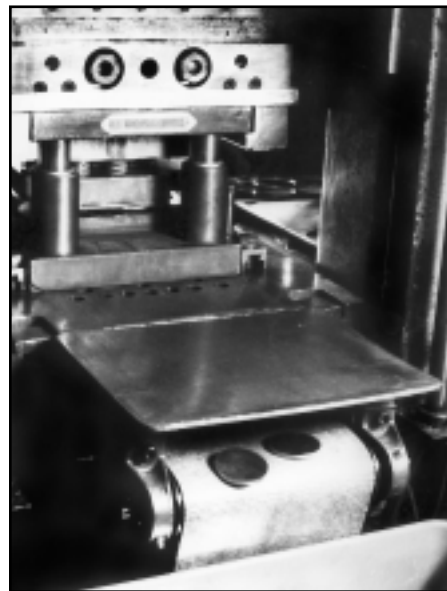
molds. Both mold release and wear life were inadequate.

Treatment with MAGNAPLATE HCR solved the problem and the manufacturer is now planning to coat nineteen more sets of molds.

Coating Blanking Dies Halts Wear, Burring, Jamming

The world famous Franklin Mint must achieve flawless perfection for the coins, medals and medallions it mints and markets.

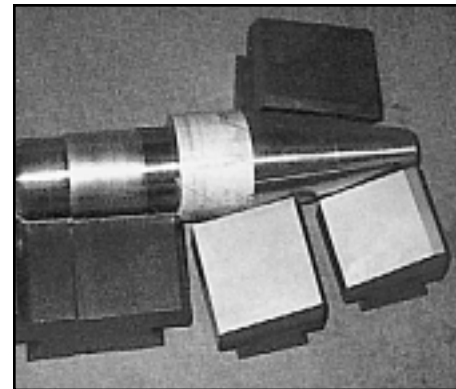
To produce coins, circular blanks are punched out of long strips of sterling silver, copper or bronze, then burnished and coined. Because the metals are soft, it was difficult — before Magnaplate — to obtain consistently proper release from the punch dies. Abrasive wear of dies by metal caused deterioration of the smooth die surfaces, further preventing quick release of the coins.



Bronze medallions, produced by the world famous Franklin Mint, were minted from burnished blanks. MAGNAGOLD® coating on the blanking dies halted wear, burring and jamming.

Die hangups and machine jams caused production downtime. In addition, burrs and other defacing of the surface of the dies caused a high reject rate.

Many coatings were tried unsuccessfully on the male and female dies before trying MAGNAGOLD®. The MAGNAGOLD coating provided a permanent, wear resistant surface. Hangups and burring came to an end. Rejects were virtually eliminated. The operating life of the dies was extended and precision improved.



General Magnaplate's MAGNAGOLD® coating boosted the tool life of General Defense's dovetail form tools as much as 24-fold.

Coating Increases Wear Life of Forming Tools Up to 24 Times

At General Defense Corporation's Flinchbaugh Division, a 3-1/2" long forming tool that shapes an aluminum cylinder into a precision-toleranced cone for kinetic energy tank ammunition required daily removal for regrinding in order to assure the exacting set-up needed to achieve the proper cut. Put-through between die changes was only 900 pieces.

Conventional coatings, special steam treatments and sophisticated freeze treatments were tried but proved to be unsuccessful.

After the high speed forming tools were treated with a MAGNAGOLD coating, they showed a 19 time improvement in wear life. Output per tool jumped from 900 to 17,365. After regrinding, the tool still produced 13,800 pieces. Another tool's production increased nearly 24 times. And after regrinding, it maintained 80% of its improved life span.



This intricate mold for plastics, used by an electronics manufacturer, was treated with a TUFAM® coating for quick release.

Manufacturer of Shoe Soles Solves Mold Release Problem

Mold release was a problem for a plant manufacturing rubber shoe soles for slippers, tennis shoes and other footwear. Soles were hanging up in the steel and aluminum molds.

Tests by General Magnaplate showed that NEDOX, TUFRAM and MAGNAPLATE HCR treatments performed what the customer called "miracles" by solving the release problems in both the steel and aluminum molds.



In Metal Forms Industries' stamping operations, this pinch-off die forms the outside perimeter of the workpiece, blanks the center hole and trims off excess, all in one operation. A NEDOX® coating increased die life by almost 30%.

Coating Boosts Die Life 30%, Cuts Downtime More Than 50%

Metal Forms Industries supplies stampings in a wide range of sizes and materials. One of its major expenses is the maintenance and replacement of stamping dies. In one case, for instance, they were making several sizes of small, flat rings from Inconel 750, an extremely hard alloy. "One ring was 0.090" thick," reports Ray Hardy, plant manager. "We had to rebuild the punch every 200 to 300 rings because we couldn't find a die metal that would not fatigue and break." What was needed was a surface enhancement coating to improve abrasion resistance and to impart permanent lubricity to die surfaces.



Use of a NEDOX® coating greatly increased the life of the die that stamps the familiar word PUSH into the lid of this bus and airline seat ash tray.

Hardy reports that when NEDOX was tried, "It increased our die life 30% or more. And it gives us additional protection against galling and seizing. Putting it another way, I'd say it does away with about 60% of our downtime while tooling is pulled and resharpened."

Capsule Case Histories

Problem: A medical equipment company packaged surgical sewing kits that included a bonded foam rubber lining. The rubber stuck to the brass forming dies, resulting in rips and tears.

Solution: Treatment of the forming dies with a NEDOX enhancement coating effectively eliminated sticking while reducing quality rejects.

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Problem: A manufacturer of bowling balls experienced a mold release problem during the molding of the cast center for the balls.

Solution: Application of one of Magnaplate's LECTROFLUOR coatings eliminated the sticking problem and allowed the center to release.

Problem: An ammunition plant had corrosion, wear and sticking problems on its large powder packing molds.

Solution: Application of a NEDOX coating eliminated the problems and allowed the molds to remain in service for over four years — a four-fold increase.

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Problem: Makers of adobe bricks, concrete edgings, and ceramic tiles found that their products were hanging up in the molds. The molds were also suffering premature wear as well as severe damage from corrosion.

Solution: Application of NEDOX and PLASMADIZE coatings eliminated release problems and increased wear and corrosion resistance.

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Problem: Plastic buildup on the dies of a chemical company extruding plastic pellets required the use of a coating acceptable to the food industry.

Solution: Application of an FDA-compliant / USDA-approved NEDOX coating on the extruder dies not only prevented the buildup, but boosted production by 10% due to an increase in the coefficient of friction at the extruder holes.

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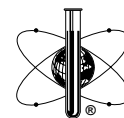
Problem: Chlorine gas and atmospheric humidity encountered in extruding PVC structural components caused severe corrosion and wear problems for a manufacturer utilizing aluminum extrusion dies.

Solution: Application of a PLASMADIZE coating prevented the corrosion and also reduced wear on the dies to a minimum.

And that's not all...

Besides improving the performance of molds and dies throughout the manufacturing sector, Magnaplate's "synergistic" surface enhancement coatings also are recommended for a wide variety of other applications to assure efficient, profitable production and consistent product quality.

General Magnaplate Corp.



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