October 2007

Finishing TODAY

Trends & Technologies for Coatings Professionals

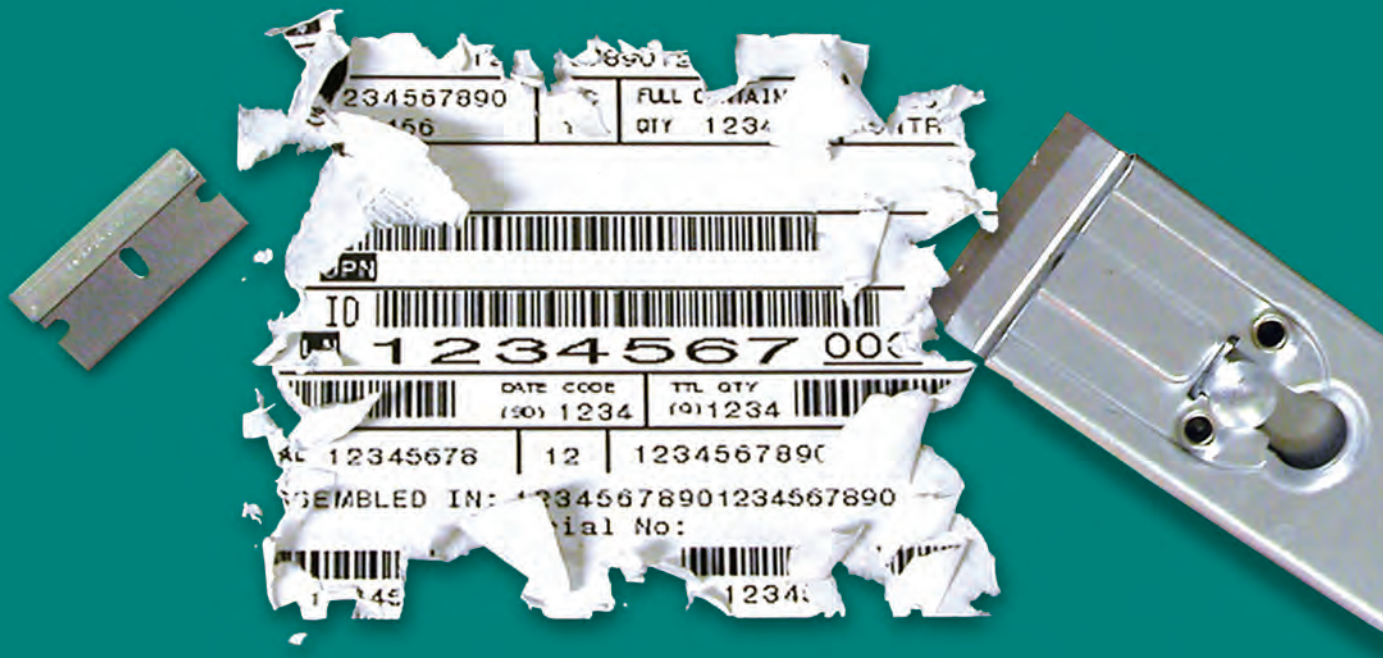
Modern CARCs for Military Protection

www.finishingtodaymag.com

A bnp media PUBLICATION

INSIDE: Innovative Coatings for Plastics • Near-Infrared Curing

Some tracking labels just don't know when to let go.



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ON THE COVER

Modern CARCs continue to evolve to provide better protection for soldiers and their equipment. Story on p. 20.

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Doing Our Part

Kevin Biller, Technical Editor

I recall as a teenager in the ’70s listening late at night to the annual draft lottery on my transistor radio. I wondered where my number would come up. What if this was my year? Would I have a low enough number to receive a first class ticket to Vietnam? As fate would have it, the draft ended just before I graduated from high school. So there was no need to speculate about joining or taking my chances with the draft.

A couple years later during the 1978-79 recession, I was persuaded by our local recruiter to pursue a career path in the military. I patiently endured all the placement testing and the physical exam. Quite unexpectedly, I stopped minutes short of committing the next five years of my young life as I realized the misinformation and half-truths my recruiter had used to get me to that juncture.

I may never have served; however, many people close to me have. Consequently, I have always recognized and respected the commitment that our young people make when they join the armed forces. Regardless of our political bent, we all wish for the safety of our loved ones when they are faced with dangerous situations.

Not surprisingly, the coatings on military equipment play a crucial role in the safety of soldiers. Providing corrosion resistance in a myriad of extreme environments, these advanced finishes keep equipment functioning for a long tour of duty. Just as important, sophisticated coating technology makes detection by enemy infrared sensors extremely difficult due to proprietary pigmentation techniques.

This month we examine some the latest coating technologies used to protect our troops and the equipment they use. We discuss the latest advances in CARC technology (pp. 20-23), as well as recently approved non-hexavalent chrome treatments used to protect aluminum items used in the military (pp. 18-19).

Elsewhere we highlight some amazing innovations that are advancing finishing technology throughout the world. New materials and processes are emerging that offer lower VOCs (powder clearcoats), improved performance (fluorosilicone resins and retro-reflective powders) and more economical processes (NIR curing, electric reciprocators, cost effective cleaning and plating operating procedures).

Hats off to those who serve and to the people who make their job a little safer.

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MEETINGS, SHOWS AND SEMINARS IN 2007 & 2008

OCTOBER 15-26
CyberCoating 2007,
www.cybercoatingshow.com

21-24
Western Coatings Symposium, Flamingo Las Vegas, Las Vegas, NV, sharongeraci@mimlv.com, *www.westerncoatingssymposium-show.com*

25-26
Fire Retardant Coatings II, Berlin, Germany, *www.coatings.de/events/ecc34.cfm*

31-Nov. 2
Kiev Industrial Week 2007, Kiev, Ukraine, olga@welding.kiev.ua, *www.weldexpo.com.ua*

NOVEMBER 5
Infrared Process Heating Seminar, Hyatt Regency O'Hare Rosemont, IL, *www.ihea.org*

5-8
AESF Electroplating and Surface Finishing Training Course, tkohler@nasf.org, *www.nasf.org*

13-16
Automotive Topcoat School, Eastern Michigan University, Coatings Research Institute, Ypsilanti, MI, *www.emich.edu/public/coatings_research/autotopcoat.html*

21-23
ChinaCoat 2007, Shanghai, China, *www.chinacoat.net*

JANUARY 22-25, 2008
World of Concrete, Las Vegas Convention Center, Las Vegas, NV, *www.worldofconcrete.com*

27-30
PACE 2008, LA Convention Center, Los Angeles, CA, *www.pace2008.com*

FEBRUARY 12-15
Polyurea Development Association Annual Conference, Hyatt Regency Atlanta, Atlanta, GA, *www.pda-online.org/program/annual.asp*

27-29
Smart Coatings 2008, Grosvenor Resort, Disney World Resort, Lake Buena Vista, Orlando, FL, 734.487.2203, *www.emich.edu/public/coatings_research/smartcoatings/index2.html*

MARCH 2-6
NASF Management Conference, Sheraton Hacienda Del Mar Resort and Spa, Cabo del Sol, Los Cabos, Mexico, 202.457.8404, lweber@nasf.org, *www.nasf.org*

16-20
Corrosion 2008 Conference & Expo, Ernest N. Morial Convention Center New Orleans, LA, 800.797.NACE, cindy.euton@nace.org, *www.nace.org*

APRIL 8-10
ExpoCoating 2008 - The International Exhibition and Conference for Coatings and Surface Treatment, WTC Congress Center, Moscow, Russia, *www.expocoating.ru/eng*

MAY 4-7
Radtech UV/EB Technology Expo & Conference 2008, McCormick Place, Chicago, IL, 240.497.1242, uveb@radtech.org, *www.uveb2008.com*

14-16
Electrocoat 2008, Marriott of Indianapolis, Indianapolis, IN, 816.496.2308, kmcglothlin@electrocoat.org, *www.electrocoat.org*

JUNE 16-18
SUR/FIN 2008, Indiana Convention Center, Indianapolis, IN, 202.457.8404, cclark@nasf.org, *www.nasf.org*

MORE EVENTS CAN BE FOUND IN OUR ONLINE AGENDA AT WWW.FINISHINGTODAYMAG.COM.

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Ford Turns Paint Fumes into Energy

Ford Motor Corp. will install its patented Fumes-to-Fuel system at its Oakville, Ontario, Assembly Plant, which will convert emissions from its paint shop into electricity. The system will launch with an internal combustion engine before shifting to a stationary large-scale fuel cell to boost effectiveness. The company reportedly will buy the DFC300MA fuel cell from manufacturer FuelCell Energy Inc. to transform fumes from the paint solvent into 300 kW of green energy.

"The Oakville installation is the first of its kind in the world to harvest emissions from an automotive facility for use in a fuel cell," said Kit Edgeworth, Ford's abatement equipment technical specialist for manufacturing. "It is the greenest technology and offers the perfect solution to the industry's biggest environmental challenge traditionally."

The technology was developed as a responsible way to remove volatile organic compounds (VOCs) from the painting operations' exhaust air. Carbon beads capture the VOCs for use in the fuel cell, which converts it to electricity. The system was launched as a pilot installation at the Dearborn Truck Plant using a 5 kW fuel cell. A year later, Ford installed similar technology at its Michigan Truck Plant using a 50 kW Stirling engine to generate electricity.

The Oakville system will launch with a 120 kW internal combustion engine before shifting to the 300 kW fuel cell, which is expected to reduce carbon dioxide emissions by 88% and eliminate nitrogen oxide emissions completely. The fuel cell unit is slated to begin use in early 2008 and could eventually be implemented at Ford's other plants.

Ford also is developing a new environmentally friendly anti-corrosion technology that reduces water use in automotive paint shops by nearly half, and lowers sludge production by 90%. It is currently being field-tested on a small fleet of Lincoln Town Cars. It uses a zirconium oxide vehicle bath instead of the traditional zinc phosphate bath, which contains heavy metals such as zinc, nickel and manganese.

Ford Motor Co.'s website is at www.ford.com. FuelCell Energy's website is at www.fce.com.

New Nanowire Coating Improves Bone Implants and Stents

University of Arkansas researchers have found a simple, inexpensive way to create a nanowire coating on the surface of biocompatible titanium that can be used to create more effective surfaces for hip replacements,

dental reconstruction and vascular stenting. Further, the material can easily be sterilized using ultraviolet light and water or ethanol.

The researchers used an alkali and heat to create titanium oxide-based ceramic nanowires that coat the surface of a titanium medical device.

"We can control the length, the height, the pore openings and the pore volumes within the nanowire scaffolds" by varying the time, temperature and alkali concentration in the reaction, said Z. Ryan Tian, assistant professor of chemistry and biochemistry in the J. William Fulbright College of Arts and Sciences. "This process is also extremely sustainable," requiring only that the device be rinsed in reusable water after the heating process.

Reconstructive bone surgeries, such as hip replacements, use titanium implants. However, muscle tissue may not adhere well to titanium's smooth surface, causing the implant to fail after a decade or so and requiring the patient to undergo a second surgery. Tian and his colleagues created a nanowire-coated joint and placed it in mice. After four weeks, the researchers found that tissue had adhered to the joint.

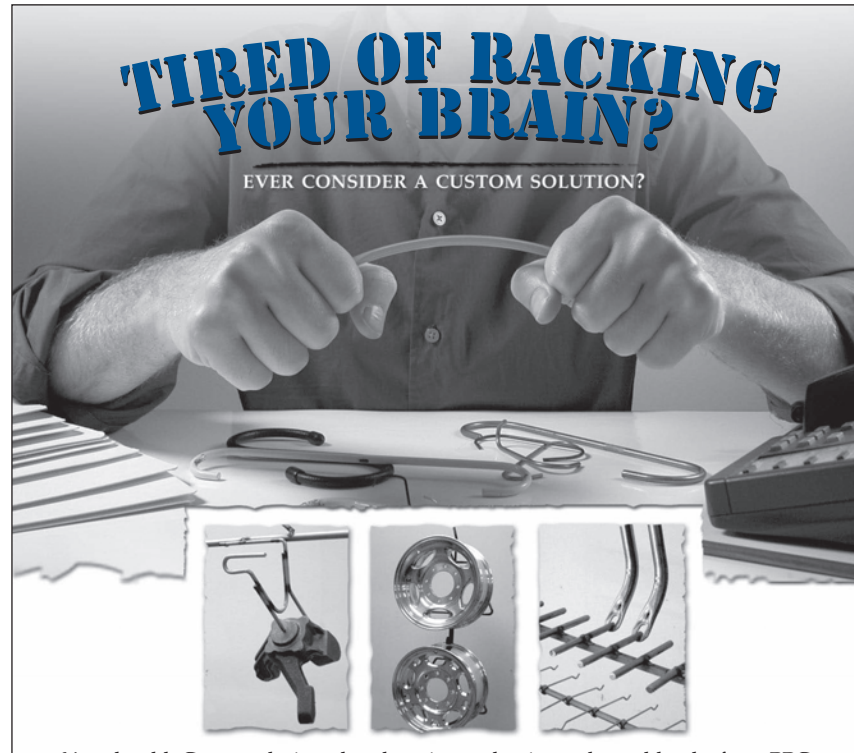
Because the researchers can control the size and shape of the pores in the nanowire scaffold, the material also could be coated onto stents used in patients with coronary artery disease and in potential stroke victims.

For more information, call Tian at 479.575.2653 or e-mail rtian@uark.edu.

MetroPaint Earns Green Certifications

MetroPaint, a 100% recycled latex paint, has received the first-ever recycled paint certification from Green Seal™, an independent environmental standards certifying organization. Green Seal approval means that MetroPaint 100% recycled latex has undergone extensive environmental and performance testing. In addition, MetroPaint received certification from the Master Painters Institute (MPI), the leading paint performance certification organization in North America. MPI standards for recycled paint are the same as for new paint. However, MPI requires recycled paint to be sampled and tested numerous times to ensure the high standards are met.

To achieve the Green Seal certification, MetroPaint 100% Recycled Latex had to meet stringent environmental standards, including that it contain at least 95 percent



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post-consumer content, be filtered to 300 microns or finer, that no harmful ingredients be added, that every batch be tested under strict quality control measures, and that the empty paint cans be recycled.

For more information, call 503.234.3000 or visit www.metropaint.info.

Demand for Radiation-Curable Coatings on the Rise

The radiation-curable coatings market in North America is witnessing steady growth due to the increasing awareness of environment-friendly technology and the need for high productivity. Moreover, increasing compliance with the stringent environmental legislation on solvent emission for a greener and safe environment is impelling the demand for radcure coatings. New analysis from Frost & Sullivan in *North American Radiation Curable Coatings Market* finds that the market earned revenues of $1.5 billion in 2006 and forecasts that this figure will reach $2.3 billion in 2013.

"Increasing awareness of the numerous benefits of radcure coatings among formulators and end-user markets is encouraging market growth," said Frost & Sullivan Research Analyst Krithika Tyagarajan.

However, the high price of equipment and consumables in radcure technology requiring substantial investment is hindering widespread adoption. This is becoming a major entry barrier to the most participants, particularly small-sized companies.

"Participants must constantly engage in research and development (R&D) activities to bring out new coating formulations to develop new applications, as this market is set to gain more prominence by expanding its scope of applications," said Tyagarajan.

For more information about the study, call 210.477.8427 or visit www.frost.com.

Rohm and Haas Earns Sustainability Award

Rohm and Haas Co. received the 2007 Hydro Sustainability Award during a recent conference held in Hafnersee, Austria. The award was presented by Dr. Karl-Henrik Róbert, founder of The Natural Step, a non-governmental organization that has pioneered an extensive set of principles to advance society toward sustainability.

As winner of the award, Rohm and Haas will act as a leader for sustainable development issues within its circle of suppliers, co-suppliers and customers. The company will co-sponsor a distance learning course regarding The Natural Step sustainability development principles scheduled to begin this fall. The course is created for professionals in the chemical industry and aims to equip "agents of change" with information to address sustainability within their own companies.

For more information, visit www.rohmhaas.com.

Rohm and Haas employees (from left) Louis Sederel, Muriel Hebrard, Gareth Oubridge, Jon Hastings and Robin Madgwick accept the Hydro Sustainability Award from The Natural Step founder, Dr. Karl-Henrik Róbert (second from right).

Akzo Nobel Recognized for Sustainability Efforts

Akzo Nobel has been ranked as the chemicals industry leader on the prestigious Dow Jones Sustainability World Indexes (DJSI),

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recognizing the company's ongoing commitment to improving its social responsibility performance. Rated on the index for the third successive year, Akzo Nobel again improved its average score in the individual indicators and achieved a best-ever overall mark.

Launched in 1999, the Dow Jones Sustainability Indexes are the first global indexes tracking the financial performance of the leading sustainability-driven companies worldwide.

Akzo Nobel's website is at www.akzonobel.com. For more information about the DJSI, including a full list of member companies and a guide to the assessment and selection process, visit www.sustainability-indexes.com/.

Radiant Energy Inaugurates Pilot Coating Line

Radiant Energy Systems, Inc. has commissioned its new pilot coating line, which allows companies to run trials on new processes and materials before scaling up to production equipment. The new pilot line is specifically designed to run water-based coatings and is capable of handling roll diameters of 24 in. and web widths up to 26 in. Various heating technologies are available in the drying stage, including infrared (gas or electric), infrared air, impingement and flotation dryers. A modular design reportedly allows for a quick switchover to different types of heaters or nozzles. Heaters are available in short, medium and long wavelength options for a variety of testing choices.

The pilot line is capable of running a variety of materials, including paper, film, foil, nonwovens and fabrics. It can be used for coating, drying, curing, laminating, annealing plastic films and printing on various substrates.

For more information, visit www.radiantenergy.com/pilotcoatingline.html.

Hardide Speeds Aerospace Development Plans

Hardide plc, a UK-based surface engineering technology provider, has decided to fast track its plans to penetrate the aerospace sector in order to take advantage of significant new market conditions and blue chip customer opportunities.

The move has been prompted by the new EU REACH environmental legislation on chemicals, which has driven many manufacturers to source alternative coating technologies to replace hard chrome. In addition, Hardide has been pursuing alternative coating studies and/or test programs with customers such as Messier-Dowty. Such programs have resulted in the company deciding to accelerate its five-year plan to grow its market share within the aerospace industry. Hardide is currently 18 months into the plan, which has, to date, included success in securing approved supplier status with BAE Systems. The new timescale will compact the program to complete within the next year and a half and will include securing further industry approvals and registrations.

The company reportedly has parts in testing with five of the largest global aircraft manufacturers and systems designers and is in application-specific discussions with another 10 companies.

For more information, visit www.hardide.com.

Valspar Acquires Teknos Nova Coil

The Valspar Corp. has acquired Teknos Nova Coil TNC Oy, a Helsinki, Finland-based manufacturer of high-performance coil coatings widely used in the construction industry, from Teknos Group Oy. Terms of the transaction were not disclosed.

"This acquisition builds on Valspar's growing international presence by expanding our coil coatings solutions in Northern Europe and the fast growing markets of

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Eastern Europe," said William L. Mansfield, chairman, CEO and president, Valspar.

Valspar's website is at www.valspar.com.

Sherwin-Williams and Columbia Paint to Merge

The Sherwin-Williams Co. and Columbia Paint & Coatings Co. have entered into a definitive merger agreement. Following the consummation of the merger, Columbia Paint & Coatings Co. will become a subsidiary of Sherwin-Williams.

Columbia Paint & Coatings Co., headquartered in Spokane, WA, is a leading manufacturer and distributor of paints and coatings in the western and pacific northwestern portions of the U.S. Columbia services the professional painting contractor, builder and do-it-yourself markets through 41 company-owned stores. The transaction will be completed upon the receipt of all regulatory approvals. The company's paints and coatings will continue to be provided through Columbia's existing stores.

For more information, visit www.sherwin.com.

Huron Capital Acquires Zolatone Automotive

Huron Capital Partners LLC, through its portfolio company, Quest Specialty Chemicals, Inc., has acquired Zolatone Automotive. Zolatone will be managed under Quest's Automotive Aftermarket Unit, Matrix System Automotive Finishes (based in Walled Lake, MI) and will relocate its operations to Quest facilities in Michigan and Wisconsin. Zolatone manufactures and markets high-performance acrylic sealers, basecoats, topcoats and other coatings to automotive refinish and paint distributors across the U.S. for sale to collision and body shops. Terms of the transaction were not disclosed.

Through a series of synergistic add-on acquisitions and significant organic growth, Quest revenue has grown fourfold during the past three years to over $80 million, reportedly making it one of the top 20 diversified coating companies in the U.S.

For more information, visit www.huroncapital.com.

X-Rite to Acquire Pantone

X-Rite, Inc., a provider of color solutions for measuring, formulating, matching, and simulating color, has entered into a definitive agreement to purchase Pantone, Inc. for $180 million. The deal is expected to close in the fall of 2007.

For more information, visit www.xrite.com or www.pantone.com.

Vail Rubber Opens Surface Technology Center

The surface coating technology that NASA and the U.S. military use to make their landing and steering gears last longer is now available at Vail Rubber Works, Inc.'s new Surface Technology Center. The 12,000-ft^2 facility, located in St. Joseph, MI, houses Vail's thermal spray coating technologies, which reportedly can extend part reliability up to four-times longer than chrome plating, metalizing or spray welding. Its HVOF (High Velocity Oxy-Fuel), combustion powder and combustion wire coating processes can restore parts to their original dimensionality, as well as improve their anti-skid properties or wear and corrosion resistance.

The company said that its thermal spray coating processes can reduce routine maintenance costs on agricultural equipment and components for power generation, water treatment, pharmaceutical, chemical, machine tool and plastics plants.

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Ralph Burke, the new center's plant manager, and Matt Fleisher, coating technician, analyze which of the more than 300 coating formulations is best suited for each application. "The expanded capability of this new center will allow us faster turnaround to minimize customer downtime," Burke said.

For more information, call 269.408.0092 or visit www.vailrubber.com.

CESCO Incorporates as Finishing Industry Engineering Firm

Coating Equipment Solutions Co. (CESCO), based in Stallings, NC, has been incorporated as an engineering house and equipment manufacturer for high-volume organic finishing. It has also been appointed an OEM distributor for Wagner liquid and powder coating systems. The company provides sales, program management and technical support throughout the U.S., Canada and Mexico.

CESCO is organized in eight related business units: finishing systems design, cleaning and pretreatment, powder coating, liquid finishing, electrocoating, ovens and heat processing, material handling, and control engineering. The company focuses on control technologies and new component and interface strategies that reduce energy costs.

CESCO's management team is headed by its new president, John Faulkner, who has 28 years of experience in the coatings equipment field.

For more information, call 704.882.3020 or visit www.coating-equipment-solutions.com.

Wagner Names Top Distributors at Recent Distributor Meeting

Wagner Systems, Inc. held its 2007 Distributor Meeting in Big Sky, Montana on August 15-18, 2007. The meeting was well attended with 17 distribution companies represented.

Led by Barry Parsonage, Wagner's new distributor development manager, the first day of presentations and discussions focused on liquid applications, while the second meeting day focused on powder applications. New products and sales tools were introduced, including InfoNet and the "Big Wagner" product catalog.

James Swainston, Providing System Solutions received Wagner's "Top Distributor" award. Mike Ball, Dove Equipment and J. R. Rogers, Industrial Air Systems, both received Wagner's "Outstanding Distributor" awards.

Wagner's website is at www.wagnersystemsinc.com.

NETZSCH Develops Outsourced Engineering Service

Responding to a need for improved process and energy efficiency for companies that use wet grinding processes, NETZSCH Fine Particle Technology, LLC, has begun offering a turnkey, outsourced

FLEX filter life extender™
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Fast, Flexible, Wireless, High Capacity Filtration.

Introducing the industry's first true wireless, high-capacity, flexible filtration system.

FLEX™, from **Paint Pockets**® is the answer to paint booth hot spots and clumsy, expensive wired filter systems.

Only the FLEX system uses Paint Pockets exclusive FLEX CELL, made from patented ***Zipper***™ mounting channels and the ***New Zip-IT***² one-pass installation tool, giving you the speed you need to stay productive with lightning-fast filter removal and replacement.

FLEX improves airflow with ESP.

We know why you change filters—because you have to. FLEX ESP (Extended Surface Pads) triple surface area allows you to decide when the filter bank will be changed rather than the filter bank dictating change-out. Change filters on your terms—not theirs with FLEX ESP.

FLEX reduces hot spots.

Strategic placement virtually eliminates hot spots where sprayed build up is a problem. Use FLEX ESP where you need them most, and maximize spray time while minimizing wasted time in changing filters.

FLEX delivers up to 1500% more

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INDUSTRY & COMPANY NEWS

engineering service called Total System Solutions. Under the program, NETZSCH conducts site surveys and feasibility studies, designs and engineers turnkey plants and systems, and specifies optimal mixing and grinding machinery to meet product specifications and processing parameters. The company acts as principal contractor, using local suppliers for the construction and equipment installation. After plant startup, NETZSCH provides operator training and on-going support and service to the plant. The company's specialists are trained in health and safety, lifting, first aid, hot work, vessel entry, risk assessment, and issuing of work permits.

For more information, call 484.879.2020 or visit http://grinding.netzschusa.com.

BNP Media Acquires Professional Services Division of Ascend Media

BNP Media, Troy, MI, has acquired the Professional Services Division of Ascend Media, which includes the Food, Beverage and Packaging Group and the Gaming Group of magazines, conferences, websites and events.

"All of the titles have been well managed by an excellent staff that has integrated print advertising, events and online media. We now have robust products for any customer looking to reach each and every corner of the food, beverage, packaging and gaming markets," said Taggart Henderson, co-CEO of BNP Media.

The Food, Beverage and Packaging Group, based in Deerfield, IL, comprises vertically integrated food industry and retailing information businesses that are accessible to customers through a combined marketing, advertising and rate program available to take advantage of targeted market penetration. The Gaming Group is based in Las Vegas, NV, and is composed of two leading magazines and the industry's premier trade shows and events.

Clear Seas Research, BNP Media's market research company, is concurrently entering these industries. "Clear Seas will present unparalleled custom market research in the food, beverage, packaging and gaming industries via our combination of online communities, industry knowledge and superior analysis. We look forward to creating research solutions for all companies wishing to gain competitive advantage in these arenas," said Mitchell Henderson, co-CEO of BNP Media.

BNP Media, the largest family owned B2B media company in the U.S., now owns and operates more than 60 magazines (including *Finishing Today*), 40 events and 75 websites. For more information, visit www.bnpmedia.com.

CORRECTION: In "Bottom-Line Benefits of Prepainted Metal" (*Finishing Today*, June 2007), the amount of coil coated steel and aluminum produced and shipped in North America was incorrectly listed as 800 million tons per year. This figure should have been 4.5 million tons.

Tom Murray

Sales and Marketing Director, Gage Products Co.

Tom Murray has been named the director of sales and marketing for Gage Products Co., Ferndale, MI, a global supplier of test fuels, paint solvents and closed-loop paint-system recycling technology for the automotive industry. Murray had been manager of manufacturing engineering, with responsibility for injection molding and two paint lines at AutoAlliance International, a joint Mazda and Ford Motor Co. automotive assembly complex in Flat Rock, MI. He previously had served as a development strategist in Advanced & Manufacturing Engineering (VO-A&ME) at Ford Motor Co.'s Vehicle Operations group. Murray began his business career in 1989 at Gage Products Co., where he held a series of key sales management jobs serving Ford, General Motors and Chrysler.

Jinsong Lin

General Manager, Asia/Pacific Rim, MetoKote Corp., Inc.

MetoKote Corp., Inc., has hired Jinsong Lin as general manager, Asia/Pacific Rim. Lin will be responsible for establishing and growing MetoKote operations within this region. MetoKote will offer its InSite®, Regional Coating Centers, and Paint Shop Management coating models in China as the firm begins to establish services within that area.

Shari Barta

Strategic Account Manager, MetoKote Corp., Inc.

MetoKote Corp., Inc., has added Shari Barta as strategic account manager representing MetoKote's Deere and Co. Business. Prior to joining MetoKote, Barta worked with Exide Technologies as director for Heavy Duty Off Road OE Sales. One of her key responsibilities with Exide was managing the company's Deere business. She also worked with Deere and Co. in Moline, IL, in various capacities.

William L. Mansfield

Chairman, Valspar Corp.

The board of directors of Valspar Corp. has elected William L. Mansfield, Valspar president and chief executive officer, to the additional role of chairman of the board. Mansfield succeeds Thomas R. McBurney, who has served as chairman for the past two years. McBurney will remain chair of the Board's governance committee and lead director.

Bioh Kim

Process Integration Manager, Enthone Inc.

Enthone, Inc., a business of Cookson Electronics, has appointed Bioh Kim to process integration manager for Electronic Materials. Kim will be responsible for integrating new chemical processes into the products and applications of major device manufacturers, equipment manufacturers and foundries. Prior to joining Enthone, Kim was employed with Semitool, Inc., Kalispell, MT. He also was a key contributor and leader in organizing the EMC-3D consortium, which targets technology and business development for through-silicon-via chip integration, and had been working as a program director until April 2007.

Philip Ford

Director, Wood Protection Business, Troy Corp.

Philip Ford has joined Troy Corp. as director of its Wood Protection business, reporting to Dr. Don Shaw, vice president of development. In his new role, Ford will lead all aspects of Troy Wood business group worldwide. He will manage Troy's business in wood protection technologies and the development of new wood application markets for Troy specialty products. Ford previously was chief operating officer at Diversified Coatings, Inc.

James Hoffman

Sales Manager, EnviroCare Corp.

James Hoffman has been named Northeast regional sales manager of EnviroCare Corp. in Wilmington, MA, a manufacturer of professional and consumer mold-resistant coatings products and systems. Hoffman previously spent 11 years working his way up through the ranks at William Zinsser Co. Inc., eventually becoming responsible for operation in the Northeast and managing four direct sales reports. ft

Send your press releases to **editor@finishingtodaymag.com.**

Industry Mourns Passing of Gary Frazier

Gary Frazier, a former vice president of Hentzen Coatings, passed away on August 31, 2007. Frazier started his career with Hentzen Coatings in September 1966 as a lab technician and was promoted to vice president in 1999. He retired four years ago due to failing health. During his 38 years at Hentzen, he handled such major accounts as Cutler Hammer, Massey Ferguson, JI Case, Utility Products (now Emerson), General Dynamics and others. He was one of the original founders of the Chemical Coaters Association (CCA) and served as president of both the Wisconsin CCA Chapter and the National CCA. At Hentzen's 80th Anniversary, he was presented a Lifetime Achievement award from the CCA.

Gary was highly dedicated to his family, his work, and his company. He was known throughout the coatings industry for his dedication, broad coatings knowledge and integrity.

In the Business of Making Your Business Easier

By Jim Dockey, CENTRIA Coating Services

One of my favorite aspects of the coil coating business is that my job makes life easier for so many other individuals. When plant managers or engineers first start thinking about converting to prepainted metal, they usually don't realize all the benefits they will enjoy, and how much of a burden they will be removing from their plant and their minds. Often they are thinking about prepaint because they are concerned about needing additional space on the factory floor or enhancing the quality of their finishes, or they may have a new product line and just not enough plant capacity for additional in-house painting. However, once they start getting into the details of the conversion process, they often start to see more possibilities.

When you outsource your product painting to a coil coater before it's formed, you are streamlining your processes significantly.

A Streamlined Process

When you outsource your product painting to a coil coater before it's formed, you are streamlining your processes significantly. When prepainted metal is introduced, the factory often begins running in a continuous workflow rather than in a batch processing method. This change occurs because time-consuming steps such as cleaning, priming, painting and curing steps — steps that often cause production backups and delays — are eliminated from the plant. With prepainted metal, the plant becomes more predictable.

In addition, environmental compliance issues and the associated paperwork and reporting requirements are reduced substantially when paint and coatings are moved out of the factory. Paint and coatings are some of the most regulated areas in manufacturing due to their flammability, potential exposure health risks to employees, and release of volatile organic compounds into the environment. By converting to prepaint, the coil coater now is the one responsible for cleanup, meeting new environmental requirements and reporting to the Environmental Protection Agency.

Coil coating is without question the most efficient coating process available today. Rather than painting piece by piece at your plant, the metal is cleaned, primed and painted in a continuous coil-to-coil process in the exact colors, textures and effects desired. Because of this, surface quality concerns are also reduced with coil coated metal. When paint is applied on the coil, it is more evenly distributed from edge to edge and is tightly adhered to the metal. A coil coated surface is also cleaned and treated more thoroughly, since the substrate is treated in its flat state, resulting in a higher-quality finish and a more consistent product.

A Happy Plant

In a nutshell, when using prepainted metal, all the materials, cleanup and manpower needed for the in-house painting process are assumed by the coil coater. That's a lot of headaches, hassles and costs that are simply removed. And fewer headaches are appreciated in any business. ft

Jim Dockey *is the director of sales and marketing for CENTRIA, a coil coater located Moon Township, PA (***www.centria.com***). He is also vice president of the National Coil Coating Association (***www.coilcoatinginstitute.com***). He can be reached at 412.299.8122 or jdockey@centria.com.*

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An Environmentally Friendly Chemfilm

A new Navy-licensed, QPL-approved, non-hexavalent conversion coating for aluminum offers an environmentally friendly alternative to conventional technologies.

BY KIMBERLY PRICE
Luster-On Products, Inc.

In the past few years, the European Union (EU) has banned the use of certain heavy metals and hazardous materials with European Directive 2002/95/EC (RoHS-Restriction of Hazardous Substances), European Directive 2002/96/EC (WEEE-Waste Electrical and Electronic Equipment) and European Directive 2000/53/EC (ELV-End of Life Vehicles). Most recently, the U.S. Occupational Safety and Health Administration (OSHA) has set a new limit of 5 $\mu g/m^3$ on hexavalent chromium exposure. These directives and limits have required the surface finishing industry to seek more environmentally friendly finishing processes while still providing protection and performance.

A Non-Hexavalent Conversion Coating

The U.S. Navy chemical researchers at Pawtuxet River, MD, developed a trivalent conversion coating for aluminum that complies with the OSHA and European directives while offering corrosion protection, adhesion and electrical resistance properties that meet or exceed the coating's hexavalent counterpart. In 2004, the U.S. government offered licenses for the newly developed chemistry to chemical manufacturers. Of the four manufacturers that received the licensing privileges, each was required to submit its own version of the conversion coating within the parameters of the basic chemical formulation.

After more than a year of rigorous testing per MIL-DTL-81706B, a product from Luster-On Products, Inc., called Aluminescent, was placed on the Qualified Products List (QPL) for MIL-SPEC-5541F Type II, Class 1A and 3, Material Form II, Application Methods A and C. The powdered product is used to form a non-hexavalent

TABLE 1. Test Results on Aluminum	
Alloy Tested	**Hours in Navair Test Cabinet**
2024	>336*
2219	<336
3105	Not Tested
5083	>336*
6061	Not Tested
7075	>336*

*End of Test Period

conversion coating on aluminum surfaces. The process used to apply the coating provides excellent corrosion protection at low cost and requires no electric current, cooling or exhaust. It is suitable for use on both wrought and cast aluminum alloys, and it is designed for ease of operation with minimum control.

Environmentally Friendly Protection

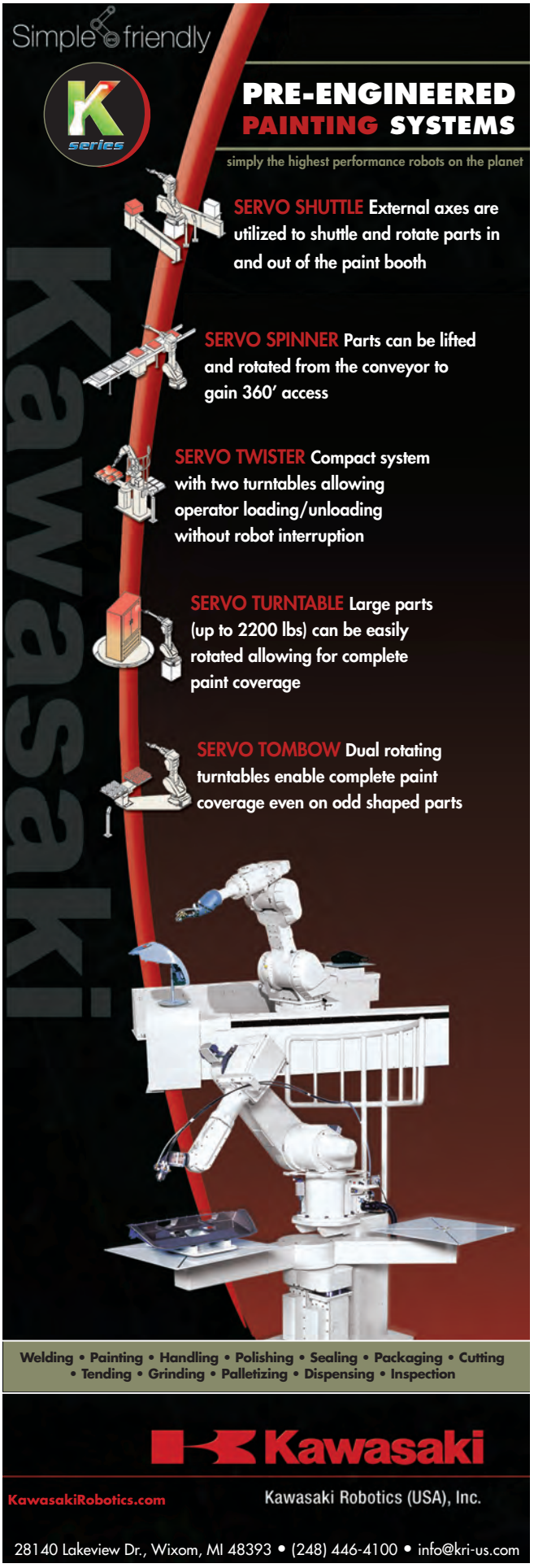
Table 1 shows the various aluminum alloys that have been tested in conjunction with MIL-DTL-81706B and ASTM B-117. As shown in the table, the product meets or exceeds performance results of the hexavalent chromium conversion coatings while still complying with RoHS, ELV, WEEE and OSHA requirements. In addition, the coating provides excellent adhesion on aluminum prior to e-coat and powder finishing.

The coating process is suitable for use on both wrought and cast aluminum alloys, and it is designed for ease of operation with minimum control.

The environmentally friendly coating is being used to provide protection in a variety of end uses, including computer chassis and aerospace and automotive components. ft

Kimberly Price *handles marketing and research for of Luster-On Products, Inc., a supplier of metal finishing chemistry, equipment and sterling barrels to the North American market. She can be reached at 800.888.2541 ext. 125 or kim@luster-on.com. The company's website is at* **www.luster-on.com**.

Do you know of an innovative new product that should be featured in our Innovation Spotlight? If so, contact Technical Editor Kevin Biller at 614.286.2148 or editor@finishingtodaymag.com. Products will be covered in this department at the editors' discretion. Additional innovations can be found on pp. 48-49 in this issue.



Modern CARCs for Military Protection

As the CARC system celebrates its 25th year in service, advances continue to be made to extend coating life, improve corrosion resistance, reduce environmental impact, enhance ease of use and make application processes more economical.

BY JOHN MORT
Hentzen Coatings

In the face of battle, today's soldiers can never be too sure of what they might encounter. Warfare continues to become ever more sophisticated and dangerous. The chemical and biological weapons, or "agents of war," that have been in use for hundreds of years have been refined over time into highly lethal and debilitating compounds. The coatings used on military hardware must resist these toxins. Moreover, they must also withstand the decontamination that typically involves a complete washdown with concentrated bleach and solvents.

The chemical agent resistant coatings (CARC) system currently applied to virtually every tactical and combat vehicle in the U.S. Armed Forces is a vital component of the overall strategy of the U.S. Department of Defense (DOD) to protect soldiers from chemical and biological

agent attacks. The military coating system also provides visual and infrared camouflage, while keeping the vehicles operational by providing sustained corrosion protection. On July 14, 2007, CARC quietly celebrated somewhat of a milestone. On that date 25 years ago, the first approval for the most widely used U.S. Army coating system was issued by Department of the Army's Mobility Equipment Research & Development Command located at Fort Belvoir, VA. Since that time, the system has evolved into the most technically advanced military vehicle coating system in the world.

The Origins of CARC

CARC is a specification-driven coating system. The specification outlines every aspect of this military finishing process, including coatings, cleaning, pretreatment and application. The organic coating portion of the specification details the substrate-specific primers and topcoats (see Table 1).

The CARC system was originally developed to address three major coating-related challenges that were identified by the Army in the late '70s: environmentally responsible corrosion control, chemical and biological agent decontamination, and camouflage through pigmentation and infrared reflectance to avoid detection. The primers and topcoats of the day that were primarily alkyd systems that did little to assist in achieving these goals.

In the late '70s, the U.S. was in the process of enacting many laws that regulated the use of some heavy metals that were commonplace in the coatings industry. Two of these heavy metals, lead and chrome, were used extensively in the manufacture of primers and topcoats. The Army wanted to eliminate the use of these heavy metals in their coatings and implement new regulations as it developed the new coating systems. The mandate was issued to all manufacturers of military vehicles, including Oshkosh Truck. Oshkosh Truck enlisted one of its suppliers, Hentzen Coatings, to see if the company could make a product that met the corrosion control criteria while eliminating the heavy metals. The Hentzen lab had previously developed a product for commercial applications that met almost all of the new Army criteria. This product was slightly reformulated, and the resulting product — a two-component (2K), lead- and chrome-free epoxy primer — was eventually the basis for the MIL-P-53022 specification. Although there have been some upgrades in performance, the basic formulation for all of the MIL-P-53022 Type I primers is essentially the same today as it was back then.

Hentzen also formulated a 2K polyurethane topcoat that met the other goals of the Army's coating team. The new system had very low light reflectance (less than 1.5% at 60 degrees), a defined infrared signature and, most importantly, the ability to be chemically and biologically decontaminated. The decontamination requirement grew out of the cold war and the practice of the Soviet Union stockpiling biological and chemical weapons. These weapons could potentially be used more effectively than conventional weapons on vehicles. The agents of war, as they are called, could render vehicles unusable by delivering a mist or aerosol of a toxic agent that would cover their ex-

TABLE 1. The CARC System*

PROCESS	FERROUS METAL	NON-FERROUS METAL
Cleaning	T-C-490	TT-C-490
Pretreating	TT-C-490, I (Zn phosphate)	
	DOD-P-15328 (wash primer)	DOD-P-15328 (wash primer)
	MIL-C-8514 (wash primer)	MIL-C-8514 (wash primer)
	MIL-C-5541 (chromate conversion)	
	MIL-A-8625 (anodize)	
Priming	MIL-P-53022	MIL-P-53022
	MIL-P-53030	MIL-P-53030
	MIL-P-53084	MIL-P-53084
	MIL-PRF-23377	
	MIL-PRF-85582	
Topcoating	MIL-PRF-22750 (interior only)	MIL-PRF-22750 (interior only)
	MIL-C-46168 (cancelled)	MIL-C-46168 (cancelled)
	MIL-DTL-53039	MIL-DTL-53039
	MIL-DTL-64159	MIL-DTL-64159

**Taken from specification MIL-DTL-53072C.*

teriors. If this type of an attack occurred, the Army wanted to ensure the safety of the soldiers and allow the vehicle to be returned to service by the use of a decontamination process. The original decontaminating agent used at that time was very basic (high pH) and would deteriorate most coating systems. The new topcoat had to withstand the aggressive decontaminating agent without discoloring or losing adhesion. The Hentzen topcoat withstood the process and was eventually the basis for the first CARC topcoat specification, MIL-C-46168.

Visual Enhancements

The current color pallet for the CARC topcoats was defined in the release of MIL-C-53039. This was well after the approval of the first CARC topcoats. These colors were identified by the camouflage group within the Army as the best for numerous visual effects. Some matched certain non-specific terrains while others matched particular theaters of war. Many of the colors came from the meetings held by the NATO countries in an attempt to unify the colors of the vehicles used by the alliance. Some of the common names of the colors come from the dates during which these NATO meetings were held. For instance, the common green CARC paint, Fed Color Std 34094 Green, or "383 Green," derives its name from the NATO group that met in March of 1983. The color "686 Tan" was presented to a NATO group that met in June of 1986. Ultimately, the unification project failed, and the U.S. was one of the few countries to adopt these colors.

Improved Formulations

By the early '80s, the 2K CARC primer and topcoat had replaced almost all of the alkyd-based coatings at the major military contractors and OEMs. In early 1983, a formulator named Bhaskar Urs introduced a new single-component, moisture-cured CARC paint. This was one of many contributions Urs would make to the military coatings market while working independently and as the technical director at Hentzen Coatings for the past 20 years. The new single-component product eventually became the basis for the MIL-C-53039 specification. Although there were early technical hurdles to overcome, the coating's ease of use made it a natural choice for the CARC paint community. This mil spec in its current form, MIL-DTL-53039, now accounts for more than 85% of all CARC topcoat usage.

In 1988, the MIL-P-53022 primer specification was changed to include a high-solids product. A Type II primer was formulated in response to tightening environmental regulations. The volatile organic compounds (VOCs) in the high-solids product is about half of the original, low-solids formulation.

Other specifications were added to the CARC system and identified in MIL-C-53072 for specific substrates or specific applications, such as MIL-C-22750 for interior topcoat applications and MIL-P-23377 for primer on non-ferrous substrates.

Environmental Changes

Many of the developments for new variants of military specification coatings over the last 20 years have been driven by environmental requirements and goals. As with all coatings, formulations have been adapted to accommodate decreasing VOC limits and reduced heavy metal content. The Army Research Lab addressed these issues by developing two new, water-dispersible specifications and canceling the original CARC topcoat. The specifications also were altered to include environmentally friendly types and classes to capture the changes that were being introduced by the military coating manufacturers.

Water-Dispersible CARC Primer and Topcoat. In 1999, ARL and a number of the existing CARC suppliers completed work on two water-dispersible coatings. A topcoat listed under MIL-DTL-64159 offered a lower VOC option. The specification had two types that were differentiated by the flattening agent: MIL-DTL-64159 Type II introduced a new polymeric bead flattening agent instead of the traditional silica. This bead gave the Type II better mar resistance and weathering properties. Another water-dispersible coating, a primer, was also developed and approved under MIL-P-53030. Although these coatings offer an environmental advantage, their slower cure, propensity to blister and multiple-component technology continues to make the transition from their solvent counterparts difficult.

Cancellation of MIL-C-46168. As the VOC regulations became more restrictive and technology improvements were made to other CARC topcoats, the MIL-C-46168 be-

came expendable. The MIL-C-46168 was easy to spray due to its lower solids and rarely blistered, making it a consistent coating for applicators. But its poorer weathering in the field and higher VOC content made it an easy target for removal. In October of 2005, the Army Research Lab canceled the specification.

Exempt Solvents. As the water-dispersible coatings reduced the VOC content to 1.5 lb/gal, manufacturers of CARCs began to take notice of the exempt solvents. These solvents were deemed to be less reactive in the atmosphere, so their addition to a formulation did not count toward VOCs. Hentzen was the first to gain approval of a 1.5 VOC solvent CARC topcoat in 2000 that offered all of the advantages of the solvent systems without the high VOCs. In late 2005, the MIL-C-53039 was altered to MIL-DTL-53039 and included the Type II designation for the new low-VOC, hazardous air pollutants (HAPs)-free formulations.

Removal of Chrome. In addition to VOC changes, chrome also was targeted by the military specification. As mentioned previously, the original MIL-P-53022 primer was formulated to exclude chrome. In 2000, the MIL-PRF-23377 and the MIL-PRF-85582 non-ferrous primers added a "Class N" designation to allow qualified non-chrome products to be included under the specification. The category has had a number of very promising products qualify in recent years, although their acceptance in the marketplace has been slow. The chromated version of the MIL-PRF-23377 is a time-tested aerospace standard. Aerospace manufacturers and the DOD have not fully bought into the effectiveness of these Class N replacements, and with the price tag of a fighter jet or helicopter in the hundreds of millions of dollars, field testing can get very costly. Some field evaluations are in progress, but they are not likely to have any conclusive results in the near future.

The Polymeric Bead. The polymeric-flattened CARCs, which now include the MIL-DTL-64159 and the MIL-DTL-53039, are the future of the topcoat program. The improved mar resistance and excellent weathering properties give the "beaded" coating a performance advantage. While the vast majority of CARCs sold today are the silica-flattened, this type of CARC will go the way of the MIL-C-46168 over the next three to five years. The "beaded" MIL-DTL-53039 will make the transition to this type of technology seamless, as it poses no application, curing or processing hurdles to current single-component users.

Future Trends

There are no official estimates by the government on the size of the CARC market. The varied applications by OEMs, government installations and subcontractors make the number difficult to identify, but unofficial estimates range from $75 million to $250 million. Both the market and the products available within the CARC specifications have grown considerably over the past 20 years.

The most prominent and achievable goals for future CARC systems include extended life and improved corrosion resistance. Environmental aims such as lower or "zero" VOCs and the elimination of hexavalent chrome continue to be pursued. As always, enhanced ease of use and more economical processes remain in the sights of coating technologists. The use of QPL powder coatings within the CARC systems is close to becoming a reality. Other goals such as self-decontaminating coatings could eventually lead to the elimination of the decontamination process. The development of "stealthy" coatings for ground vehicles, which have the ability to destroy a heat image, have also been part of the CARC system discussion. All of these factors will ensure that the rate of change within the CARC system will continue at a relatively fast pace into the foreseeable future. These improvements will allow the CARC system to keep up with innovation, while continuing to fulfill its primary goal of protecting soldiers.

John Mort *is the sales manager – CARC technology for Hentzen Coatings. He can be reached at jmort@hentzen.com or 414.353.4200.*

Instant CURING

Near-infrared technology can substantially improve production line efficiencies by reducing curing times to mere seconds.

BY NIELS FREDERIKSEN
AdPhos North America

Speed is critical in any industry. In finishing operations, line speed dictates process efficiency, and the amount of time required for curing largely dictates line speed. The faster the curing process, the greater the throughput and the higher the profits.

A new technology* based on near-infrared (NIR) thermal processing is improving the field of surface treatment by substantially reducing curing time. Applying technology that has grown out of the European Space Program's research, the system provides almost instant curing of waterborne, solventborne and powder coatings, requiring minimal if any changes in standard commercial formulations.

The technology involves high energy sources that radiate near the infrared spectrum (more than 90% of the energy emitted is below 2 µm). The achieved density is double that of high-performance induction systems and at least four to six times greater than the maximum densities reached with conventional shortwave infrared systems. Through these and other benefits, the system enables extremely high process efficiencies and system reliability.

Technology Basics

The near-infrared part of the shortwave spectrum lies just above that of the visible spectrum. This is where the wavelength of electromagnetic radiation reaches its maximum energy density and optimum physical characteristics.

With conventional infrared (IR) systems and gas convection ovens, the high absorption of the coating systems limits penetration depths. The energy is almost complete-

ABOVE: With the NIR technology, a small hand-held device can be used to cure repair coatings on on micro-spot defects in 15 to 45 seconds, depending on the type of defect, body area and car type.

**The technology is available through AdPhos North America as NIR-Near Infra Red.*

ly absorbed at the surface. Drying and curing processes are determined by the inherently slow layer heat-up and warmth condensation of the coatings. Such processes can take anywhere from 30 seconds to 45 minutes or more, with a typical efficiency of less than 60% (more than 40% of the energy is wasted in the drying/curing process).

The near-infrared thermal processing technology applies instantaneous power dynamics to the complete coating system, not just the surface. It permits energy densities up to 16 MW/ft² (up to 32 MW/ft² with double-sided radiation) or focused line geometries of up to 100 MW/ft² using specially focused reflectors. Such high energy densities achieve direct penetration into the coating layer while simultaneously heating the coating, allowing complete drying or curing within a few seconds. Often the drying or curing process is complete before the substrate is completely heated. As a result, the near-infrared technology can be used with in-line processes to achieve process efficiencies of up to 80%.

In some cases, the significant reduction in processing time permits applications that would incur severe thermal damage or material degradation with conventional techniques, such as when using powder coatings on wood or plastics. Typical processing times for various applications are given in Table 1.

The technology also enables defined and precisely controlled heating and drying/curing processes that can be applied to curing solvent-based coatings in hazardous (e.g., explosive) environments, as well as controlled atmospheres.

One other benefit of the near-infrared technology is that it is designed to minimize maintenance requirements. The radiation emitters, which generate high filament temperatures (3,000 to 3,500 K) and heat intensities from 1,000 to 1,500 kW/m², ensure stable operation with no filament degradation in various application configurations (horizontal, vertical or angled). They are designed for an average operational life of 5,000 to 6,000 hours — approximately equivalent to replacing one set of emitters per year in a production facility operated on a three-shift, around-the-clock schedule. Ongoing system optimization and development work suggests that future emitter performance could be extended to as much as 8,000 hours.

Current Applications

The most common application for the near-infrared technology is in curing coatings on metal substrates. Other potential applications include ceramics, plastics, glass, wood-based and even mixed-material sandwich-based components. The applications described below illustrate the broad potential of the technology.

Coating Airbag Gas Generators. The gas generator used to instantly self-inflate an airbag on impact is filled with an air/argon mixture, pressurized to approximately 300 bar or 4350 psi. To ensure long-term corrosion resistance (at least 15 years), a water-based zinc coating is applied to the welded areas of the pressure component. Since the generator also contains an explosive for rapid opening of the membrane to inflate the airbag, it is naturally temperature sensitive. The risk of explosion above 250°F precludes the use of a conventional high-temperature gas-convection curing process, which requires an air temperature of at least 300°F and 30 minutes curing time. A conventional coating process with five-second curing intervals in a fully automated production system would require an unacceptably long line. With the near-infrared technology, curing can be completed in less than three seconds, ensuring a maximum component temperature of not more

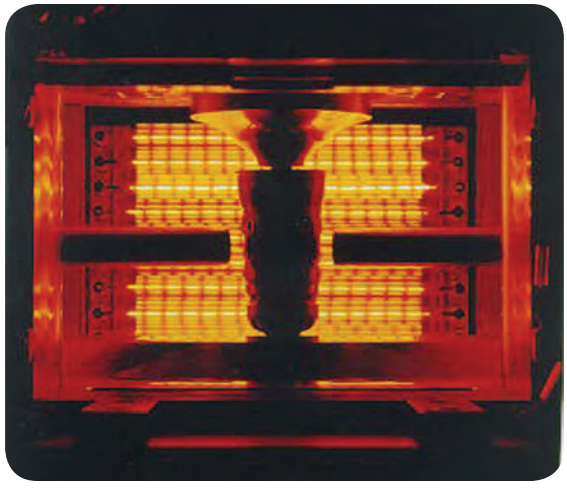


Figure 1. A 16 x 16 ft² NIR system used for curing coatings on airbag gas generators.

The most common application for the near-infrared technology is in curing coatings on metal substrates.

TABLE 1.
Processing Time Comparison for Various Applications

	NIR	IR	Hot Air
Powder coatings	1 – 10 sec	30 – 300 sec	120 – 1,200 sec
Automotive coatings	5 – 120 sec	300 – 1,000 sec	600 – 300 sec
Industrial coatings	1 – 8 sec	30 – 600 sec	60 – 1,200 sec
Wood coatings	2 – 6 sec	15 – 60 sec	30 – 300 sec
Coil coatings (≤ 10 µm)	0.5 – 1.5 sec	8 – 12 sec	15 – 25 sec
Coil coatings (> 12 – 20 µm)	1.5 – 3 sec	12 – 15 sec	20 – 40 sec

than 140°F, and the system is no bigger than a regular shoe box (see Figure 1). With this configuration, the completely automated coating and curing facility, including handling and paint preparation, is no larger than 16 x 16 ft².

Door Handle Powder Curing. A fully automated production line (shown in Figure 2) with a line speed of 30 ft/min from casting to packaging was achieved through the integration of a near-infrared-based powder curing station, which reduced the curing time from more than 3 minutes to below 20 seconds (from a 65 ft gas oven down to less than 10 ft with the near-infrared technology). The system has ensured complete process control based on the different door handle geometries. Additionally, the oven's instantaneous on/off capability has provided substantial energy savings.

The significantly shorter and simplified curing process permits off-line verification of curing quality.

Curing Plastic Components. Often, temperature-sensitive components such as plastics can only be properly surface treated through extraordinary curing processes due to the necessary low thermal curing conditions. Oven times around 45 minutes often are required. With the near-infrared technology, an equivalent curing process can be accomplished in less than one minute. Such short curing times are also possible for three-dimensional surfaces like bumpers, where the process times can be reduced drastically. Precise and highly sophisticated near-infrared modules, routed and robotically controlled, are necessary to achieve the required consistent surface temperature over the entire surface of the component.

Spot Repairing Automotive Surface Defects. The conventional technique used to repair surface defects detected late in the automotive production line (1 to 2% of defects) normally involves a 10- to 20-minute curing process, in which infrared (IR) panel heaters are used to ensure a properly cured and blister-free surface. This method interrupts the continuous car production process, as the damaged vehicles must be removed from the line and placed into special "spot-repair" booths. With the near-infrared technology, a small hand-held device, originally developed in association with a Bavarian car manufacturer, can be used to achieve an equivalent curing process on micro-spot defects in 15 to 45 seconds, depending on the type of defect, body area and car type. The spot repair curing process provides fully controlled closed-loop thermal treatment. It even determines the required curing profile for the specific defect, ensuring consistent, high-quality in-line repair of surface defects on the production line. The operating principle of the spot-repair system is illustrated on p. 24.

Figure 2. A fully automated production line with a line speed of 30 ft/min used for curing powder coatings on door handles.

High-Capacity Coil Coating. An essential part of the coil coating process, curing has traditionally imposed major limitations on line capacity. For decades, gas convection ovens have dominated this part of the process. While IR and induction curing systems offer significant space gains, the cost differential between gas and electricity has led to a preference for gas-heated ovens. The development of near-infrared technology specifically engineered for the demanding manufacturing conditions of the metal processing industry has radically changed the situation. Near-infrared ovens for curing organic, solvent-based, water-based and powder coatings have been installed in more than 50 coil coating lines.

An in-line near-infrared system, constituting the industry's most powerful curing oven for organic coatings, was recently placed in operation on the coil coating line of one of Europe's leading steel manufacturers. The curing system ensures the production of a consistent and blister-free topcoat (up to 20 µm dry film thickness) at a line speed of 600 fpm — or up to 120 tons per hour. The system permits a complete curing process in less than three seconds.

Figure 3. This in-line NIR system was recently placed in operation on the coil coating line of one of Europe's leading steel manufacturers.

Figure 3 shows a section of the in-line near-infrared system. The significantly shorter and simplified curing process enabled by near-infrared technology permits off-line verification of curing quality, in which a pilot line is used to simulate conditions of the actual production line. This technique permits realistic verification of the feasibility of new coatings and allows advance estimates to be made concerning the curing oven's operating parameters. These capabilities eliminate the adjustments in production that are common when using conventional ovens.

A Matter of Time

Ultra high-speed drying/curing solutions cannot be found merely by substituting existing components (including IR-based replacements). An optimized ultra-high-speed drying/curing process consists of defined and carefully controlled profiles of heat intensity, solvent evaporation rate, fume exhaust and thermal air/gas flow — all of which can be achieved by tailoring the near-infrared technology to specific applications.

Near-infrared thermal processing can yield significant gains in speed, efficiency and profitability. Time is money, and the near-infrared technology can save both.

Niels Frederiksen *is president of AdPhos North America, headquartered in Brookfield, WI, a supplier of UV, IR, hot air and near-infrared drying and curing systems. He can be reached at 937.885.4753 or n.frederiksen@eltosch.com.*

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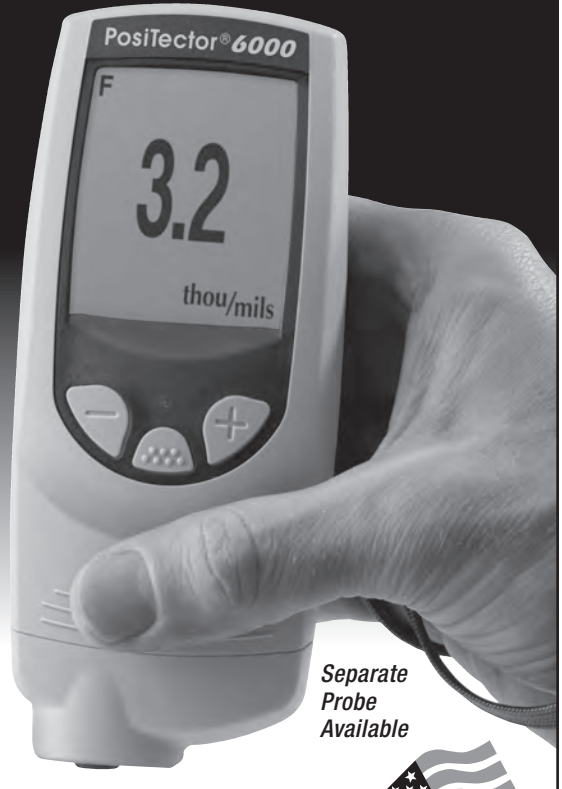

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High-Performance Coatings for Plastics

A new fluoropolymer coating that combines excellent performance characteristics with a fast, low-temperature cure offers the potential for significant cost savings and expanded application flexibility.

BY STEVEN BLOCK
Dow Corning Corp.

Fluorine-based coatings are used extensively for surface protection due to their water and oil repellency, weatherability, chemical resistance, stain repellency and durability. Silicone-based chemistries, which offer fast, low-temperature curing, have been investigated for numerous applications, especially on plastic substrates, for their potential to increase productivity and energy savings.

Recently, a silicone-cure fluoropolymer coating has been developed that combines the beneficial attributes of both technologies. With its excellent physical properties and low-temperature-cure capabilities, the new coating offers new opportunities in a variety of applications.

Improving Fluoropolymers

A wide range of fluoropolymer coatings exist today that provide substantial performance benefits, but many of these coatings are limited in their use due to the processing conditions required for film formation on a substrate. One of the

TABLE 1. Properties of Common Fluoropolymers

Fluoropolymer	Melting Point	Solvent Solubility	Fabrication Temperature Range	Reactive
PTFE	621°F (327°C)	Poor	680-716°F (360-380°C)	No
PFA	576-590°F (302-310°C)	Poor	662-716°F (350-380°C)	No
ETFE	500-518°F (260-270°C)	Poor	536-644°F (280-340°C)	No
PVDF	329-347°F (165-175°C)	Moderate	392-482°F (200-250°C)	No
TFE Copolymer	—	Excellent	Room temperature	Yes

most common coatings is polytetrafluoroethylene (PTFE), which is used as a low-maintenance coating for cookware and bakeware. PTFE provides excellent stain resistance and durability but requires high-temperature processing when applied, thereby limiting its application to temperature-resistant substrates. Vinylidene fluoride (PVDF) and other common fluoropolymers, such as copolymers of tetrafluoroethylene and perfluoroalkyl vinylether (PFA) or tetrafluoroethylene and ethylene (ETFE), also require high-temperature processing. In addition, the high degree of crystallinity in these polymers makes their solubility in common organic solvents very poor and limits the options for processing and fabrication of these materials as coatings.

Monomers such as tetrafluoroethylene and chlorotrifluoroethylene can be copolymerized with a variety of different vinyl monomers to yield polymeric materials that are amorphous in structure and have excellent solubility in common organic solvents. Reactive functionality can also be introduced into these copolymers by adding suitably functionalized monomers during the polymerization process. Polymers of this type can be processed at room temperature and can be readily fabricated into coatings and films on a variety of substrates. Using TFE as the monomer enables some of the inherent characteristics of PTFE — such as excellent weatherability and dirt resistance — to be retained in the final copolymer (TFEC), but with the added advantage of the improved ease of processing. The properties of common fluoropolymers are summarized in Table 1.

The accelerating interest in reducing energy consumption and the environmental load has increased the demand for fast and low-temperature-cure processability and adhesion to various substrates without requiring surface treatments or primers. Researchers began investigating whether a silicone-curable fluoro resin technology could impart these properties to the TFEC-based coating.

Testing Cure Characteristics

The cure behavior of the silicone-based TFEC coating at various cure temperatures was investigated using methyl ethyl ketone (MEK) resistance of the cured film as the response metric (see Figure 1). The silicone-based TFEC coating showed a rapidly increasing cure profile that started after a very short induction time, with complete cure achieved in 60 seconds at 302°F (150°C), while the melamine-cure system required twice the cure time to achieve good MEK resistance. The isocyanate-cure system displayed essentially no cure within the initial 120 seconds at 302°F. As the cure temperature increased from 302 to 446°F (150 to 230°C), the induction time of the silicone-based TFEC coating decreased, with a dramatic increase in the cure speed. This data demonstrates the high curing speed of the silicone-based TFEC coating system, which could provide a lower total applied cost by improving productivity and reducing energy consumption.

In terms of the cured film properties of the silicone-based TFEC coating, Figure 2 summarizes the relationship between the flexibility and hardness of the TFEC-based coatings using the different cure systems on aluminum plates. Surprisingly, the silicone-based TFEC coating displayed excellent flexibility as demonstrated by the T-bend test (0-1T), in spite of the high surface hardness (H-3H). The flexibility and hardness of the melamine- or isocyanate-cured films depended on the crosslinker type, crosslink density, cure temperature and cure time, but they usually gave trade-off results, such as high hardness with poor flexibility or low hardness with good flexibility. The combination of good flexibility and high hardness in the silicone-based TFEC coating can provide resistance to mechanical damage after coating and formability of coated substrates.

Table 2 summarizes the adhesion properties of the silicone-based TFEC coating on a variety of substrates compared with conventional fluoropolymer coatings. The

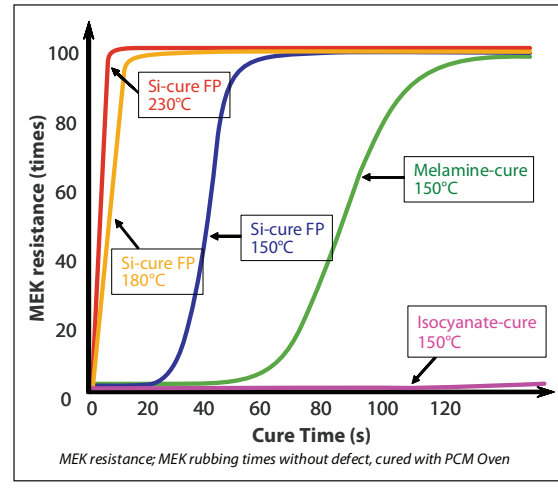

Figure 1. Comparison of the cure speed of the TFEC-based coating with different cure systems.

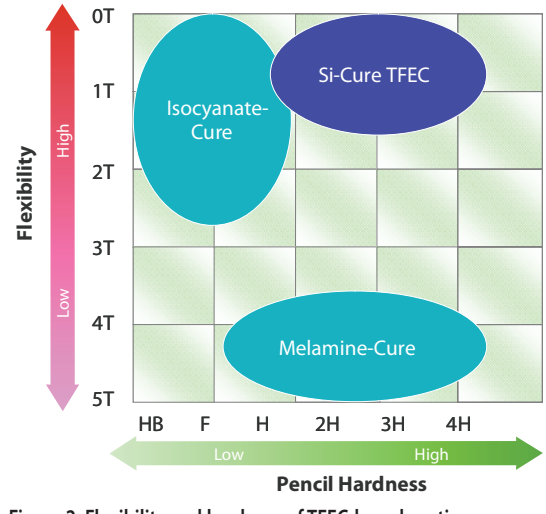

Figure 2. Flexibility and hardness of TFEC-based coatings.

TABLE 2. Adhesion Characteristics of the TFEC-Based Coatings

Substrate		Silicone TFEC	Isocyanate TFEC	Melamine TFEC	PVDF
Aluminum*	Initial	Pass	Pass	Pass	Pass
	Hot water**	Pass	Pass	Pass	Pass
304 SS	Initial	Pass	Pass	Pass	Pass
	Hot water	Pass	Fail	Fail	Fail
PET	Initial	Pass	Pass	Pass	Pass
	Hot water	Pass	Fail	Fail	Fail
Acrylic	Initial	Pass	Pass	Pass	Pass
	Hot water	Pass	Fail	Fail	Fail

Chromate-treated aluminum.
***Hot water immersion for three days at 122°F (50°C).*

PVDF coating could not be applied to plastic substrates such as PET and acrylic because the required high processing temperatures would damage these materials. The silicone-based TFEC coating showed good adhesion to aluminum, stainless steel, PET and acrylic substrates initially and even after hot water immersion, while the isocyanate- and melamine-cure TFEC systems and PVDF coatings lost adhesion after hot water immersion. It was further noted that the silicone-based TFEC coating showed good adhesion to these substrates without any primers. None of the conventional fluoro-based coatings bonded to non-treated stainless steel without a primer.

Weatherability tests showed that silicone-based TFEC coatings pigmented with titanium dioxide (TiO_2) maintained 90% gloss retention after 4,000 hours using the Weather-O-Meter accelerated test procedure (see Figure 3). Unexpectedly, this long-term weatherability was better than current isocyanate- and melamine-cure systems. The incorporation of silicone-cure chemistry into the TFEC-based coating could improve weatherability due to the stability of the silicone crosslinking system.

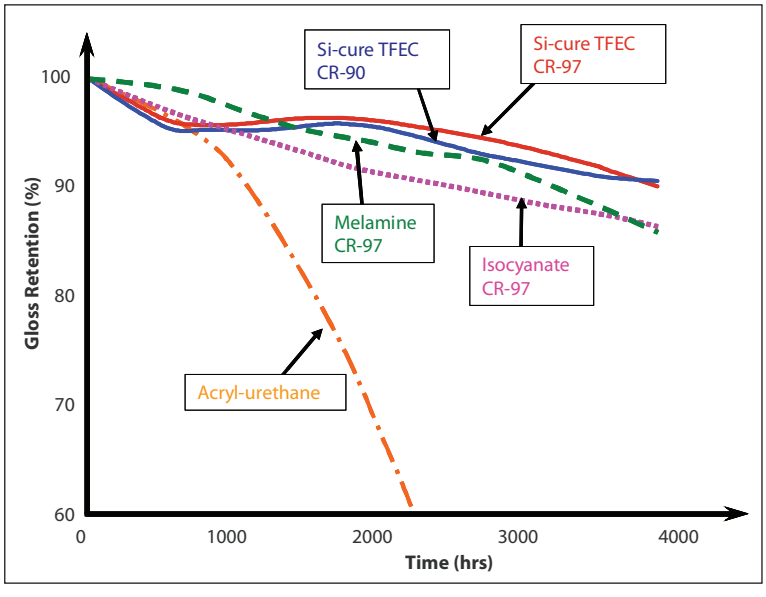

Figure 3. Weatherability test of TFEC-based coatings.

Expanding Applications

Silicone-based TFEC coatings exhibit excellent weatherability, chemical resistance and anti-corrosion properties, as well as transparency, solvent solubility and compatibility with pigments and polymer additives. They provide a combination of good flexibility and high hardness, with good unprimed adhesion to many common substrates. They can also be cured quickly at low temperatures, contributing to a potential reduction in energy consumption and an increase in application flexibility. These new coatings can lower processing costs and broaden application areas for fluoropolymer coatings, especially on substrates such as plastics that are easily damaged at high fabrication temperatures.

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Editor's note: *This article is based on the paper, "New Chemistry Improves Surface Performance," which was named the "Best Paper" at the 10th Annual International Coatings for Plastics Symposium™, co-hosted by* Paint & Coatings Industry *and* Finishing Today *in June 2007.*

The Art of Powder Coating

For Susan Coughlan, powder coatings are the perfect media to create vibrant, durable works of art.

Susan Coughlan from Southern California has been "painting" with powder coatings for more than 20 years. She does not do the industrial type of powder coating we are all familiar with, but creates works of art on canvas and other substrates using the unique properties of powder colors.

On her recent works, she lays down an image on a treated canvas with modified black ink, and then adds dry color and powders using brushes, silk screens and other tools. With the precision of the silk screen process, Susan can replicate highly technical images in her work, which stand in sharp contrast to the ephemeral and playful designs of ink. Using a modified hot plate, she heats the powder to the melt point when she is satisfied with each stage of the painting, taking care not to degrade the canvas surface. The lustrous dry colors reflect light directed on the image and become eye-catching aspects of the work. In some cases she adds semi-precious gems to the work to complement the colors.

Since powder coatings are so durable, Susan has applied her technique to stone surfaces for outdoor use. Flagstone and marble stepping stones outside her studio display vibrant animal, flower and human images. She has done many pieces on large sheets of galvanized steel and aluminum, in one case capturing a large spreading tree on a triptych of three steel pieces, which hangs in the lobby of a well-known powder equipment manufacturer.

Susan's powder coated artwork presents a combination of color, texture and luster that could not be achieved through any other medium. ft

For more on Susan's work, visit **www.zaumart.com**.

ABOVE: A powder coated masterpiece by Coughlan.

Retro-Reflective Powder Coatings

A new powder coating process can enhance corrosion protection and nighttime safety by achieving true retro-reflectivity.

Drive anywhere at night, and you'll see light from your vehicle's headlights bouncing back at you from license plates, road signs, highway markers, railroad cars and other surfaces. This effect, known as a retro-reflectivity, typically is achieved by using retro-reflective tape. However, retro-reflective tape is costly to produce on a linear-foot basis, and it does not provide a corrosion-resistant surface. Tape also cannot provide a reflective surface on complex fabrications such as fire hydrants, mailboxes, bicycle frames and rims, sign posts, and fencing.

While some powder coatings have provided what is commercially known as a "reflective" surface, this usually has meant simply a high gloss level. This type of reflection, where light is "scattered" or diffused, is not retro-reflection.

Recently, North Coast Polymers in Port Clinton, OH, has created and patented a process using retro-reflective elements and a new formulation of powders to create a retro-reflective surface with powder coatings. Using this cost-effective process, all surfaces that can be powder coated — including metals, plastics, wood and glass — can be made to reflect light at night, thereby improving safety.

The Process

The process begins the same as most powder coating operations. The part is pretreated normally, then the coating is applied through spraying or a fluidized dip and is subsequently baked. While some proprietary nuances are involved, the process involves minimal line adjustments and up-front costs. There are few changes in the overall powder coating process.

The reflectivity of the coating rivals that of the tape seen on stop signs and other highway safety items. The color of the reflection is a bright white, no matter what daytime color option is used. Red, yellow, green and even black all reflect a bright, luminous white at night.

In addition to retro-reflection, the powder also provides improved salt spray resistance. Parts that have been

ABOVE: The color of the reflection is a bright white, no matter what daytime color option is used.

North Coast Polymers is currently using the new process to produce retro-reflective mailboxes at its 40,000-ft² facility in north central Ohio.

coated in this process have passed well over 4,000 hours of ASTM B 117 (salt spray) testing. The substrates that have been tested in this manner were simply cold rolled steel panels, with no other pretreatment than a basic iron phosphate cleaner/sealer, typical of the pretreatment that most coaters use. The powder itself both chemically and mechanically bonds to any substrate to create excellent adhesion. Hot dipped galvanized panels have exceeded 6,000 hours in the same corrosion test and were pulled only because all other comparable coatings had failed at the scribe.

The coating must be applied at a minimum of 3.5 mils and can be applied as heavily as 20 mils through electrostatic spraying of a cold part.

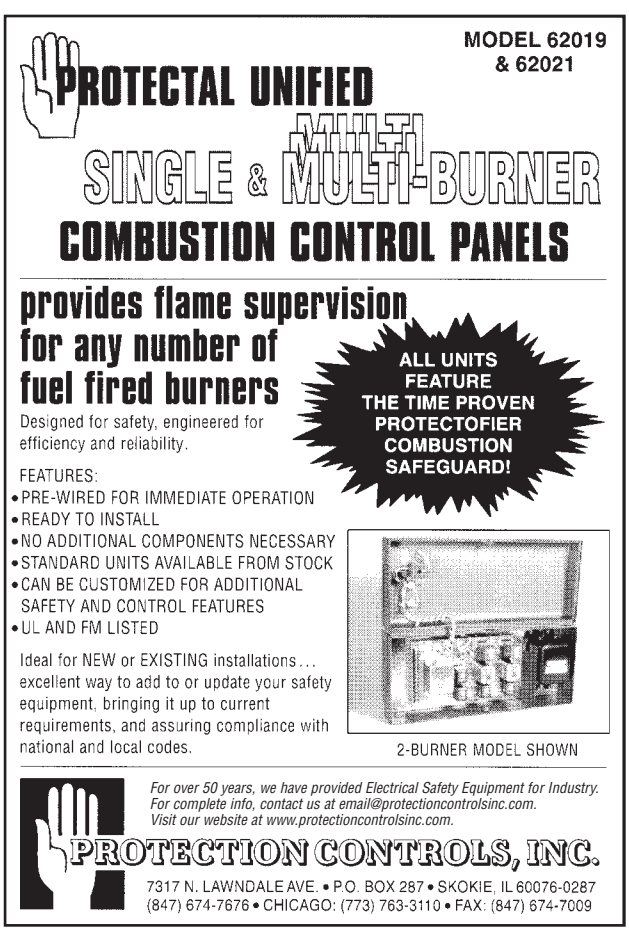
The Progress

North Coast Polymers is currently using the new process to produce retro-reflective mailboxes at its 40,000-ft² facility in north central Ohio. The U.S. Federal Highway Safety Administration (FHWSA) is evaluating the coating for possible additional uses. North Coast is also working with the national highway safety director of Germany to investigate coating guardrails in that country to improve safety, and perhaps replace the need for hot dipped galvanization, which is environmentally unfriendly and quite costly.

Through technology licensing and other arrangements, the company hopes to see retro-reflective powder coatings take over a substantial share of the market from tapes in the coming years.

"We believe that nighttime safety could improve drastically as a result of this coating," says Aaron Bates, vice president of North Coast.

For more information about the retro-reflective powder coating process, call North Coast Polymers at 419.635.2151 or e-mail rekraft@msn.com or ab3000_1@hotmail.com.



SCRATCH-RESISTANT CLEARS

Next Generation Powder Clearcoats

New automotive powder clearcoats can provide excellent scratch resistance, along with substantial environmental benefits.

BY STACEY ORZECH AND ED PAGAC
PPG Industries

Highly durable and cost-effective, liquid clearcoats have long been the norm in the automotive industry. But with increasing energy costs and the specter of tightening solvent and carbon dioxide emissions looming on the horizon, forward-thinking manufacturers have begun searching for alternatives. One solution that offers both high durability and substantial environmental benefits is a new generation of powder clearcoats.

The BMW Group was the first automaker to embrace powder clearcoat technology. Through a collaboration with PPG Industries and other suppliers, the company installed its original powder application equipment at its Dingolfing, Germany facility, where its premier 5, 6 and 7 series automobiles are produced. For more than 10 years, this line has consistently delivered high quality, durable finishes.

The use of a powder clearcoat has yielded many advantages for the BMW Group. The plant has enjoyed a respectable 90% first run capability (FRC) while being able to reclaim and reuse its powder overspray, which allows for more than 95% product utilization. The powder clearcoat booth is also energy-efficient; it uses 85 to 90% recirculated air, compared to less efficient liquid systems that might also require incineration of the solvent-laden air for emissions compliance.

Formulating a powder clearcoat with the smooth, flawless properties required by the automotive industry can be quite a challenge. There is a constant battle to achieve low molecular weight resins for appearance that are still high enough so that the end result is in solid form.

These obstacles notwithstanding, PPG and BMW won several awards for their innovative collaboration, including the R&D100 and the prestigious *Automotive News* PACE Award. And due to the great success of powder technology at Dingolfing, the BMW Group converted its Regensburg and Leipzig plants to powder clearcoat, as well.

In recent years, BMW challenged PPG to develop an even better powder clearcoat. While existing formulations had scratch resistance comparable to many liquid clearcoats of the time, BMW wanted this aspect of the coating raised to a higher level.

Increased Durability

To equal the excellent scratch resistance of the industry's "superior" liquid clearcoats — such as CeramiClear® and carbamate liquid — the team at PPG Industries had to

ABOVE: This BMW 7 Series features improved scratch resistance thanks to the newest generation of powder clearcoats.

drastically narrow the gap. Their efforts led to the development of new flow additives for improved appearance, alternate additive packages to improve humidity resistance and the use of mar enhancement additives (MEA) for substantially improved scratch resistance.

These improvements mean that consumers will enjoy the look of their new BMW even longer than before. Scratches inevitably happen over time; however, if a scratch does mar the surface of the new powder clearcoat, there will be less visual damage. This effect occurs because the MEA acts like a small layer of ball bearings partially sticking up from the coating surface. Instead of a child sliding a backpack against the car and scratching the clearcoat, for instance, the child's backpack is actually rubbing against the ball bearings, which keeps the clearcoat well protected.

Continued Developments

The newest generation of powder clears was successfully implemented in BMW's Regensburg and Dingolfing plants by mid-2006. According to a company spokesperson, the new products "completely met BMW's expectations." In addition to the main target of improved scratch resistance, significant improvements in processability (e.g., fluidization) have been achieved.

But the research and development efforts have not stopped there. Additional advances in most of the materials that make up the clearcoat, from the resins to the additives, continue to be made. Researchers are close to equaling the liquid CeramiClear® specification for scratch resistance, and the technology fits into the "best in show" category for automotive clearcoat performance in both the liquid and powder forms.

A major barrier to the adoption of powder coatings in the past has been the fear associated with running a powder booth. Manufacturers have worried that the application equipment would not be easy to maintain or robust enough to be used day in and day out in an automotive setting.

The growing success of both powder primer surfacer and powder clearcoat has alleviated these concerns to a great extent. Nearly four million units using powder coatings will hit dealerships globally this year. The environmental benefits — use of overspray, recirculation of booth air, and reduced energy costs hazardous waste — have all been proven. As the comfort level of running a powder booth rises, so does the performance of the powder clearcoats being developed.

As environmental regulations change and energy prices increase, automotive manufacturers worldwide will need to investigate alternative technologies. With the many improvements taking place, powder clearcoats offer a smart, efficient and eco-friendly alternative to liquid systems.

Stacey Orzech *is automotive powder clearcoat technical manager for PPG Industries, based in Pittsburgh, PA. He can be reached at orzech@ppg.com.* **Ed Pagac** *is product manager, Clearcoat, for PPG. He can be reached at 248.641.2192 or pagac@ppg.com. PPG's website is at* **www.ppg.com**.

Editor's note: *In addition to PPG products, BMW also uses powder clearcoats from DuPont (***www.dupont.com***). BMW's website is at* **www.bmw.com.**

An Electric Finishing Solution

Replacing a hydraulic reciprocator with a new electric model is helping an aluminum extrusion coater improve quality and lower maintenance costs.

"Designing for the Future" — that's how Aerolite Extrusion Co. defines its aluminum extrusion business. Established in 1953, the company is a full service custom extruder of residential windows and other consumer products, as well as automotive extrusions. Realizing that it's impossible to design for the future with outdated production equipment, Aerolite has always tried to remain on the cutting edge of technology in its manufacturing and finishing plants. When its coating operation, Youngstown, Ohio-based EPCO Finishing, was asked to be the first to install a new electric reciprocator from ITW Ransburg (a 21' TurboDisk), the company carefully researched the technology and then readily agreed.

"We studied a lot of systems before committing to ITW Ransburg's pilot program," explained Plant Manager Gerry Emery. "We had to replace a 40-year-old hydraulic system, and we wanted to get away from the hydraulic oil, seal replacement and other maintenance issues, while keeping better control on our coating operations. This new system promised to do all that for us."

Streamlined Operations

The new electric reciprocator was designed to be an effective alternative to hydraulic reciprocators for applications demanding critical regulation in blended pattern applications. It operates at a machine speed of 60 in./sec, and can be configured to deliver stroke lengths from 5 to 32 ft in 1-ft increments.

ABOVE: The electric reciprocator installed by EPCO, which moves the TurboDisk2 applicator (shown), operates at a machine speed of 60 in./sec, and can be configured to deliver stroke lengths from 5 to 32 ft in 1-ft increments.

A typical aluminum extrusion application with a TurboDisk applicator.

ITW's Pete Norris has worked with EPCO since the early 1990s, providing the hydraulic reciprocators and manual painting controls. "ITW created a fast, responsive, smooth electric reciprocator," Norris said. "We asked EPCO to test one of the systems for us, just to see how it would work for their operations."

EPCO initially agreed to replace one of its manual reciprocators, and the plant set aside five days for the installation. "Installation only took one and one-half days to complete, and EPCO was up and running," said Norris. "Within three weeks they had ordered a second electric reciprocator." EPCO also installed a profile coater and paint process station (PPS), which have greatly streamlined their overall operations.

The profile coater reads bar codes from the extruded parts and then programs the operation down the line. According to Norris, the system can change the flow rates of the paint, the stroke length of the reciprocator or the turbine speed of the disk almost immediately. Automatic solvent flushes and color load changeovers typically can take as little as one minute. Leaving just a one-minute gap on the line can accommodate the changeover.

"All the information of every painted part is collected, analyzed and catalogued, and can be used when bidding new jobs, developing emission reports and even in employee training. The system assures consistency in every part, and it also helps with managing paint inventory," said Norris.

Improved Quality and Reduced Costs

The move from hydraulic to electric reciprocators has been a great decision, according to Emery, resulting in better paint coverage and lower maintenance costs. In fact, the system EPCO ultimately installed allows for a wide range of controls and efficiencies that can significantly improve aluminum extrusion coating.

The system EPCO ultimately installed allows for a wide range of controls and efficiencies that can significantly improve aluminum extrusion coating.

"The reciprocators have worked out really well for us," Emery said. "This field study was a very good idea." ft

For more information about electric reciprocator systems, contact ITW Ransburg at 800.909.6886 or visit **www.itw-ransburg.com.**

For more information about EPCO, visit **www.aeroext.com.**

Cost-Effective Cleaning with Vapor Degreasing

With modern equipment and solvents, vapor degreasing is a safe, cost-effective and environmentally acceptable cleaning method.

BY JOHN HOFFMAN
AND TOM TATTERSALL
MicroCare Corp.

For decades, vapor degreasing was the cleaning technology of choice in the finishing industry. This ended in the 1990s, when the ozone issue forced the phase-out of the most popular vapor degreasing solvents, and water-based systems filled the void. Today, most precision cleaning is performed using aqueous technology. But aqueous cleaning systems tend to have large footprints, require a significant capital investment, guzzle electricity at a prodigious rate, are maintenance intensive, and require processed water and wastewater treatment systems. Most young engineers feel these constraints are locked in stone, but there is another cleaning option, one from the history books. If you're willing to go "back to the future," it's time to revisit vapor degreasing.

Vapor Degreasing Concepts

To a certain degree, the term "vapor degreasing" is a misnomer. Certainly it is possible to clean in the solvent "blanket" of vapors, with the solvent vapors condensing to liquid on the part. But for faster, more reliable cleaning in the vapor degreaser, the parts normally are immersed into the liquid solvent. There, liquid surrounds the part and enters all of the nooks and crannies to maximize solvent contact and cleanliness.

ABOVE: This look inside a vapor degreaser shows the boil sump on the left and the condensate rinse sump on the right. The boil sump has an aggressive boil. Note the clean solvent in the right sump. The basket of parts is first submerged in the boil sump and then moved manually or by automatic hoist (not shown) into the rinse sump.

The concept behind vapor degreasing is simple. Figure 1 illustrates the design of a modern, efficient, two-sump degreaser. A vapor degreaser boils a liquid into a vapor, contains the vapors, cools the vapors back into a liquid, and collects this purified liquid for continuous use. A vapor degreaser therefore is not only a parts cleaning system but also a tight, fast, energy-efficient recycling system that captures and refreshes the solvent with little waste.

The solvent is placed in the "boil" sump (lower left chamber in Figure 1) and is heated to its boiling point, usually 100-170°F (38-77°C), depending on the solvent. The heat can be provided with electric heating elements, hot water coils, steam coils or the heat from a "heat pump" refrigeration unit.

It's noteworthy that even a small water-cleaning system will consume considerably more energy in heating the cleaning solution than a vapor degreaser of comparable capacity. The higher energy consumption occurs because water has a much higher specific heat and a much higher latent heat of vaporization than vapor degreasing solvents. This fundamental characteristic of water also explains why it takes so many BTUs to dry the parts after they have been cleaned in an aqueous system. In contrast, some small vapor degreasers operate on 120 V power supplies.

Once boiling, the solvent produces a clear, dense vapor that rises through the machine, displacing the air in the degreaser. Eventually the vapors rise up and reach the lower set of cold coils, called the "primary condensing coils." These coils chill the solvent vapors and condense the solvent back into its liquid state. This liquid drips into a condensate trough that is under the primary condensing coils and around the interior circumference of the machine. There it is routed through a water separator, decanting any water that may have condensed on the condensing coils and removing it from the solvent.*

At this point, the distilled solvent is directed back into the rinse sump from the water separator (lower right chamber in Figure 1). Since the rinse sump already is filled with clean solvent, the addition of clean, newly distilled solvent will cause the sump to overflow into the boil sump, completing the distillation cycle. The addition of this fresh, pure solvent maintains a consistently clean rinse sump and also allows contamination and particulate to be washed back into the boil sump and concentrated there.

Equipment Considerations

Numerous options are available that make the vapor degreasing process even simpler, cleaner and faster, some of which are shown in Figure 1. The rinse sump is usually fitted with a circulating filtration system to remove insoluble contamination (particulate). Another common option is for the rinse sump to be fitted with ultrasonic transducers to enhance cleaning. Automated hoists can free up technicians from lifting parts in and out of the system while also ensuring that the proper cycle time and part movement takes place, which can lead to reduced solvent use and more consistent cleaning.

Another important feature of modern vapor degreasers is a second set of cooling coils, located above the primary condensing coils (also shown in Figure 1). Called "freeboard chillers," these coils are always colder than the primary condensers, usually around -20°F (-29°C). Their purpose is to lower the temperature and humidity of the air above the vapor blanket to minimize solvent diffusion from the saturated vapor blanket into the air, thereby minimizing solvent losses. In addition, since the freeboard chillers dehumidify the area above the vapor blanket, minimal water will be condensed on the primary condensing coils, which helps maintain solvent integrity.

WHY CONSIDER VAPOR DEGREASING?

A properly designed, operated and maintained vapor degreasing process offers many advantages versus aqueous cleaners and other choices. Vapor degreasers and solvents:

- Use minimal floor space
- Minimize energy consumption
- Minimize solvent consumption
- Distill and recycle the solvent for continued use
- Minimize waste disposal
- Minimize chemical exposure
- Provide consistent, reproducible cleanliness performance
- Can be completely automated
- Are easy to maintain
- Do not require a chemist to run
- Can easily clean complex configurations
- Have the lowest cost per part cleaned

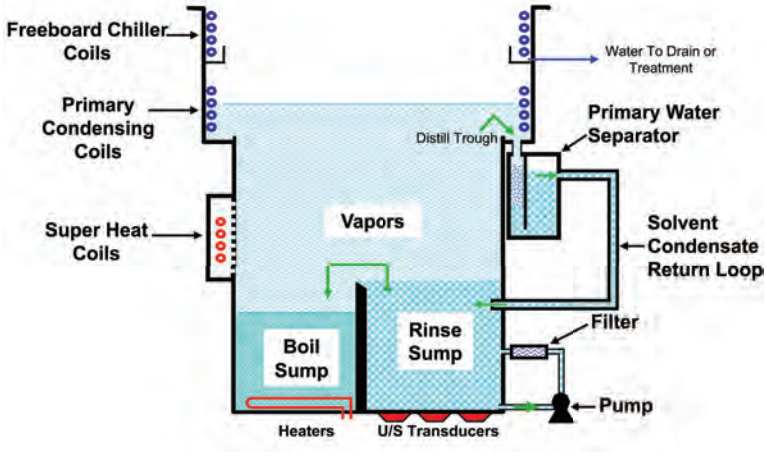
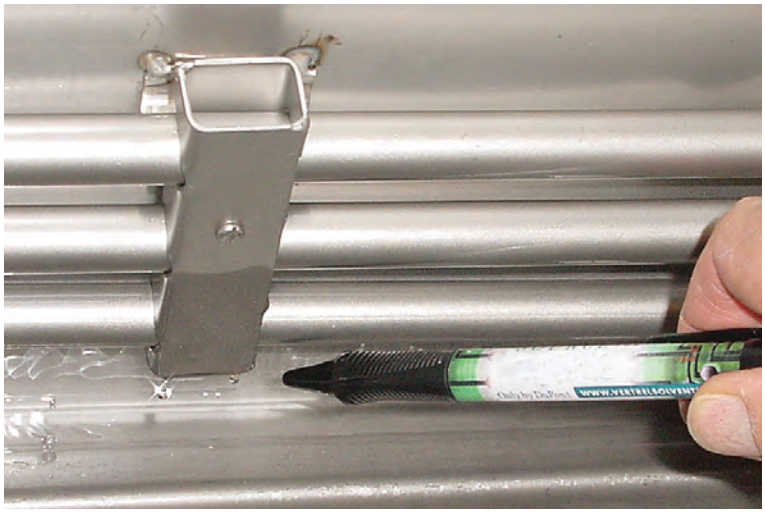


Figure 1. The internal workings of vapor degreasers tend to be remarkably simple, which is one characteristic that makes them so highly cost-effective. Crucial to the process is the selection of a nonflammable "low-boiling" solvent (as opposed to a high-boiling liquid, such as a hydrocarbon solvent or water), which makes the liquid-vapor-liquid cycle fast and reliable.

**Water and solvents are easily separated in these systems since they generally are not miscible in each other. The lighter water floats on top of the heavier solvent, and the water is easily separated and discharged from the system.*



The primary condensing coils on a vapor degreaser, with droplets of solvent falling from the coils into the condensate trough in preparation for being recycled.

(Note that the freeboard chiller coils are not used to contain the solvent blanket in the degreaser. That's the job of the primary condensing coils. If the vapor blanket ever rises above the primary condensing coils into the area of the freeboard chiller coils, there is something wrong with the primary condensing coils and a refrigeration technician needs to be consulted.)

Lastly, another option in the degreaser is the installation of "superheated" coils. These coils superheat the vapor blanket above the "normal" boiling point of the solvent. This superheated vapor quickly heats the freshly cleaned parts and ensures that all the condensed solvent on the parts is vaporized and recovered under the vapor blanket. This process guarantees that the parts are dry before being removed from the system, which minimizes solvent drag-out and solvent consumption.

There are more than a dozen manufacturers of vapor degreasers in the U.S., and several dozen more worldwide. Depending on the cleaning application and process requirements, the technology exists to handle the largest parts and highest volumes. These large machines, when properly designed, operated and maintained, can be extremely efficient with minimal solvent consumption.

Cost Comparison

Despite the historically proven performance advantages of vapor degreasers, many engineers worry about the operating costs of these systems. After all, water is basically free, while ozone-safe solvents cost $1,500-$10,000 per drum. Can vapor degreasers truly be cheaper to run than water cleaning systems?

The best way to evaluate the operating costs of different types of cleaning systems is to compare them on a cost-per-part-cleaned basis. This approach provides an apples-to-apples comparison that can illuminate the hidden costs of water cleaning.

First, the acquisition and installation costs are tabulated. Included among these are the direct capital costs of the cleaning system (the hardware itself, plus the support systems, wastewater treatment systems, and so on), as well as the indirect capital costs (the floor space, upgrades to the facility's electrical system, plumbing costs, etc.).

The next step is to estimate the direct operating costs for both systems. This estimate includes the solvent and water costs, energy costs, labor costs, waste disposal costs, inventory costs that change due to faster or slower cleaning cycles, and any other direct expense that touches the cleaning system. Engineers also will need to take into account the personnel time needed to operate and maintain the cleaning equipment. Vapor degreasers typically are almost maintenance-free; aqueous systems can be much more complex and time-consuming.

SOLVENT SOLUTIONS

Prior to the 1990s, the two most common vapor degreasing solvents were CFC-113 and 1-1-1-trichloroethane. The production of these "Class I Ozone-Depleting Substances," as defined under the Clean Air Act, was terminated on January 1, 1996, and industry has been living off stockpiles ever since. Scarcity has driven up prices, making these cleaners impractical as precision cleaners except in the most exotic uses.

A less-damaging group of cleaners, called the "Class II Ozone-Depleting Substances," was recommended to users as an interim cleaning option. The most popular of these was a solvent called HCFC-141b. However, the manufacture of HCFC-141b ended on January 1, 2003, and the use of this material in solvent cleaning applications was banned in 1997.

Fortunately, suppliers have developed more environmentally acceptable alternatives. Newer hydrofluorocarbon-based fluids and solvents based on n-propyl bromide (nPB) have zero or minimal ozone depletion and low global warming potential, while providing consistent, affordable, high-quality cleaning. Additionally, advanced product stewardship programs can help ensure the safest, most efficient use of these chemicals in vapor degreaser applications.

Then there is the solvent cost. While the solvent selection process is beyond the scope of this article, evaluating the cost of the solvent is simple. The proper way to estimate solvent costs is not to compare the cost per pound, but to compare the cost per part cleaned. For example, a modern vapor degreaser will use approximately 0.062 lb of solvent/hr/ft^2 of solvent/air interface when in use. A typical 10-gallon degreaser has about 2.5 ft of solvent/air interface, so it will lose about 1.25 lb of solvent (less than one cup) in an eight-hour work day. If the solvent is priced at roughly $3/lb, the solvent cost for a day of cleaning

Vapor degreasing has come full cycle, and many engineers have realized that it is a safe, economical and environmentally acceptable cleaning method.

is under $4, and the cost-per-part, assuming 1,000 parts were cleaned that day, is $0.00372 per part.

When these costs are tabulated and then divided by the total number of parts cleaned by the system, the true cost of cleaning becomes apparent.

Economical, Environmentally Acceptable Cleaning

For decades, the vapor degreasing process has proven to be the most consistent and "headache-free" cleaning process for manufacturing engineers. Vapor degreasing has come full cycle, and many engineers have realized that it is a safe, economical and environmentally acceptable cleaning method. Energy demands and new environmental concerns are generating an increased interest in the vapor degreasing process. If a current aqueous cleaning system is reaching the end of its life cycle, now is the time to explore vapor degreasing as an alternative in your manufacturing plant.

To obtain the desired results in the most economical and environmentally acceptable manner, it is imperative that the degreaser system be properly configured, operated and maintained. In addition to the hardware issues, the proper solvent selection requires careful analysis, and that selection depends on the contamination being removed. When analyzing the application, always define the impurities first, then select the chemistry that removes those impurities, as well as the equipment that uses the chosen solvent properly.

It is clear that the vapor degreasing concept is being revitalized. In today's world, where quality, reliability and energy efficiency are paramount, the old process of vapor degreasing deserves another look as a modern, planet-friendly and cost-effective cleaning process. ft

John Hoffman *is technical manager and* **Tom Tattersall** *is vice president of MicroCare Corp., New Britain, CT, a global supplier of solvents and tools used in precision cleaning, coating and lubricating. They can be reached at 800.638-0125 or 860.827.8105. The company's website is at* **www.microcare.com.**

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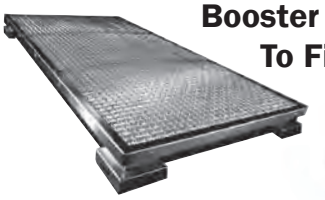
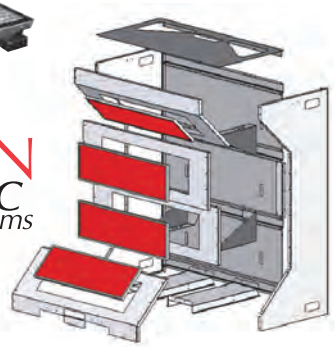


VULCAN catalytic systems



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Profitable Plating

By establishing standard operating procedures and making sure they're followed, you can reduce rejects and improve the profitability of your plating line.

BY PAUL HANCHARIK
Atotech USA Inc.

The profitability of a plating line depends on the line's reject rate. The higher the reject rate, the lower the profitability.

Most plating lines have multiple steps to achieve the final finish. In general, the steps involve cleaning and activating the metal to be plated, plating the desired finish, and post plate rinsing and drying. A formalized approach to reject prevention requires establishing standard operating procedures (SOPs) for each plating line and "walking the line" before startup to assess whether the plating line meets the SOPs and is ready to run.

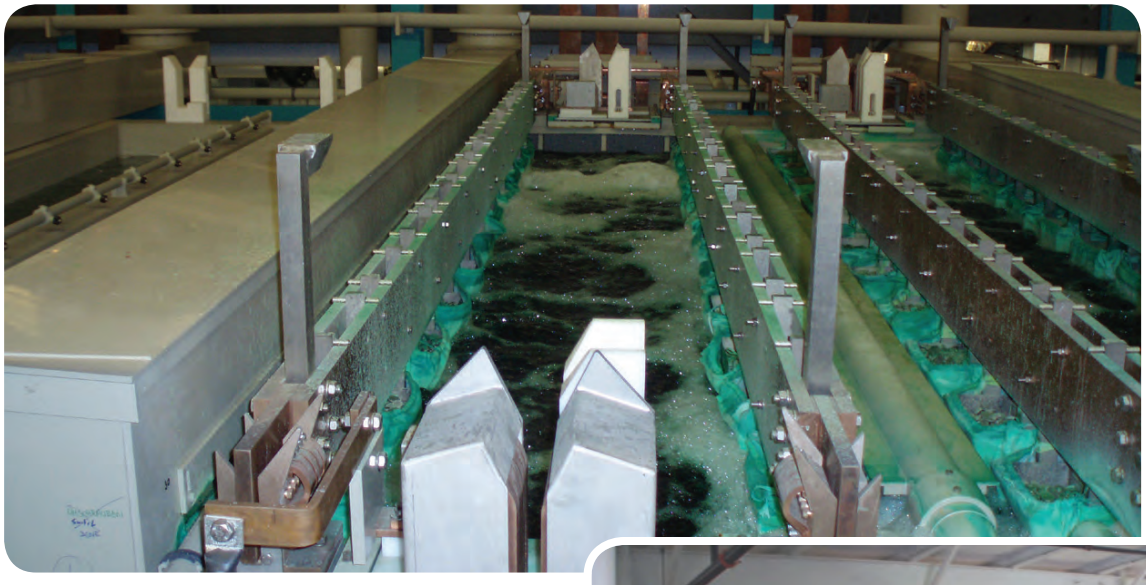
The ABCs of SOPs

SOPs should be prepared for each tank on the plating line and should contain the following information:

- Purpose and description of each tank
- Makeup procedure and quantities used
- Concentration ranges
- Safety precautions
- Operating conditions — temperature, pH, current/voltage, time, filter flow rate and change frequency, agitation
- Maintenance procedures and frequency
- Control procedures
- Troubleshooting procedures
- Other comments

The objectives of the SOPs are to improve and maintain quality, ensure trouble-free operation, find and correct potential problem areas before they occur, and find and correct causes of existing problems.

ABOVE: Most plating lines have multiple steps to achieve the final finish.



SOPs should be prepared for each tank on the plating line.

Walking the Line

After the SOPs are prepared, the line should be "walked" (audited) on a routine schedule. Walking the line is especially important after a shutdown has occurred. It is too easy to start the line on Monday morning because production needs to run, without regard for whether the process solutions are up to temperature or whether the rinses are flowing correctly. But out-of-spec conditions lead to rejects. When walking the line, you should compare the actual condition of each tank to the SOPs that have been developed for that tank. Inspect the overall plating line, as well as the mechanical/electrical system, operating conditions and tank chemistry.

Compare the actual condition of each tank to the SOPs that have been developed for that tank.

General Plating Line Observations: Look for overall cleanliness and any line maintenance that might be required. Check to make sure all safety procedures are being followed correctly.

Mechanical/Electrical Systems: Check the hoist, rectifier, filters and bussing to make sure everything is well maintained and working correctly. Also check the condition of racks and rack coatings, the flight bar and tank saddles.

Operating Conditions: Check the condition of the anode bags and make sure the anode baskets aren't too full or too low. Also make sure that the solution levels are correct. Check the accuracy of the temperature controller by verifying the temperature with a thermometer. Make sure the solution agitation equipment is on and that the agitation is uniform. Also check to make sure the rinses are on and flowing, with no turbidity.

The plating line should be "walked" (audited) on a routine schedule to check for problems and out-of-spec conditions.

Chemistry: Check the lab analysis prior to startup to verify that all of the tanks meet the required specifications.

Improving Profitability

By establishing standard operating procedures and using them to assess whether the plating line is ready to run, you can reduce reject rates and improve profits.

Paul Hancharik *is eastern regional sales manager of Atotech USA Inc., Rock Hill, SC, a supplier of processes, services and equipment for metal finishing. He can be reached at 803.817.3500 or phancharik@atotech.com. The company's website is at* **www.atotech.com**.

Better Business and a Cleaner Environment

An energy efficient regenerative thermal oxidizer is helping a plastics finishing company minimize emissions while maximizing its ability to grow and succeed in an increasingly competitive environment.

BY JEFF KUDRONOWICZ
Anguil Environmental Systems

Phillips Plastics Corp. (PPC) is a world-class injection molder with leading-edge secondary decorating and assembly capabilities. The privately owned company is solely based in Wisconsin and has almost 1,600 employees spread across 15 separate locations operating in seven communities. Its eleven manufacturing facilities provide products to the medical, automotive, telecommunication and consumer product industries. The Medford, WI, facility performs plastic injection molding and provides the organization with secondary decorating operations such as painting, laser etching, laser marking, pad printing and assembly of automotive, telecommunication and consumer products.

Through the 1990s, this facility ran successfully with a minor source air pollution control operation permit. This permit consists of very specific requirements to meet the EPA's Latest Available Control Technology (LACT) regulation. These included restricted limits on volatile organic compounds (VOC) per gallon of paint, catalyst, thinner and cleaning solvent as purchased. The regulation limited the types of paints and colors PPC could offer customers, but given its customer needs and production volume at the time, the situation was manageable.

As the business grew and the company began to receive a greater number of requests by customers for more exotic forms of paint and colors, PPC realized the need to increase its paint capabilities in order to compete. In De-

ABOVE: The oxidizer installed at PPC achieves VOC destruction through high temperature thermal oxidation, converting the VOCs to carbon dioxide and water vapor while reusing released thermal energy to reduce operating costs.

cember 2000, the company applied for two new permits with the Wisconsin Department of Natural Resources (DNR), one for an air pollution construction permit to install a new state of the art robotic paint line system and the other for the ability to paint small metal parts. This permit modification changed the facility from a minor source of less than 100 tons per year of VOC emissions to a major source with the potential to emit over 225 total tons.

With the new permit, PPC not only had to meet the LACT requirements for painting plastic parts but now also needed to meet the Maximum Achievable Control Technology (MACT) requirements for painting small metal parts. While the MACT requirements added a higher level of restrictions to VOCs per gallon of paint as applied to metal parts, these restrictions were applicable and once again manageable.

Although the new permit allowed PPC to meet additional painting volume capacity requirements, the company observed continued demand by its customers for paints that could not be used under the air permit. Additionally, with the facility's acceptance into the ISO 14001:1996 standards, PPC realized the need to significantly reduce its VOC emissions.

The only way to meet customer demands and reduce emissions was to install pollution control equipment.

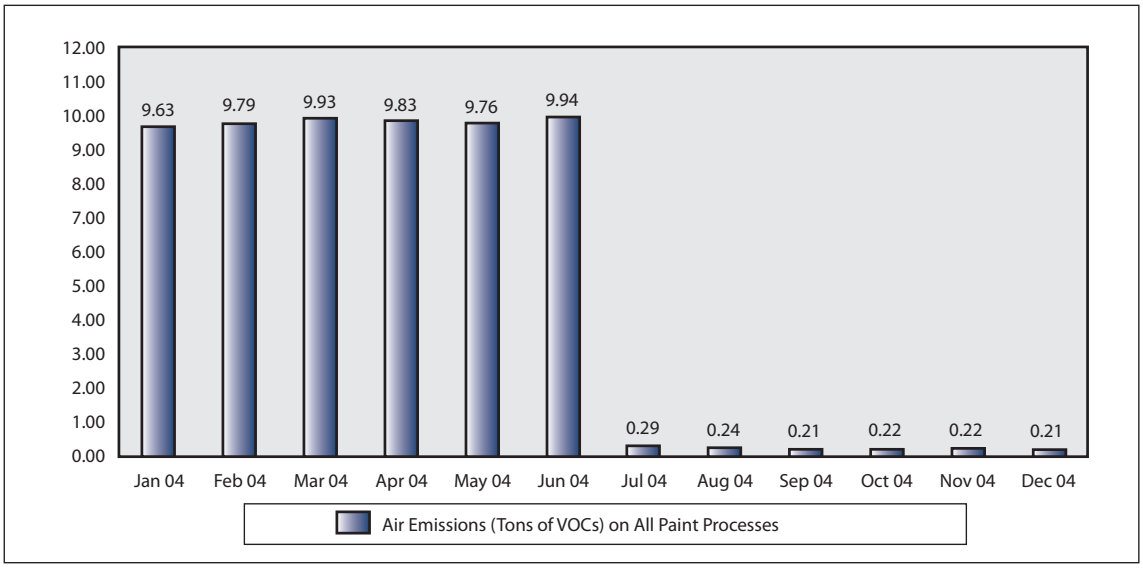
Evaluating the Options

PPC formed an internal group to explore the various control technologies available on the market. Consideration was given to equipment and concepts such as:

- Catalytic oxidizers
- Thermal oxidizers
- Regenerative thermal/catalytic oxidizers
- Rotor concentrator coupled with a regenerative thermal oxidizer
- Microwave VOC reduction technologies
- Biofilter VOC reduction technologies

The company began to work closely with the sales and engineering team at Anguil Environmental Systems, a global air pollution control provider also based in Wisconsin. The two companies worked together to establish the best available control technologies to meet the pollution control requirements at the Medford facility. By doing some calculations, Anguil demonstrated that a regenerative thermal oxidizer (RTO) would be the most cost-effective control technology for the facility's current and future process demands.

The only way to meet customer demands and reduce emissions was to install pollution control equipment.



Reduction achieved through installation of RTO pollution control equipment

Jan - June Average = 9.81 Tons
July - Dec Average = 0.23 Tons
} Difference = 9.58 Tons Average → 97.66% Red./Change

Jan - June Average = 58.88 Tons
July - Dec Average = 1.39 Tons
} Difference = 57.49 Tons Average → 97.64% Red./Change

Figure 1. The new RTO provided a net reduction of 58 tons of emissions in the first six months of operation.

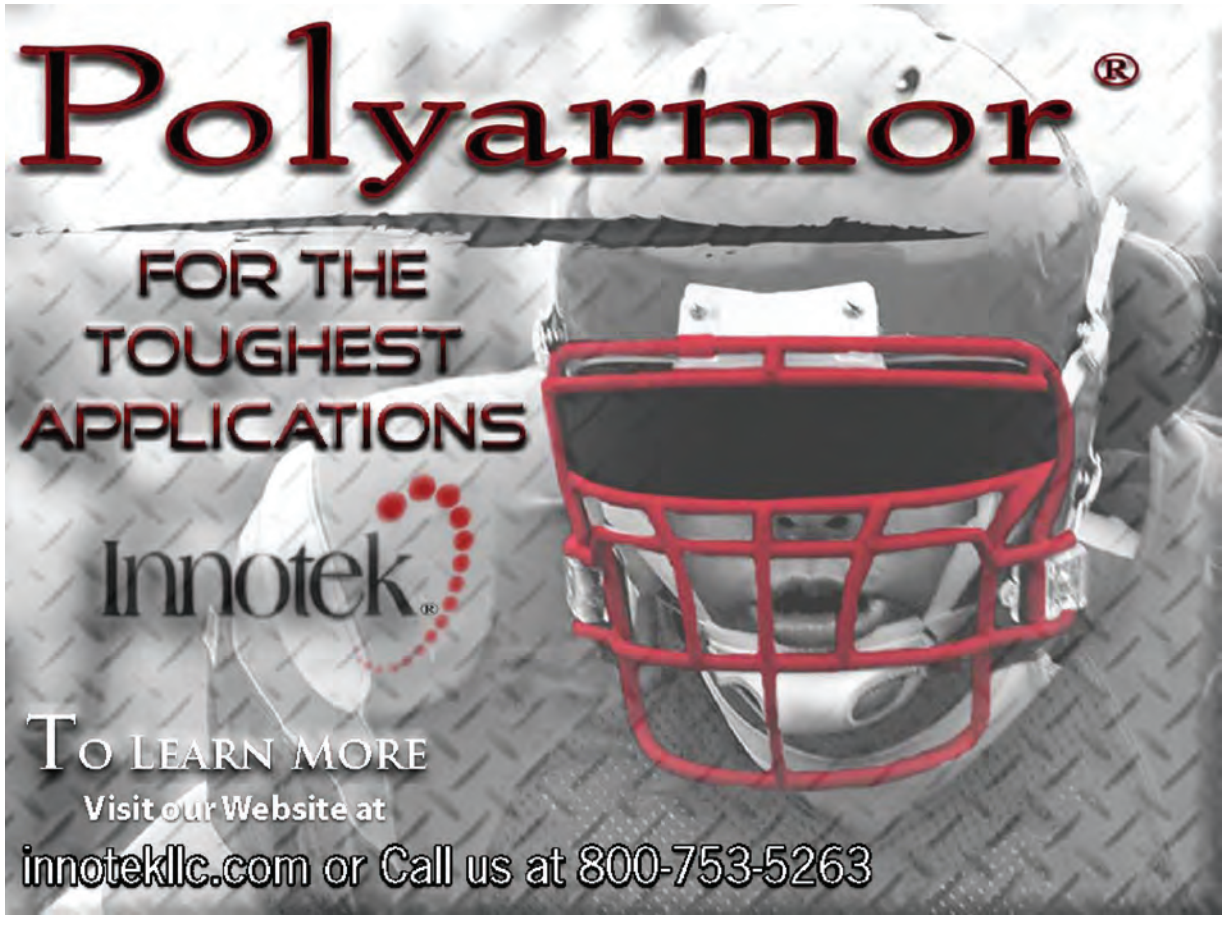
ENERGY EFFICIENT RTOs

The RTO has allowed PPC to offer its customers a large variety of colors and finishes to meet their more unique paint finish requests, and to use previously restricted thinners and paints to better process products with fewer rejects.

After thoroughly evaluating several suppliers, PPC decided to go back to the Department of Natural Resources (DNR) and request a new air pollution control construction permit to install an Anguil Model 400 40,000 SCFM (62,800 NM^3/hr) RTO for its existing paint operations.

The oxidizer would achieve destruction through the process of high temperature thermal oxidation, converting the VOCs to carbon dioxide and water vapor while reusing released thermal energy to reduce operating costs. Process gases with VOC contaminants enter the oxidizer through an inlet manifold. Flow control valves direct this gas into energy recovery chambers where the process gas is preheated, then progressively heated in the ceramic beds as they move toward the combustion chamber.

The VOCs are oxidized in the combustion chamber, releasing thermal energy in the structured ceramic media beds that are in the outlet flow direction from the combustion chamber. These outlet beds are heated and the gas is cooled so that the outlet gas temperature is only slightly higher than the process inlet temperature. Fast-acting vertical poppet valves alternate the airflow direction into the ceramic beds to maximize energy recovery within the oxidizer. The VOC oxidation and high energy recovery with-



in these oxidizers reduces the auxiliary fuel requirement and saves operating cost. For example, at 95% thermal energy recovery, the outlet temperature may be only 70°F (40°C) higher than the inlet process gas temperature with an RTO. The oxidizer can reach self-sustaining operation with no auxiliary fuel usage at low concentrations.

Allen Bradley programmable logic controllers (PLCs) are used to control the automatic operation of the oxidizer from startup to shutdown so minimal operator interface is required. These controls also provide for remote telemetry to enable the system's operation to be viewed and altered via a modem connection to reduce maintenance costs.

A stack test measured 99% destruction rate efficiency for VOC emissions at 100% capture. This equated to a net reduction of 58 tons of emissions in the first six months of operation.

Reaping the Benefits

Later that fall, the permit was accepted by the DNR for an air pollution control construction permit to install the RTO. Anguil was able to complete the design, fabrication, delivery, installation and startup of the equipment so it could go on-line early the next year.

After startup of the new RTO, a stack test measured 99% destruction rate efficiency for VOC emissions at 100% capture. This equated to a net reduction of 58 tons of emissions in the first six months of operation (see Figure 1). The benefits of installing the RTO included the ability to offer PPC customers a large variety of colors and finishes to meet their more unique finish requests. The RTO also allowed PPC to use previously restricted thinners and paints to better process its products with fewer rejects. This ability has allowed the business to grow and succeed in an increasingly competitive environment and meet the new demands from customers while significantly reducing the amount of air pollution released into the environment.

Jeff Kudronowicz *is the application engineering manager for Anguil Environmental Systems based in Milwaukee, WI. He has a chemical engineering degree from the University of Wisconsin Madison and almost 25 years of experience in the air pollution control industry. He can be reached at 414.365.6400 or jeff.kudronowicz@anguil.com. The company's website is at* **www.anguil.com.**

MATERIALS & EQUIPMENT

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Scratch-Resistant Auto Refinish Clearcoat

PPG INDUSTRIES' AUTOMOTIVE REFINISH BUSINESS: The DC4125 CeramiClear is a mar- and scratch-resistant clearcoat in the Deltron family of refinish products. According to the company, this durable clear creates a glasslike, extremely hard surface for superior gloss retention and resistance to car wash and polish scratches. The new product is designated for use with PPG's DBC and DBU Refinish Systems, and it is designed for the repair of cars that have a CeramiClear OE finish. A high-solids clear, it reportedly meets all current VOC limits and is suitable for use in Southern California Districts. It is formulated for use with DCH4126 CeramiClear Hardener. Call 440.572.2800 or visit www.ppgrefinish.com.

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FERRO CORP., ELECTRONIC MATERIAL SYSTEMS: This company has developed eight new products that reportedly improve the electrical output, efficiency and manufacturability of PV silicon solar cells, enabling solar energy to become a more cost-competitive energy generation alternative. Four new front silver contacts yield greater power output, fire through silicon nitride anti-reflective coatings, and also provide a broad processing window. Two of the other products offer the advantages of the company's patented Hot Melt ink technology, and two new aluminum compositions are also included in the launch. All eight new products are RoHS-compliant. Visit www.ferro.com.

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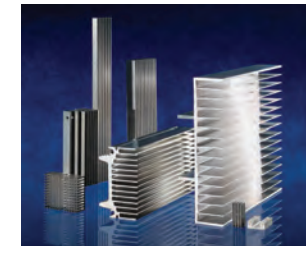

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PICKERING LABORATORIES: A newly formulated line of artificial eccrine perspiration reportedly guarantees accurate "sweat testing" on coatings and other products. Synthesized after an extensive analysis of natural perspiration, the artificial perspiration product contains nine minerals, including sodium, copper, potassium and magnesium, and three metabolites, uric acid, lactic acid and urea along with 20 amino acids. All components are normalized to the same proportions found in natural perspiration. Call 800.654.3330 or 650.694.6700, or visit www.pickeringlabs.com.

Equipment

Protective Blower Enclosure

SONIC AIR SYSTEMS, INC.: The Sonic All-Environment (AE) Blower Enclosure™ is designed to reduce noise exposure levels to below OSHA standard 26 CFR 1910.95(a) while helping extend the life of the blower/motor unit by providing protection in outdoor and industrial environments. This enclosure reportedly is adaptable to any vertical centrifugal blower with a 145T-284T motor frame for either NEMA or IEC configurations. It features external filters with change gauge, quick access maintenance panel door, and hinged with dual gas shocks to allow full access by one person. The enclosure is made of a molded polyethylene cover and is designed with a double-wall foam filled construction to reduce the sound levels to as low as 75 dBA, depending on blower size and horsepower. Call 714.255.0124 or visit www.sonicairsystems.com/blower_enclosures.php.

EQUIPMENT & SOFTWARE

Temperature Profiling System

DATAPAQ: The new EasyTrack2 temperature profiling system reportedly offers twice the choice, power, speed and accuracy of earlier tools. The system features a rapid sampling interval of 0.5 seconds, greater accuracy of ±0.9°F (±0.5°C), and USB communication. It incorporates an easy-to-use data logger that is available in four or six channels and has an internal operating temperature of up to 185°F (85°C). The thermal barrier provides two hours of protection at 400°F (200°C), keeping the data logger at a safe working temperature as it travels through the process. The corresponding Insight software allows data to be analyzed over time to confirm cure against the paint suppliers' specifications, make comparisons probe to probe and identify peak temperatures and time-at-temperature. Call 978.988.9000 or visit www.datapaq.com.

Spray Gun Attachment

PAUL N. GARDNER CO.: The LaserPaint is a spray gun attachment used to improve spray application performance and increase transfer efficiency while decreasing costs, materials and air emissions. According to the company, the targeting tool enhances spray technique by using two laser beams that converge to form a single dot when spraying at the optimal gun-to-part distance. The single dot also gives feedback on the proper amount of overlap being produced and can help when spraying difficult parts. The gun reportedly allows users to spray at the correct distance for maximum efficiency, use the single dot for targeting on difficult to spray parts and achieve an accurate 50% overlap for a uniform coating. It is designed to increase transfer efficiency up to 38.8%, reduce VOC emissions and decrease material consumption. Call 800.762.2478 or visit www.gardco.com.

Consistent Dispersion System

NETZSCH FINE PARTICLE TECHNOLOGY, LLC: The Voyager Control System II can achieve consistent dispersion quality by effectively monitoring the energy input and controlling the process by automatic adjustment. The user simply enters the amount of grinding energy into the system's enhanced control panel, and the same product quality will then be achieved on a consistent basis, the company reports. This automatic control system includes a variety of new features, such as an improved alarm notification system that allows in-house maintenance and NETZSCH service personnel to evaluate possible machine faults. Call 484.879.2020 or visit http://grinding.netzschusa.com.

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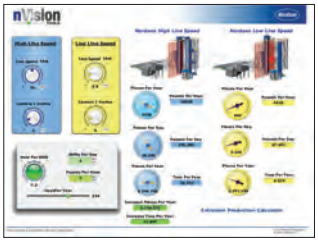

NORDSON CORP., INDUSTRIAL COATING SYSTEMS: nVision™ Tools is a series of interactive computer modeling tools that can help global coaters analyze the best available solutions for coating systems for liquid and powder lines. The models are designed to handle the number of variables, permutations and calculations for options available to finishers when looking to upgrade or convert to a different finishing method. The effect of any variable on overall profitability can be tested and evaluated. Detailed "what-if" scenarios allow for various input data so users can input what they know in the most convenience format to help them make educated decisions. The tools address more than 30 separate variables across both liquid and powder coating applications that can be used to provide several options for analysis, depending on a finisher's future requirements. Call 800.433.9319 or visit www.nordson.com.

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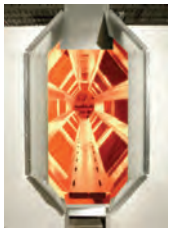

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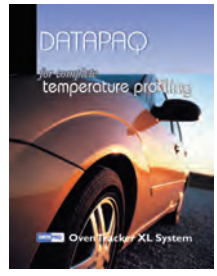

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Ask Joe Powder

Dear Joe,

I run a powder coat line for a custom sheet metal house. Lately we have been having application issues due to extreme variations in humidity levels. Currently the RH has been around the 40% range, and I have my guns set at 60 KV. I know that the tuning of the KV setting is a "feel" and the desired outcome is in the results of the correct setting, but do you know of any guidelines for various RH conditions versus KV settings?

Joe Campanini

Hello Joe,

I asked one of my old friends, Ron Srsa, what he thought. He's been around powder application systems for over 25 years. He says, "Forty percent RH is a little too low. A low RH creates a static electricity (SE) environment, in which it is hard to control KV to parts being sprayed. Remember, there is a lot of air moving in and around the booth. In any new powder system, we always recommend 45 to 60% RH. If there was a question about being able to maintain that RH, we would install humidifiers in the powder coating room.

"The quality of coating depends on the gun KV, an acceptable ground and the coating environment. We always talk about KV and ground but often forget about the environment."

So I would install humidifiers to increase your RH above 40% and set your KVs between 65 and 80. If 80 doesn't allow you to penetrate tight inside corners I would keep lowering the KVs until you get good penetration. And remember to check that you're getting a good ground with your hangers.

Dear Joe,

I have heard that TGIC powder coatings cannot be used in Europe. Is this true? If so, why?

Jay Montemayor

Dear Jay,

Basically powder coatings containing TGIC (triglycidyl isocyanurate) can be used in Europe. However, TGIC powders sold in European Union countries must have a skull and crossbones label and certain hazard warning labels depending on the concentration of TGIC. (A link to a downloadable PDF from the European Council of the Paint, Printing Ink and Artists' Colours Industry [CEPE] can be found in this column at www.finishingtodaymag.com.) Because of this labeling, many finishers have found alternatives to TGIC-based powders.

The crux of the matter is that TGIC is classified by the EU as a potential mutagen based on exposure test results involving laboratory animals.

However, TGIC historically has not caused any observed mutagenic response in humans. Most people who continue to handle TGIC containing powders simply use the necessary personal protection equipment recommended by the TGIC suppliers and don't seem to incur any deleterious health issues.

The most important point is always to respect chemicals and chemical-containing materials. This means thoroughly reading the material safety data sheets (MSDSs) and abiding by the handling instructions provided by the supplier.

Dear Joe,

Is there a known problem with powder coatings being contaminated, resulting in white flecks on our finished product?

Simon Cherriman

Hi Simon,

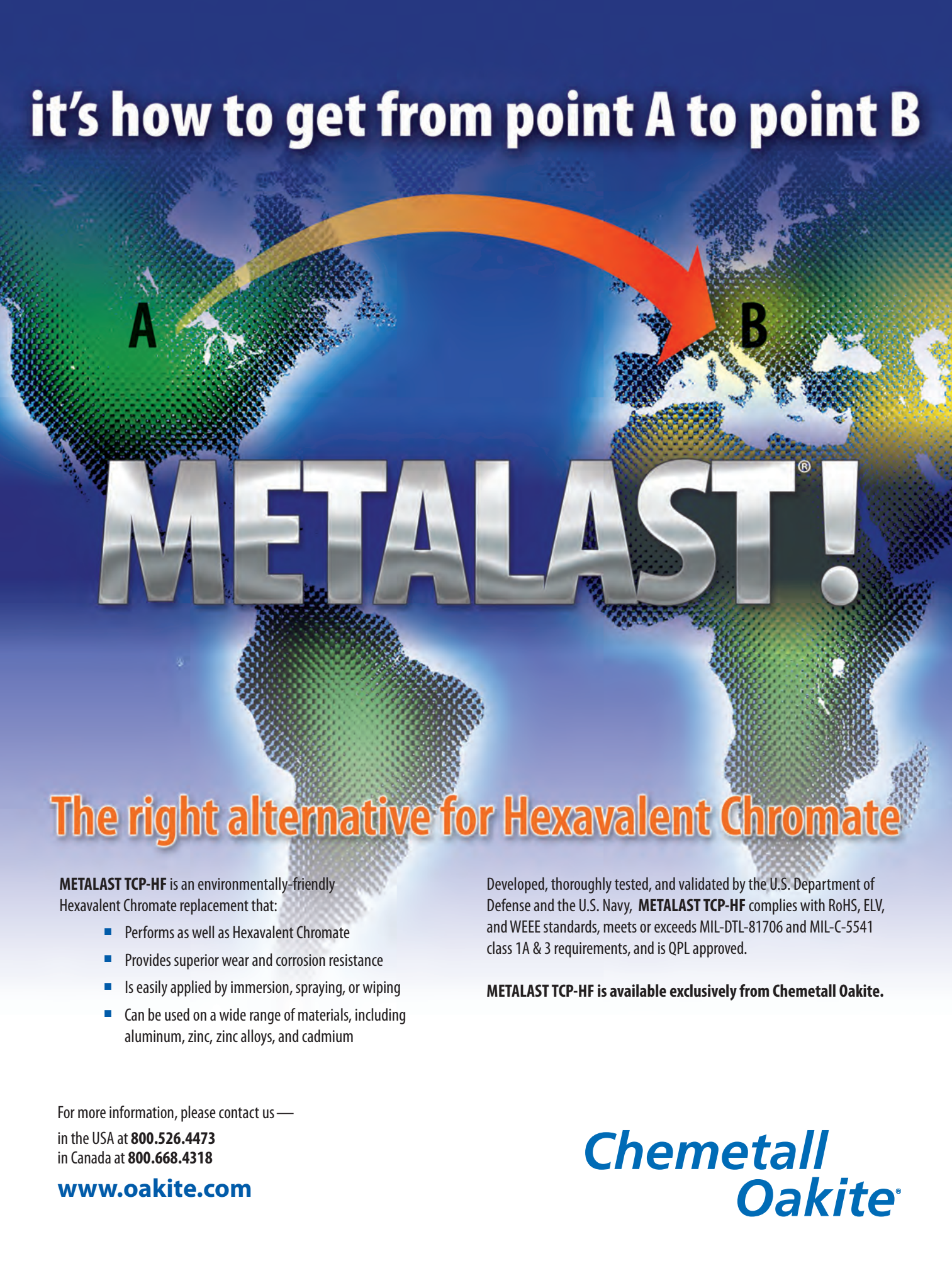
The most common cause that I have encountered is a contaminated oven. Powder coatings emit anywhere from 0.5 to 3.0% volatiles (although not considered volatile organic compounds in the U.S.) during the baking cycle. These volatiles condense on the interior of ovens and can descend on coated parts as they pass through the oven.

Another source of white specks is ash from recently cleaned racks and hooks. Some shops use a burn-off process to clean these items, and this process can leave a fugitive residue that becomes airborne in the oven.

To diagnose the problem, isolate a coated part or panel as it travels through your oven. I have used a clean, empty paint can to accomplish this. Place a coated test panel or small part in the can and compare its appearance to that of an adjacent part traveling through the oven simultaneously. If the isolated piece is clean and the other part has white specks, then the oven is producing the contamination. If both pieces are contaminated, then either the powder is dirty or the application area is causing the problem.

Send your questions to **askjoepowder@yahoo.com.** *Additional questions and answers can be found online at* **www.finishingtodaymag.com**.

it's how to get from point A to point B



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