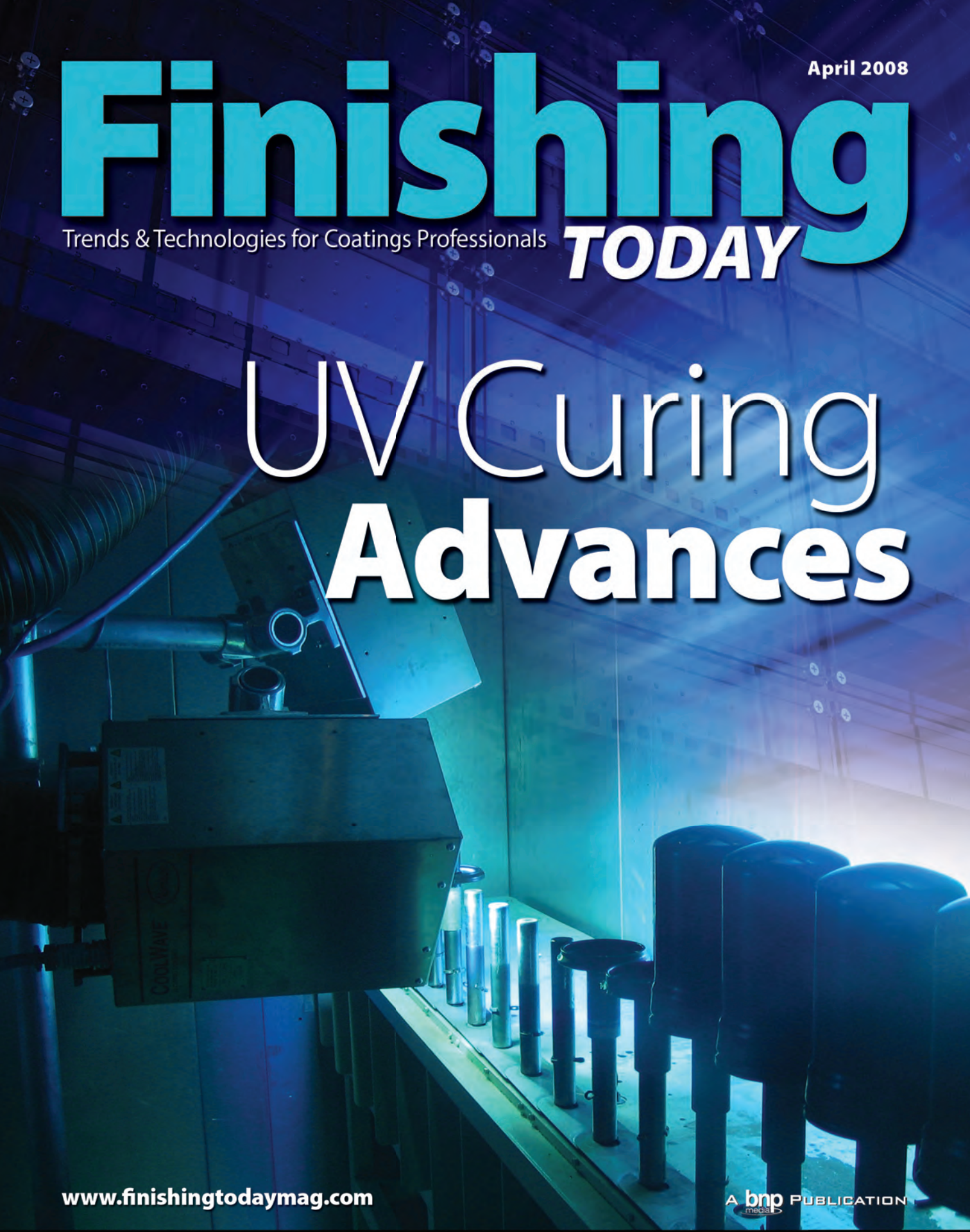
April 2008

Finishing TODAY

Trends & Technologies for Coatings Professionals

UV Curing Advances



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INSIDE: Low-Cure Cathodic E-Coat • Tumble Spraying Plastics

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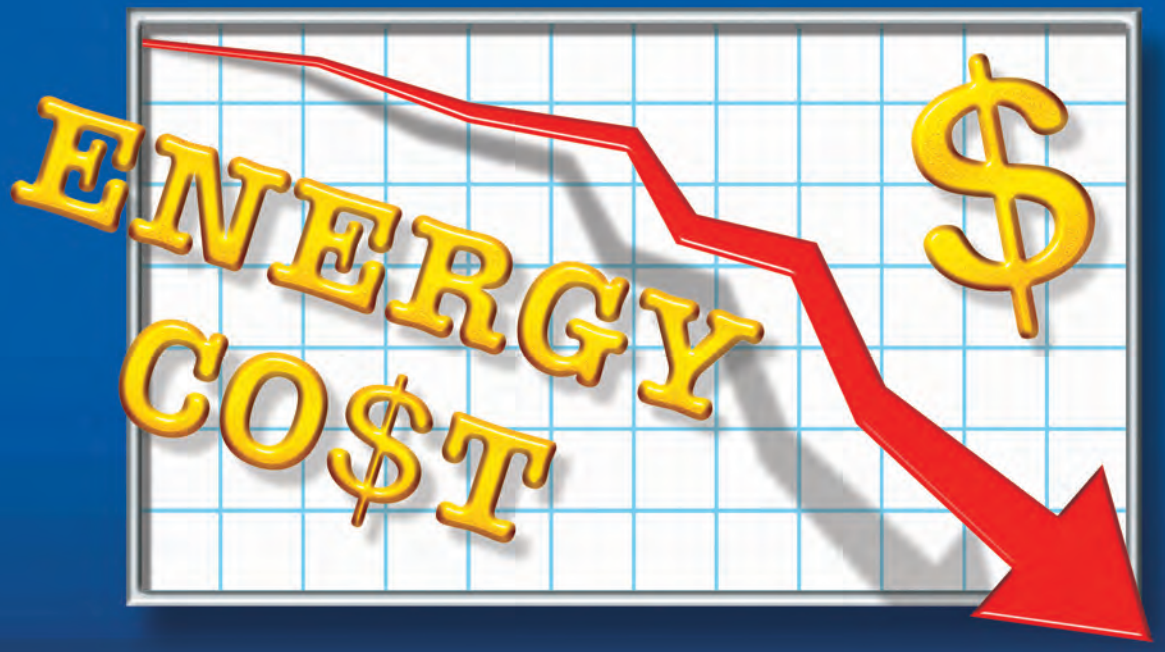

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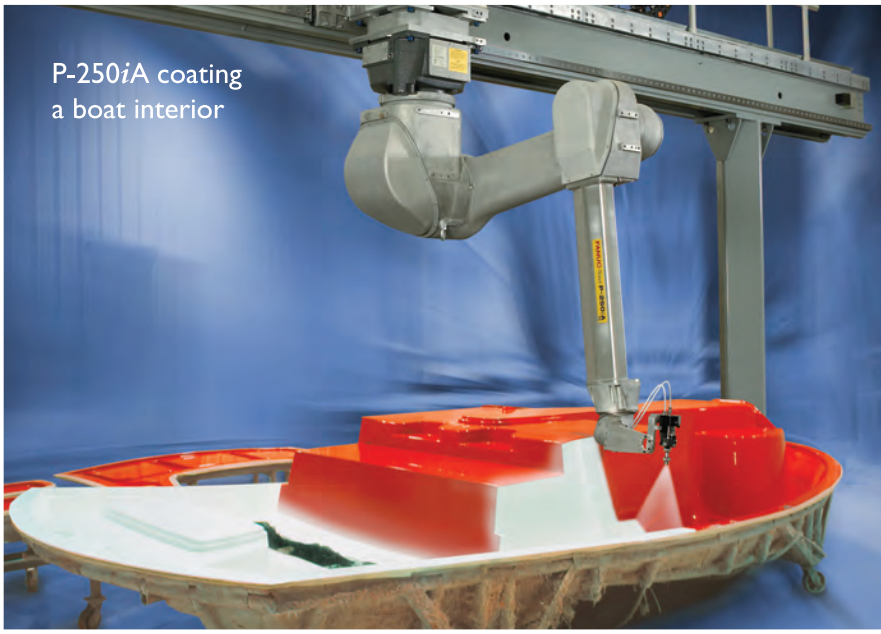
FIT for COATINGS

P-250*i*A applying finish to an automotive fascia



P-250*i*A coating a boat interior

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ft inside

APRIL 2008
VOLUME 84, NUMBER 4

FEATURES

COLUMNS

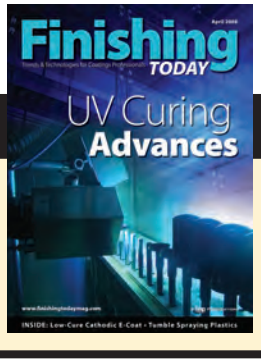
FINISHING DEPARTMENTS

ft online exclusive

www.finishingtodaymag.com

Link to show previews and highlights of RadTech UV&EB 2008 and Electrocoat 2008.

ON THE COVER



Direct-to-metal applications for UV technology are growing, thanks to recent advances in raw materials, UV equipment and manufacturing processes. Photo courtesy of Strathmore Products, Inc. Story on p. 24.

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What Drives You?

Joe Jancsurak, Editor

Having spent 11 years covering the appliance market as editor of *Appliance Manufacturer* (now *Appliance Design*), I'm familiar with the challenges posed by offshore competition, pricing pressures and environmental regulations. And I think they're great.

Why? Because without these drivers, companies wouldn't be nearly as motivated to innovate as they are today. And though I've been editor of *Finishing Today* for only a short while (10 days as of this writing), I am truly impressed by this industry's many advancements and cutting-edge technologies, some of which are covered in this issue.

More on those in a bit.

I'm also excited to be a part of the BNP Media organization once again (as I was when I covered the appliance market). Like you and your companies, BNP and FT are driven to innovate as part of our commitment to continuous improvement.

With that in mind, and beginning next month, look for "At a Glance" feature boxes that will show the challenges, solutions and end results that are being met and achieved by new technologies and advanced processes. And, of course, since we're driven to innovate, we will soon be announcing improvements made to our Innovation Awards program. (See the December 2007 issue or visit us online for the 2007 award winners.)

As for the issue you're holding, here's a sampling of what you can look forward to:

- **Advanced UV technologies responsible for accelerating the development of DTM coatings** is the subject of this month's cover story, "Put the UV to the Metal," page 24, by Kevin H. Joesel of Fusion UV Systems, Inc., Gaithersburg, MD.
- **A cost-effective tumble spraying system for coating small plastic parts** to help manufacturers regain their competitive edge is presented in this month's "Innovation Spotlight," page 20, by Ken Raby of Walther Trowal GmbH and Co., Grand Rapids, MI.
- **Why EB curing is more practical than ever** for such applications as coil coating, molded parts coating, UV curing, optoelectronics applications and narrow web printing is the subject of "The EB Advantage," page 28, by Josh Epstein of Advanced Electron Beams, Wilmington, MA.
- **Energy costs and environmental concerns are fueling demand for e-coat materials** with lower cure temperatures, according to Grant Fry and Tab Semanision of DuPont Performance Coatings, Mount Clemens, MI. In their article, "How Low Can You Go?", page 48, the authors discuss how new developments are meeting market demand for such e-coat materials.

We invite you to "stay tuned" to *Finishing Today* each month and to visit www.finishingtodaymag.com regularly for information on the latest and greatest new technologies, products and applications. And if you'd like to share your comments about something you read in *FT*, or on other industry matters, please e-mail me at the address below.

Cheers!

jancsurakj@bnpmedia.com

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Finishingagenda

MEETINGS, SHOWS AND SEMINARS IN 2008

APRIL 20-23
Southern Society for Coatings Technology (SSCT) 2008 Annual Technical Conference, Sandestin Beach and Golf Resort, San Destin, FL, 800.969.1606, dr@mccanda.com

21-23
11th Annual Coatings for Plastics Symposium, Westin Yorktown Center, Lombard, IL, 888.530.6714, *www.coatingsforplastics.com*

22-24
2008 NASF Washington Forum, L'Enfant Plaza Hotel, Washington, DC, 202.457.8404, cclark@nasf.org, *www.nasf.org*

28-29
MacDermid Electroless Nickel School, Irvine Marriott, Los Angeles, CA, 203.575.5680, lriley@macdermid.com, *www.macdermid.com/industrial*

MAY 1-2
MacDermid Electroless Nickel School, Marriott Suites Dallas Market Center, Dallas, TX, 203.575.5680, lriley@macdermid.com, *www.macdermid.com/industrial*

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

5-6
IHEA Safety Standards & Codes Seminar, Indianapolis, IN, 513.231.5613, *www.ihea.org*

6
Pittsburgh Chemical Day, Pittsburgh Hilton & Towers, Pittsburgh, PA, 800.890.2436 *www.pittchemday.com*

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

JUNE 3-5
American Coatings Show and Conference, Charlotte Convention Center, Charlotte, NC, 202.462.6272, cmatthews@paint.org, *www.american-coatings-show.com*

15-18
Aluminum Coatings - XXI Century, Hotel Slovenia, Portorose, Slovenia, *http://eng.alusil.ru/aluminium_coatings_eng*

15-18
ASTM International Committee D01 on Paint and Related Coatings, Materials, and Applications, Hyatt Regency Vancouver, Vancouver, BC Canada, 610.832.9738, jadkins@astm.org, *www.astm.org/COMMIT/D01.htm*

16-18
SUR/FIN 2008, Indiana Convention Center, Indianapolis, IN 202.457.8404, *www.sur-fin.net*

JULY 8-11
Polyurea Development Association Applicator Spray Course, Houston, TX 816.221.0777, *www.pda-online.org*

SEPTEMBER 10-11
Powder Coating Forum, Cleveland, OH 888.530.6714, *www.pcimag.com/pcforum*

14-16
Southern Metal Finishing Conference, Francis Marion Hotel, Charleston, SC, 704.995.2263, *www.surfacefinishingacademy.com*

22-25
COATING 2008, Indiana Convention Center, Indianapolis, IN, 513.624.9988, lmuck@one.net, *www.thecoatingshow.com*

APRIL '08

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

BMW to Expand SC Factory, Paint Shop

BMW is investing an additional $750 million in its upstate South Carolina factory to add 1.5 million ft^2 and 500 new jobs on-site to produce three models and to increase production capacity to 240,000 units by 2012. The investment is the largest ever announced for the Spartanburg County factory, increasing investments of the BMW Group in its South Carolina operations to $4.2 billion.

The three-year construction project includes a new 1.2-million-ft^2 assembly facility north of the existing factory to accommodate the next generation BMW X3 sports activity vehicle. In addition, the paint shop will expand by about 80% or 300,000 ft^2, and the existing body shops will be renovated.

"Centralizing our know-how for BMW X models in Spartanburg will enable us to work more efficiently, thus supporting our long-range corporate strategy. In addition, it was a logical step for the BMW Group as a global player to increase production capacity in its largest market," said BMW Board Member Frank-Peter Arndt.

For more information about the expansion, visit www.bmwgroup.com.

BASF Coatings Supplies E-Coats for Arçelik A.S.

BASF Coatings Spa is now a supplier for Arçelik A.S., Europe's third largest producer of household appliances. The Turkish company, with production sites in Romania, China and Russia, has a 50-year history in the household appliance sector.

The agreement with BASF Coatings Spa calls for an initial delivery of liquid e-coat paints for coating dryers produced on the new production line at the plant in Çerkezköy, Turkey. Up to 80% of the appliances are destined for export.

For more information about the agreement, visit www.basf-coatings.com.

Sherwin-Williams and Becker Trade Subsidiaries

The Sherwin-Williams Co. has acquired Becker Powder Coatings Inc. in North America, a subsidiary of AB Wilh. Becker based in Sweden. Headquartered in Columbus, OH, Becker Powder Coatings Inc. produces powder coatings applied to appliances, metal furniture, fixtures, equipment and electronic products manufactured

Letter to the Editor

Aluminum Castings and Porosity


Finishinganswers

Ask Joe Powder

Regarding Joe Powder's answer about coating the aluminum castings on sailboats (March 2008, "Ask Joe Powder"), I would like to add that the finisher should have the castings impregnated with resins to eliminate (fill) the porosity. As a materials and processes engineer for more than 30 years, I have been heavily involved with coatings, corrosion and castings. The U.S. Department of Defense mandates resin impregnation for all aluminum castings used in the military specifically for this reason — porosity in the castings causes coating failures and corrosion. Even when the castings are dried, the porosity traps air. I have seen it happen often.

Impregnating castings with resins before powder coating can cause blistering in the bake oven. However, such problems can be avoided by telling the resin manufacturers the temperatures at which the coatings will be baked/fused, and making sure that the resin used is one that will withstand those temperatures. —*Jerry Mandel*

Joe Powder responds: *In my experience, there are only a few materials that can adequately fill imperfections in a casting or metal surface. One is called Lab-metal® (Alvin Products), the other All-Metal® (US Chemical). Both work, but I have had the best results with All-Metal.*

We welcome your feedback! *Send your letters to jancsurakj@bnpmedia.com*

throughout North America. The company has more than 45 employees and sales of approximately US$14 million.

Simultaneously, AB Wilh. Becker has acquired the North American coil coatings business of Sherwin-Williams and related assets. The business will be integrated into Becker Specialty Corp., a Chicago-based subsidiary of AB Wilh. Becker. Becker Specialty's products are used in construction applications that employ coated steel and aluminum substrates. As part of the acquisition, Becker Specialty Corp. also acquired Sherwin-Williams SuperClad® Plastisol coil coating technology.

For more details, visit www.sherwin.com or www.beckers-bic.com

MacDermid to Host Electroless Nickel Schools

MacDermid will host two Electroless Nickel Schools in the coming weeks. The first school will be held in at the Irvine Marriott in Los Angeles, CA, April 28-29. The second school will be held at the Marriott Suites Dallas Market Center in Dallas, TX, May 1-2. The comprehensive two-day seminars will discuss all aspects of EN, including process control, equipment design, applications, troubleshooting, environmental drivers, and economic considerations. The course, recommended for anyone who works with electroless nickel, uses a building block approach to training to appeal to all levels of expertise.

There is no charge to attend the seminars, and all meals are provided by MacDermid. Students are responsible only for travel and lodging expenses.

For more information or to register, contact Lizz Riley at lriley@macdermid.com or 203.575.5680. MacDermid's website is at www.macdermid.com.

Columbia Chemical Corp. Expands Operations

Columbia Chemical Corp., a supplier of zinc and tin plating additives, has moved into its new headquarters building, located at 1000

INDUSTRY & COMPANY NEWS

Western Dr., Brunswick, OH. Construction on the $4 million building project began in August. The four-acre land parcel is in the same industrial park where Columbia resided for 16 years. The new headquarters doubles the company's space to 44,000 ft^2 of offices, labs, manufacturing and warehousing area.

"We needed the extra space to handle increasing demand for proprietary chemicals for the zinc plating industry," says Columbia President Bill Rosenberg.

For more information, call 330.225.3200 or visit www.columbiachemical.com.

Dow Corning to Present Research on Anti-Fingerprint Coatings

Dow Corning Corp. will present research findings in "New Anti-Fingerprint Coatings" at the 11th annual International Coatings for Plastics Symposium this April. The presentation, based on work by Dow Corning and Daikin Industries, Ltd., will focus on recent advances in the hybridization of perfluoropolyether polymers modified with organofunctional silanes. During their research, Dow Corning and Daikin found that creating an anti-fouling surface on plastics has many advantages, including a reduced need for cleaning, better aesthetics and improved safety.

The Coatings for Plastics Symposium, sponsored by *Paint & Coatings Industry* and *Finishing Today* magazines, explores the emerging trends in the coatings for plastics industry and defines technologies that will have an impact on the industry's future. The event will take place April 21-23, 2008, at the Westin Yorktown Center in Chicago, IL.

For more information about the symposium, visit www.coatingsforplastics.com. The website for Dow Corning is at www.dowcorning.com/plastics, and Daikin's website is at www.daikin.com.

Electrocoat 2008 Hosts Big Prize Giveaway

Electrocoat 2008 will host a Big Prize Giveaway on the final day of the conference to reward attendees for their support of the event. Electrocoat Association member companies will sponsor prizes awarded in their name. Prizes to date include a 160GB iPod Classic, sponsored by George Koch Sons, LLC; a $500 Best Buy Gift Card, sponsored by BASF; and a Toshiba Satellite laptop and leather carrying case, sponsored by Therma-Tron-X, Inc.

INDUSTRY & COMPANY NEWS

Electrocoat 2008, held May 14-16, 2008 at the Indianapolis Marriott Downtown in Indianapolis, IN, will give attendees the opportunity to learn from suppliers and end users; stay current with new, more efficient methods of managing electrocoat systems; develop cost-saving plans for systems; learn about new technology and applications; and meet and network with industry colleagues. Each morning will open with a keynote speaker during a general session, but then attendees can choose from two educational options for the remainder of the morning. Afternoons may be spent in interactive workshops, meeting in exhibit rooms with suppliers to discuss products and services, or divided between both activities.

For more information on program topics or registration, visit www.electrocoat.org/conference or call 800.950.8020.

PDA Honors Polyurea Project, Product Development

Polyurea Development Association (PDA) honored two companies with Platinum Poster Awards during its Ninth Annual Conference February 12-15, 2008, in Atlanta, GA.

The Platinum Project Award, geared toward companies that apply polyurea, focuses on a specific job or application that displays the exceptional properties of the coating. The 2008 Platinum Project Award winner was Polyval Coatings for its poster, "Changi Waste Water Waterproofing Polyurea Project."

The Platinum Development Award is geared toward advances in polyurea technology, and recognizes the most significant development in the polyurea industry in the past year. The 2008 Platinum Development Award winner was Specialty Products, Inc. (SPI) for its poster, "New Generations of Chemical Resistant Polyurea."

All future PDA poster awards will be named after the late Tom Davis of Visuron Technologies, a long-time pioneer in the polyurea industry and a valuable addition to the Polyurea Development Association.

The next PDA Platinum Poster Awards will be held during the 2009 Annual Conference, scheduled to be held in Albuquerque, NM, in March 2009. For more information, visit www.pda-online.org or call PDA at 816.221.0777.

Partnership Advances Color Measurement Technology

At its annual management conference in February, Akzo Nobel Car Refinishes (CR) presented its Alliance Award to Dr. Georg Schröder, president of BYK-Gardner. The award recognized both BYK-Gardner's innovative work in a joint project on color measurement and its performance as a business partner.

BYK-Gardner is part of ALTANA AG and a subsidiary of BYK-Chemie, a supplier of additives for coatings and plastics. A pioneer since 1924, BYK-Gardner has specialized in developing instruments to measure color, appearance and the physical properties of coatings and plastics.

In 2002, Akzo Nobel Car Refinishes and BYK-Gardner joined forces to gain a deeper understanding of color and appearance. They were joined by Merck, a supplier of pigments, and all three companies launched the TARBAM (Total Appearance Research Byk Akzo Merck) project.

The results brought Akzo Nobel Car Refinishes nearer to its goal of color digitization, embodied in the launch of the BYK-mac. This innovative spectrophotometer has a built-in digital camera able to measure effects like coarseness and glint, as well as color. BYK-Gardner also developed a completely new color-matching system for Akzo Nobel, the Sikkens Automatchic 3, which is expected to be launched soon.

Visit www.carrefinishes.com or www.byk.com for more information.

INDUSTRY & COMPANY NEWS

Allied PhotoChemical Awarded 17th U.S. Patent for UV Technology

Allied PhotoChemical recently received its 17th U.S. patent for a key UV technology. U.S. Patent 7,323,499, issued in January, addresses "UV Curable Silver Chloride Compositions for Producing Silver Coatings." The company now has more than 70 patents reserved solely for UV technology, including UV paint and coatings, UV silver conductive inks, UV dielectrics and lubricants, 100% UV electroluminescent displays and specialized UV formulations, all of which are based on 100% solids technology with no volatile organic compounds (VOCs) or hazardous air pollutants (HAPs).

For more information, visit www.alliedphotochemical.com.

Enthone Opens Advanced Plating Applications Lab

Enthone Inc., a business of Cookson Electronics, recently celebrated the grand opening of its advanced plating applications laboratory located at the company's West Haven, CT, facility. More than 150 guests, including customers, state and local government officials, media and company employees attended the event. A ribbon-cutting ceremony was followed by tours of the applications laboratory and a buffet luncheon.

The mission of the West Haven Applications Laboratory and its staff includes:

- Evaluating and validating Enthone processes prior to beta-site field testing.
- In-depth training and demonstration of process capabilities to Enthone personnel and select customers.
- Identifying and implementing the best processing methodologies and operating windows for Enthone's best-in-class, new and emerging technologies.
- Working collaboratively with key customers to develop unique plating solutions.
- Training the industry's next generation of plating engineers via internship programs established with universities and colleges.

The Enthone ribbon-cutting event.

INDUSTRY & COMPANY NEWS

The West Haven Applications Laboratory also will serve as the central location for the Enthone Americas Plating Academy.

The state-of-the-art laboratory houses multiple high-performance plating lines that enable processing of Enthone functional, decorative and electronic coatings that deliver corrosion protection, wear resistance and superior aesthetics on a variety of parts used in automotive, plumbing, printed wiring board (PWB), and other surface finishing applications.

For more information about the new lab, visit www.enthone.com.

Delta Foremost, Scorpion Select ACCESSA as Distribution Partner

Delta Foremost Chemical Corp. has entered into an agreement with ACCESSA Coatings Solutions in which ACCESSA will serve as the sales and distribution partner of Delta Foremost's Dust Command line. The product line is a water-based, ionically-charged, easily applied liquid that is designed to attract dust and hold it at floor level to improve maintenance, product cleanliness and safety.

Scorpion Protective Coatings, Inc. also has entered into an agreement with ACCESSA Coatings Solutions on its line of Scorpion protective coatings. ACCESSA will serve as Scorpion's sales and distribution partner. The Scorpion line reportedly offers high tensile strength, excellent abrasion resistance, superior elongation, optional high nonskid rating, and excellent UV and weathering characteristics.

For more information, call 800.593.0126 or visit www.ACCESSA.biz.

Sika Corp. Acquires Flooring Business from The Valspar Corp.

Sika Corp. has acquired the commercial and industrial polymer flooring business of The Valspar Corp. According to the company, Valspar Flooring's complete sales and technical support staff have come on board and will remain first points of contact. To ensure a transparent transition, new Sika Industrial Flooring will continue to offer Valspar Flooring products, gradually consolidating Valspar and Sika solutions into Sikafloor™ and Sikaguard™ (wall) lines. Though Sika Industrial Flooring will continue offering Flowfresh® products in the short term, it eventually intends to carry only the Sikafloor Purcem® line of urethane concrete floors.

For more information, call 800.637.7793, e-mail flooring.marketing@sika-corp.com, or visit www.sikafloorusa.com.

FANUC Launches Robot Training Program

FANUC Robotics America, Inc. recently introduced the Certified Education Robot Training (CERT) program, a new certification available to qualified high schools, community colleges and universities. The program certifies instructors at educational institutions to train their students to program FANUC robots.

For more information, call 248.377.7000 or e-mail CERT1@fanucrobotics.com.

Extrusion Coating Technology Chosen for Solar Panels

A leading organic photovoltaic (OPV) materials and process development company has ordered an Advantage Extrusion Coating system from NexTech Solutions, Inc. and FAS Holdings Group, LLC, doing business jointly as NexTech FAS, for integration into a pilot production line. This technology will be used for the development of solar panels in an industry that is predicted to grow to more than $30 billion by 2012, according to industry analysts at BCC Research.

INDUSTRY & COMPANY NEWS

NexTech FAS Advantage Series coating systems, which typically are used in the manufacturing of flat panel displays, can coat complex OPV materials precisely, even at submicron thicknesses, thereby eliminating the waste of expensive materials. This particular system, which will be installed at the company's U.S.-based facility, will include several custom features to specifically accommodate the plant's proprietary process and materials and is designed to work in a fully automated and controlled environment.

In addition to this order, NexTech FAS reportedly has received significant interest from other players in the photovoltaic market to implement the company's know-how, technology and ability to develop custom solutions for companies in this industry.

For more information, visit www.nextechfas.com.

Chrysler Names PPG Top-Performing Supplier

Chrysler LLC recently named PPG Industries the top-performing supplier of exterior systems in the automaker's 2007 Supplier Pentastar Awards. PPG, a leading supplier of coatings and glass products to Chrysler, was honored for performance based on Chrysler's External Balance Scorecard, which rates suppliers on quality, technology, cost and delivery.

For more information, visit www.ppg.com.

DuBois Chemicals Earns Recognition from John Deere

DuBois Chemicals has earned recognition as a Partner-level supplier for 2007 in the John Deere Achieving Excellence Program. The Partner-level status is Deere & Co.'s highest supplier rating. This is the second year in a row that DuBois has received this award from John Deere. The Cincinnati-based company was selected for the honor in recognition of its dedication to providing products and service of outstanding quality, as well as its commitment to continuous improvement. DuBois Chemicals is a supplier of indirect materials to John Deere's operation in Waterloo, IA.

For more information, visit www.duboischemicals.com.

Raymor Buys SE Techno Plus

Raymor Aerospace Inc., a wholly owned subsidiary of Raymor Industries Inc., has purchased SE Techno Plus Inc., a company specializing in the manufacturing, repair and precision grinding/superfinishing of industrial and aerospace components. This strategic acquisition reportedly will allow Raymor Aerospace to implement one-stop-shop facilities for its coating services in the aerospace and industrial sectors and develop a larger market presence for Raymor's other subsidiaries. According to the company, certain major manufacturers in the aerospace sector for which Raymor has recently been accredited require this additional service.

For more information, visit www.raymor.com.

Mark Zimmerman

Liquid Equipment Specialist, Wagner Systems, Inc.

Wagner Systems, Inc. has hired Mark Zimmerman as liquid equipment specialist. Zimmerman brings many years of experience to Wagner in the paint and powder coatings industry. As a specialist in Wagner wet application equipment and with more than 10 years of experience in the wet paint industry, he will be responsible for developing relationships with new distributors, as well as supporting liquid sales to end users. Zimmerman will also be responsible for training and demonstrations in the new liquid lab facility located at Wagner's U.S. headquarters in Elgin, IL.

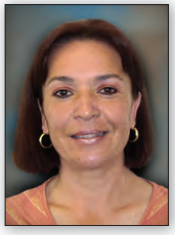
Howard Wright

General Manager, Global Coil and Extrusion Products (COEX), PPG Industries

PPG Industries' industrial coatings business has promoted Howard Wright to general manager, global coil and extrusion products (COEX). Wright will manage the company's global COEX business, including integration of the recently acquired SigmaKalon coil coatings business. He also will pursue growth opportunities in the Asia-Pacific region and further develop recent market gains in the Americas. Wright joined PPG in 1994 and has progressed through sales, product management and business development positions within PPG's automotive coatings, automotive glass and industrial coatings groups, serving most recently as business director, coil and extrusion coatings.

Martha Horner

Sales Account Manager, MetoKote Corp., Inc.



MetoKote Corp., Inc. has appointed Martha Horner as sales account manager. Horner will act as the primary liaison with current and future customers for the company's new San Luis Potosi, Mexico Regional Coating Service Center, which is scheduled to start production in April 2008. Prior to joining MetoKote, Horner spent seven years as an account manager of Industrial Coatings Mexico at PPG Industries de Mexico for the San Luis Potosi, Queretaro, Silao, Aguascalientes and Guadelajara regions.

Dr. Clifford Schoff

2008 Tess Award Winner

Dr. Clifford K. Schoff, formerly of PPG Industries and now a private consultant, will receive the American Chemical Society's Roy W. Tess Award in Coatings for 2008. Schoff is recognized as one of the world's leading experts in the area of coating defects, electropaint-substrate interactions, paint flow and rheological measurements, mechanical properties, and cure of coatings. He has contributed more than 40 papers, articles and chapters to the coatings literature. He has led ASTM Subcommittee D.01.24 on Physical Properties of Liquid Paints for over 20 years, has written numerous ASTM test procedures and has championed the use of ASTM standards. He currently is the secretary of ASTM Committee D01 on Paints and Related Coatings, Materials and Applications. Schoff will receive the Tess Award from Dr. Dean Webster, chair of the PMSE Division, on August 18, 2008, during the 236th National Meeting of the American Chemical Society in Philadelphia, PA.

John Shaffer

Business Director, COEX Americas, PPG Industries

PPG Industries' industrial coatings business has promoted John Shaffer to business director, COEX Americas. Shaffer will develop and execute marketing and growth strategies throughout North, South and Central America, including managing all commercial and operational activities and directing the business' product and technology portfolios. Shaffer joined PPG in 1991 and has been promoted through sales, product management and marketing positions, including his most recent role as zone manager for PPG's industrial coatings business.

Greg Bocchi

Resigning as Executive Director of PCI

After more than 24 years of service to The Powder Coating Institute (PCI) and the coatings industry, Greg Bocchi will resign from the position of PCI executive director, effective April 30, 2008. Bocchi has accepted the position of president of The Vinyl Institute in Arlington, VA, which represents manufacturers of vinyl resin and vinyl systems additives. PCI is expected to announce a replacement within the next several months.

Valspar Makes Executive Appointments

The board of directors of The Valspar Corp. has appointed **Gary E. Hendrickson** as president and chief operating officer. The company also announced that **Paul C. Reyelts**, executive vice president and chief financial officer, will retire at the end of 2009. **Lori A. Walker**, currently vice president, treasurer and controller, has been appointed senior vice president and chief financial officer. Valspar also appointed **Tracy C. Jokinen** vice president and controller, and **Tyler N. Treat** vice president and treasurer.

Uncle Sam Wants U…V

By Paul Mills

For a long time, I've kept a well-measured distance from all programs involving space and the military. Probably because I am horrible at remembering acronyms. For me, AOL is where I log on to get my e-mail, but at Goddard it stands for Airborne Oceanographic LIDAR, while to military brass it signals an aircraft operating limitation.

Still, I have long marveled at the impact that government programs have had in spinning off technological innovation to improve my everyday life. The space race has given us conveniences from Nomex to the smoke detector, from Tang to the cordless drill. The military has blessed us with everything from the microwave oven to the jet engine and those ridiculous Hummers. My life changed forever the first time I logged onto ARPANET, the Defense Department project that evolved into today's ubiquitous Internet.

I have long marveled at the impact that government programs have had in spinning off technological innovation to improve my everyday life.

Our own paint industry has benefited from coatings developed for space and military applications. NASA developed launch pad coatings that are now used to protect the Statue of Liberty. Space-age hardcoats for optics developed at NASA Lewis Research Center in my hometown of Cleveland have been licensed to Ray Ban to protect my sunglasses.

But until recently, it seemed like military coatings have been a tad removed from my everyday existence. Aside from camouflaged ATVs and hunting gear, the average American doesn't have much need for (or access to) military coating technology. While the Army's Aberdeen Proving Ground routinely assesses Chemical Agent Resistant Coatings (CARCs), most folks just don't need a paint that withstands the rigors of these exotic materials. And while laser-invisible stealth coatings might be handy for a hot-footed teenage speedster, he is not likely to get his hands on that technology any time soon.

Recently, however, I discovered that my world and the military world have in common my favorite acronym: UV

Fast and Green

Take, for example, an award made by the Department of Defense through their Environmental Security Technology Certification Program (ESTCP, of course) to fund research into the potential of ultraviolet (UV) powder as an alternative coating system for repairing military aircraft.

"There are several forces at work," explains Christopher Geib, a program manager at Science Applications International Corp. (SAIC), a large contractor providing expertise to the military, intelligence community and homeland security.

"The military is going green," says Geib. (Not the fatigue kind, the environmental kind.) And, at the same time, there is a pressing need to speed up the paint process — the "dry-to-fly" time, as the Air Force calls it.

Geib began working with low-temperature powder a few years ago under a Strategic Environmental Research and Development Program (SERDP to you and

me). But Geib feels that UV is "a natural progression" of coatings development because of its rapid cure and low temperature.

The following excerpt from a current technical order points out a problem that watching paint dry has on our military readiness:

> **5.6.3 Curing of Finishes.** After painting, allow aircraft finish system to cure in a dust-free temperature controlled atmosphere for a sufficient time prior to placing in service. In the absence of accelerated curing, the aircraft shall not be flown for at least 72 hours after painting. In general, all painted aircraft should be handled, taxied, etc., as little as possible during the first week after painting.

"UV coatings could allow aircraft to be cured in minutes rather than hours and days," says Corey Bliss of the Air Force Research Laboratory at Wright Patterson Air Force Base in Dayton, OH.

Reduced cure time added to the environmental compliance of UV materials made UV coating attractive enough to Bliss and his colleagues that he spearheaded the proposal to evaluate UV powder. "A typical conventional USAF coating today contains from 340 to 420 grams/liter of VOCs," explains Bliss. UV powder coatings are VOC-free.

Reinvigorating Research

The UV powder program is just one of a number of current military initiatives to integrate UV coating technology into the U.S. arsenal. In January, Concurrent Technologies Corp., another major military contractor providing coating expertise, held its 3rd Advanced Aerospace Coating/Decoating Technical Symposium. At times, the event resembled a RadTech International conference with UV dominating presentations on topics ranging from color-code marking of bullets to painting helicopters. It was clear from the program that there has been remarkable progress in formulating coatings to meet the demanding rigors of stringent MIL specifications.

While the military began with hopes that Conventional Off-The-Shelf (yes, COTS) technology would meet its needs, the shortcomings of conventional products led to R&D projects that have advanced the technology to the edge of current UV capabilities, including coatings that can now withstand abuse from the most caustic solvents such as Skydrol™. It's only been through the deliberate and generous outlay of funding through the daunting maze of ESTCP, SERDP, SBIR and STTR that such progress has been possible.

This help from Uncle Sam could not have come at a better time, since paint industry R&D spending (particularly in the UV arena) has been woefully lacking for years.

UV powder, which seemed to rocket skywards in the late 1990s, turned into a dud in the wake of the 2000-2001 economic downturn, never to fully recover. An early success, the technology soon stalled from a lack of support and funding by the companies that supported it at the outset. Now the Air Force support might give UV powder new wings — a phoenix rising again from the ashes of corporate R&D.

Hallway conversations at depots and bases turn to the flexible arrays of UV LEDs, robotic curing, and super-durable UV waterborne formulations using nanocoating technology.

A Valuable Gift

While having the government step in to help move UV technology forward is enormously satisfying for those of us prone to frustration, there is a decided downside to the corporations watching idly from the sidelines. In her presentation "Intellectual Property: Rights and Responsibilities of Government Employee Inventors," Mona Arvidson of the Johnson Space Center's Technology Transfer Office reminds her audience that "what is available to everyone is of interest to no one," a quote Arvidson attributes to Mark Bloom, a patent attorney at the Cleveland Clinic Foundation. The clinic is renowned among patients for its leadership in heart surgery and among attorneys for its prowess in the licensing of intellectual property. Since in battle parlance, "to the victor go the spoils," it's likely that many a patent will be forfeited as industrial practitioners subrogate their role to the government.

For manufacturers, UV innovations might become another spinoff gift, like ski boots or ear thermometers — only this technology promises to save energy, space, and possibly American manufacturing jobs at a time when marginal improvements in productivity and profit can make the difference between surviving and closing up shop.

In 2005, The Berkeley Roundtable on the International Economy, in a paper titled "From Spin-off to Spin-On: Redefining the Military's Role in Technology Development," observed that "the technology base from which American firms compete in today's commercial markets is the same technology base that determines whether or not the United States is prepared to respond to the national security concerns of the future. Americans can conjure many potential threats to their well-being, but only one technological arsenal with which to meet them."

From computer chips to lasers, the bonds between military and industrial technology continue to draw tighter. UV technology is just part of the evolutionary chain in each of these areas. ft

Paul Mills *is an industry consultant working primarily in new coatings technologies, including UV cure and antimicrobial coatings. He consults to a number of coating and equipment suppliers and is president of UV Robotics, a company specializing in robotic UV curing of complex and large parts. Paul is a board member of RadTech and is a frequent contributor to* Finishing Today. *He can be reached at* **pmillsoh@aol.com**.

What do you think? E-mail your opinion on this column to **jancsurakj@bnpmedia.com**

Tumble Spraying Plastics

A new mass-finishing system for small plastic parts can help manufacturers substantially reduce labor costs and eliminate coating waste due to overspray.

BY KEN RABY
Walther Trowal

The competitive pressures from overseas markets make generating a profit extremely tough for U.S. manufacturers. Manufacturers of plastic parts that need to be coated face a particularly difficult challenge. Conventional finishing methods such as hanging small parts on racks that must go through a large paint system or robotically spraying individual parts often require people to handle each part before and after it is coated, which increases labor costs. Additionally, while coating material costs are relatively low, the large amount of waste from overspray increases the amount of coating required to complete the finishing process and can dramatically reduce profitability.

Recently, a new tumble spraying system* was developed to eliminate these parts coating issues and help manufacturers of plastic products regain their competitive edge.

Tumble Spraying Basics

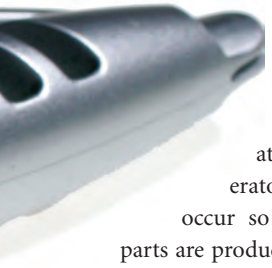
The new system works by tumbling small parts in an elliptical-shaped barrel beneath a spray nozzle or nozzles (see Figure 1). Heated, prefiltered forced air is injected into the spray zone to help the coating adhere to the parts. Since parts will tumble differently in the barrel depending on their geometry and weight, the inclination of the barrel can be adjusted from 0 to 35 degrees to "customize" the coating angle for each batch of parts and further optimize the coating application. The barrel also can rotate 125 degrees in either direction to allow for easy part loading and unloading. The barrel can run anywhere from 2-30 rpm, and the processing temperature can

ABOVE: These plastic parts were coated in the tumble spraying system.

*Rotamat Small Parts Coating System, available from Walther Trowal, Haan, Germany and Grand Rapids, MI

range from ambient to 300°F, depending on the parts and the finish being applied.

An exhaust fan with a post filter allows negative pressure to be maintained in the spray area where the parts are being coated. A Fanuc PLC controller monitors every aspect of the coating process and immediately notifies the operator if any deviations occur so that no off-spec parts are produced. The use of an elliptical-shaped barrel, rather than a conventional octagon, prevents parts from riding only along the outside edge of the barrel and ensures even paint coverage on all areas of the parts. When the process is complete, the barrel is tilted to unload the completely dry parts, which then can be placed directly into a shipping container or moved to an assembly area for further processing.



The coating used in the tumble spraying system can be solvent- or water-based.

Efficient Fixture Finishing

One application for this technology is in coating plastic furniture parts. In a conventional coating process, the parts would be hung on a rack and sprayed. A substantial amount of labor is required to hang the parts on hooks, and as much as 70% overspray can occur during the finishing process.

The parts shown in Figure 2 are ⅞ x 1 x 9⁄16-in.-thick. In a test, approximately 4,230 parts similar to these were loaded into a tumble spraying system. The heated air warmed the parts up to about 140°F. Spray nozzles applied multiple thin layers of the coating material to the parts until the desired thickness and coverage had been achieved. The desired results for these plastic parts took about 45 minutes from start to finish. Only 200 grams of coating material, diluted with additional 300% clear water, were required to coat all of the parts, with hardly any overspray. Figure 3 (p. 22) shows a finished part.

Some companies in Europe have already begun to embrace this new technology for coating furniture and home furnishing components. One goal in these industries is to produce inexpensive plastic door handles and fixtures that are coated to look like high-end shiny aluminum. Several manufacturers had originally invested several million dollars in a robotic coating operation that picked up and sprayed each drawer handle individually so that all areas of the parts were coated with no touch marks, smearing of the coating or orange peel defects. These companies were using a very expensive paint to achieve the required "mirror aluminum" look, but most of the coating was being lost through overspray.

By turning to the new tumble spraying system, these companies are using the same coating material that was being applied by the robotic system to achieve the same high-quality mirror aluminum finish, but with substantially less coating material and much higher coating efficiencies. An example of a processed coat hook with a mirror aluminum finish is shown in Figure 4 (p. 22).

Toys and Other Applications

The coating used in the tumble spraying system can be solvent- or water-based (or epoxy-lacquer based for metal parts). The system also can be used to coat one part with two different materials in one process in order to achieve the desired finish. For example, one manufacturer needed an "an-

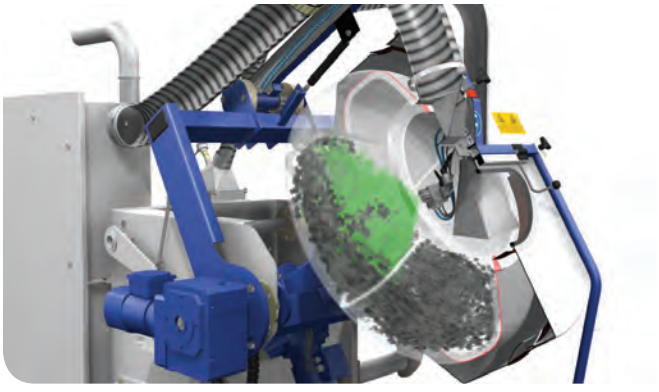


Figure 1. The system works by heating and tumbling small parts in an elliptical-shaped barrel beneath a spray nozzle or nozzles.

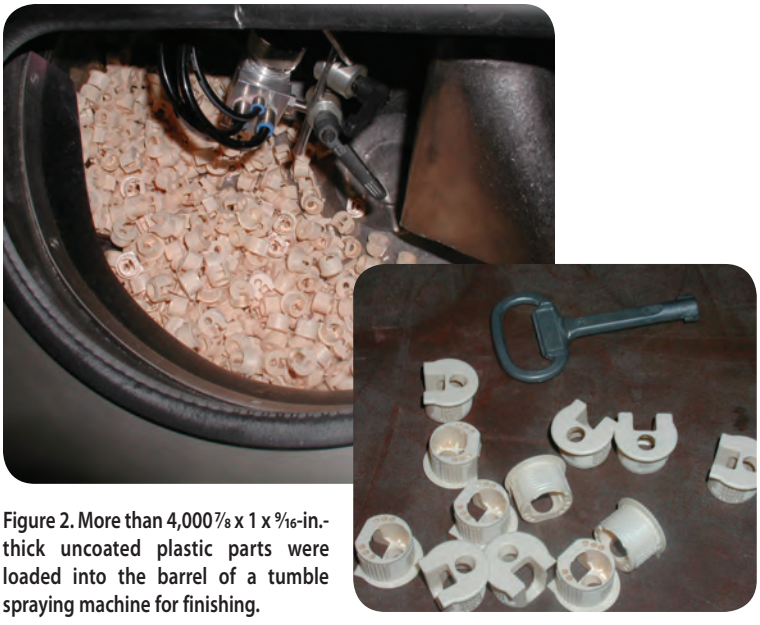


Figure 2. More than 4,000 ⅞ x 1 x 9⁄16-in.-thick uncoated plastic parts were loaded into the barrel of a tumble spraying machine for finishing.

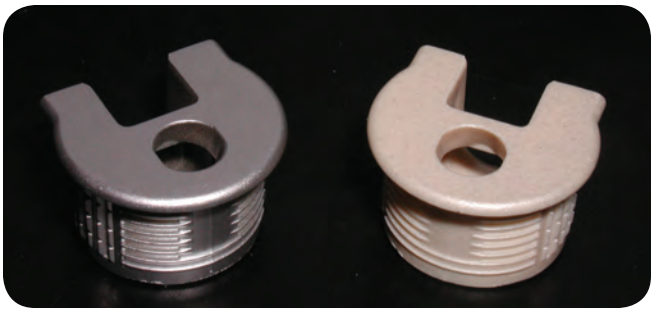


Figure 3. A finished part is shown on the left.

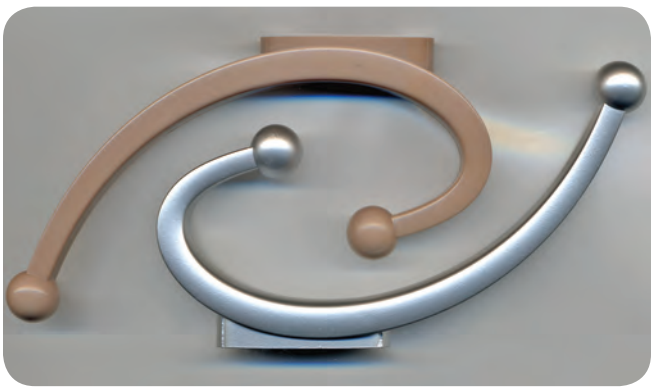


Figure 4. An example of a processed coat hook (bottom) with a mirror aluminum finish.

tique" finish on a small plastic toy. The tumble spraying system was set up to use two pressure vessels and two nozzles for this application. The uncoated toy shields enter the machine, and a very specific amount of one coating is applied through one nozzle, followed by a drying cycle. A specific amount of a second coating is then applied through the other nozzle to create the required antique look. As soon as the coating process is finished, the parts are ready to packed and shipped. They only need to be touched twice — once to be loaded into the machine, and the second time when they are unloaded and packed into a box.

There are some restrictions on what types of plastic material can be coated — for example, most crystalline plastics will need plasma pretreatment to etch the surface prior to coating. However, plastic parts made from acrylonitrile butadiene styrene (ABS), polycarbonate and polystyrene can be coated easily in the tumble spraying system. The machine also has been used successfully outside of the plastics industry for the decorative coating of metal parts, applying colored slide coatings to rubber "O" rings for easier assembly and identification, and finishing metal parts with anti-corrosion coatings.

As manufacturers search for ways to lower labor costs and reduce waste in their finishing operations, new finishing alternatives such as tumble spraying provide an attractive solution.

Ken Raby *is North American sales manager for Walther Trowal GmbH and Co., Grand Rapids, MI. For more information about the tumble spraying technology, call 616.455.8940, e-mail k.raby@walther-trowal.com or visit* **www.walther-trowal.com**.

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Put the UV to the Metal

Technology advances and improved system designs are making UV curing a viable option for complex metal finishing applications.

BY KEVIN H. JOESEL
Fusion UV Systems, Inc.

Every company in every industry is facing challenges due to global competition and ever-increasing energy costs. It is certainly no different for the industrial coatings industry. As companies search for ways to improve efficiency and competitiveness, new techniques and processes are being scrutinized for their ability to increase productivity while decreasing energy consumption.

Ultraviolet (UV) curing technology is being chosen at an increasing rate to meet these challenges and improve profitability through lower initial costs and operational expenses while increasing throughput and first-time-quality. Not only does UV technology offer direct savings, but it also permits the development and adoption of new techniques and finishing concepts, such as cellular finishing, that were not economically viable with more traditional finishing technology.

It has been difficult to implement a cellular finishing concept economically. In the case of thermal systems, it is well known that the best economies are achieved through large finishing systems. Line density — specifically in the oven — is the primary driver. The most efficient oven arrangements are those that minimize the surface-area-to-volume ratio. Heat losses occur through oven openings, roof, walls and the floor. By increasing the volume, you decrease the relative heat losses. With UV curing technology, openings and enclosure surface area have no effect. The primary challenge is to provide adequate space between the parts and have the parts arranged/oriented in a way that maximizes the UV energy exposure to cure the coating with the minimum number of lamps.

ABOVE: Coatings on oil filters are cured with UV technology. Photo courtesy of Strathmore Products, Inc.

The earliest and widest adoption for UV-cured technology was in web-based or flat-line applications due to the ease with which the coating is exposed to minimum UV energy to achieve cure. Many of the early applications were limited to clearcoats or thin pigmented coatings used in operations such as printing, where performance requirements were minimal but high processing speeds were desired. Over the decades, advances in raw materials, UV equipment and manufacturing processes have resulted in adoption by industrial coating applications for three-dimensional (3D) parts, including direct-to-metal (DTM) applications.

Formulating Concerns

A fundamental difference between traditional thermal coatings and UV coatings is the strong interdependency between the curing conditions and the formulation. The UV emission source (lamp) is a critical component of the formulation. Three important aspects must be considered by the formulator regarding the optical properties of a coating — 1) getting the UV energy to the substrate to achieve full coating cure, 2) minimizing competition or interference of the UV energy with other noncuring components of the formulation and 3) maximizing the absorption of UV energy by the photoinitiator. Pigments and other constituents absorb some of the UV energy, making through-cure a challenge.

Several key raw material developments have helped significantly, including photoinitiators that absorb in the longer UV wavelengths, hyperbranched oligimers and nanomaterials. Photoinitiators that absorb in the longer wavelengths minimize the competition of energy with the pigments in the coating. It also has been known for years that longer UV wavelengths penetrate deeper into pigmented coatings. Hyperbranched oligomers and monomers achieve a high crosslink density with a minimum of shrinkage, maximizing adhesion to the substrate and increasing corrosion resistance. A review of product literature and patents also shows that the use of nanoparticles improves coating performance with minimal interference with the UV energy employed for curing.

Applications

The applications of UV technology in metal finishing vary widely from shafts and cylinders to complex shapes, such as portable propane gas cylinders, hydraulic cylinders, motor assemblies, oil filters, and underhood automotive parts such as damper pulleys. Of course, not all applications are candidates for UV curing. Asking several key questions can help determine whether processes lend themselves to UV:

- **Are the part surfaces easy to illuminate?** The critical element here is the shadow areas on the part and its complexity. Parts that are convex in nature and with few or small appendages are ideal.
- **Is there a large variation in the parts to be cured?** The most cost-effective solutions are those with a minimum of variation. Typically, if two of the three dimensions have low variation, then there is a high probability of success.
- **Are the color options limited?** If a wide variety of colors are used, then providing the best UV spectrum might be difficult.
- **How does the UV process fit with upstream and downstream processes?** Matching productivity with cells before and after UV curing is a primary concern. If the finishing/curing of the coating is a bottleneck in your operations, then UV curing has to be a key technology candidate.

UV Process Considerations

When designing the UV curing process, the primary concern is how the optics of the lamp relate to the geometry of the part to provide the UV energy required by the curing

A 100% solids UV coating on a hydraulic cylinder. Photo courtesy of Strathmore Products, Inc.

A 100% solids UV coating on a metal pulley. Photo courtesy of Allied PhotoChemical, Inc.

process window. Though this may be a complex problem, a number of standard solutions are used. They can be broken down into the following groups:

- **Multiple arrays of UV lamps.** This is the most common and most flexible solution. The lamp array usually is designed to provide UV energy to a defined part window.
- **Single lamp or one array of multiple lamps.** This solution is used for simple shapes or for one- or two-dimensional substrates.
- **Automation of the lamp(s).** This can be as simple as a lamp or an array of lamps rotating on an axis or moving in a single plane, or as complex as a UV lamp mounted on a robot.
- **Movement of the part.** Lamps usually are fixed.
- **Hybrid systems.** Hybrid systems use a combination of fixed lamps with lamps that have some movement.

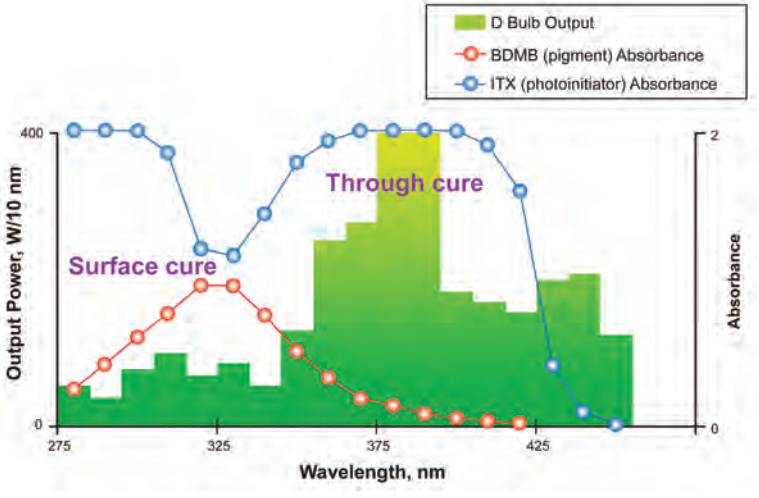

Figure 1. Dark or black coatings commonly are cured with a single D bulb.

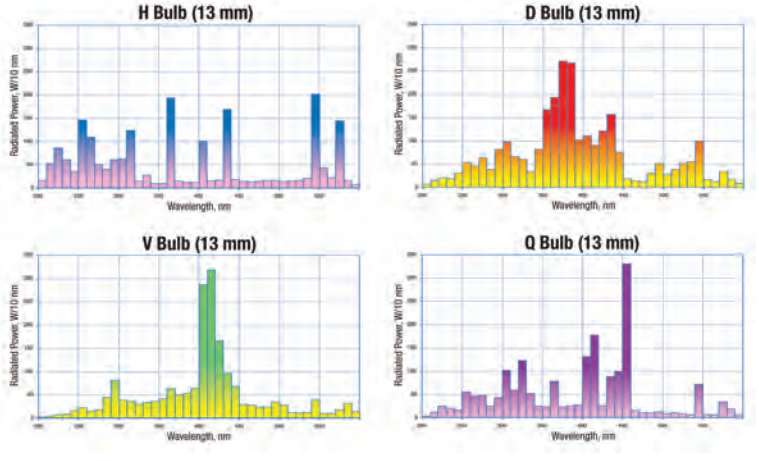

Figure 2. Long-wavelength D, V and Q bulbs more easily penetrate coatings and are used to achieve through-cure, while the shorter-wavelength exposures of H bulbs enhance surface cure.

The curing of the pigmented systems usually comes down to two different strategies: using a single bulb or using a dual-spectrum cure achieved by exposure to two different bulb types, sequentially.

Single bulbs for pigmented systems most commonly use a D bulb. This type of cure is relatively common with dark or black coatings and is demonstrated in Figure 1.

Often with DTM coatings, using a single bulb will not meet the performance requirement, and a dual-spectrum cure is needed. In some cases, typically with whites or pastels that use a significant amount of titanium dioxide, the best curing conditions are achieved using a long-wavelength bulb (most commonly a V bulb). In almost all cases, the V- or D-bulb cure is followed by an H-bulb cure. The long wavelengths more easily penetrate coatings and are used to achieve "through cure," while the H-bulb exposure enhances surface cure. Figure 2 illustrates the differences between the various bulb types. Again, the primary factors are color and film thickness.

A critical aspect of the UV process is cleanliness. The UV system is an optical system, and contamination of the lamp system must be minimized to maintain the peak output and a consistent UV output. Ensuring cleanliness can be a challenge in an environment where metalworking lubricants and general shop dust particles are prevalent. Consideration of the air handling needs such as filtration, air source (outside is preferred) and cooling exhaust is crucial in the process design. Isolating the cooling air from the shop environment is strongly encouraged.

Cellular Finishing

Manufacturing operations increasingly have been adopting cellular manufacturing techniques to maximize productivity and minimize waste by linking manual and machine operations. Process balancing is a key consideration. In the case of finishing, the idea is to have smaller finishing lines in the same scale as other manufacturing operations, such as molding. UV technology allows much smaller finishing systems to be used.

Figures 3 and 4 show an example of a four-walled finishing cell with an internal turntable that indexes from station to station. The unit has self-contained spray application, air handling, liquid handling and UV curing. The size varies depending on the part envelope; in this case, the cell is approximately 8 x 8 x 8 ft. In one station, the parts are loaded and unloaded. The second station is where the coating is applied, and the part then indexes to the UV curing station.

Parts are finished with a 100% solids coating achieving >90% transfer efficiency. The gun tracks up the part as is the part rotates on the turntable. The part is presented to the UV curing lamps shown in Figure 4. In this case, the lamps have the ability to scan up and down as the part rotates to accommodate parts of varying height.

Figure 3. This four-walled finishing cell has self-contained spray application, air handling, liquid handling and UV curing. Image courtesy of Lesco – A Division of AUV.

Another key advantage to UV curing in cellular manufacturing is that products can be finished with temperature-sensitive components such as seals, gaskets, and plastic components already on the part. In most cases, the finishing step can become the last step of the assembled product prior to packing.

Performance Specifications

One of the recent major achievements has been the success of formulators to meet the corrosion and appearance requirements for a variety of substrates, such as untreated and phosphate-treated steel, galvanized steel, and aluminum. All of these applications must meet aesthetic requirements, but the primary performance requirement is corrosion resistance. A typical requirement for corrosion resistance is salt fog resistance (ASTM MB117) of 250 to 1,000 hours. DTM UV coatings are available that meet these requirements.

Another advantage of a UV-cured coating is that 100% of the properties are achieved upon cure. UV coatings are usually harder and cooler after curing, making the part ready for packing and shipping significantly faster.

The typical film thickness ranges from 0.5 to 2.0 mils. Film thickness control is a critical process parameter for UV coatings, making it highly desirable to automate the application process. With UV coatings, the thicker the coating, the more UV energy usually is required to maintain productivity.

Proven Technology

More than 20 years ago, UV coatings were starting to be adopted by the metal tube and pipe industry. Over the same timeframe, UV-cured coatings on 3D plastic parts have become commonplace, demonstrating that proven UV process solutions have been developed. The success of UV technology in these market sectors, coupled with the recent advances in raw materials, is accelerating the development of DTM coatings that meet market and customer performance requirements that a few years ago were deemed too difficult. With continued developments and cooperation among the stakeholders, the growth of the DTM application is very promising. ft

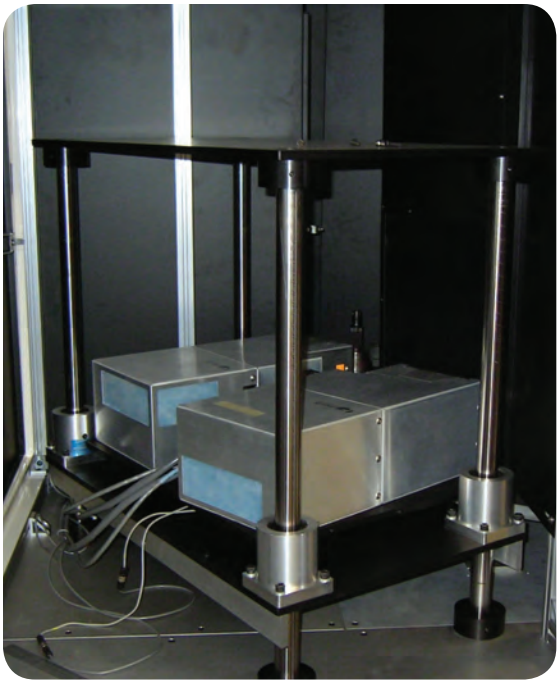

Figure 4. Each part is presented to the UV curing lamps in the finishing cell, and the lamps have the ability to scan up and down as the part rotates to accommodate parts of varying height. Image courtesy of Lesco – A Division of AUV.

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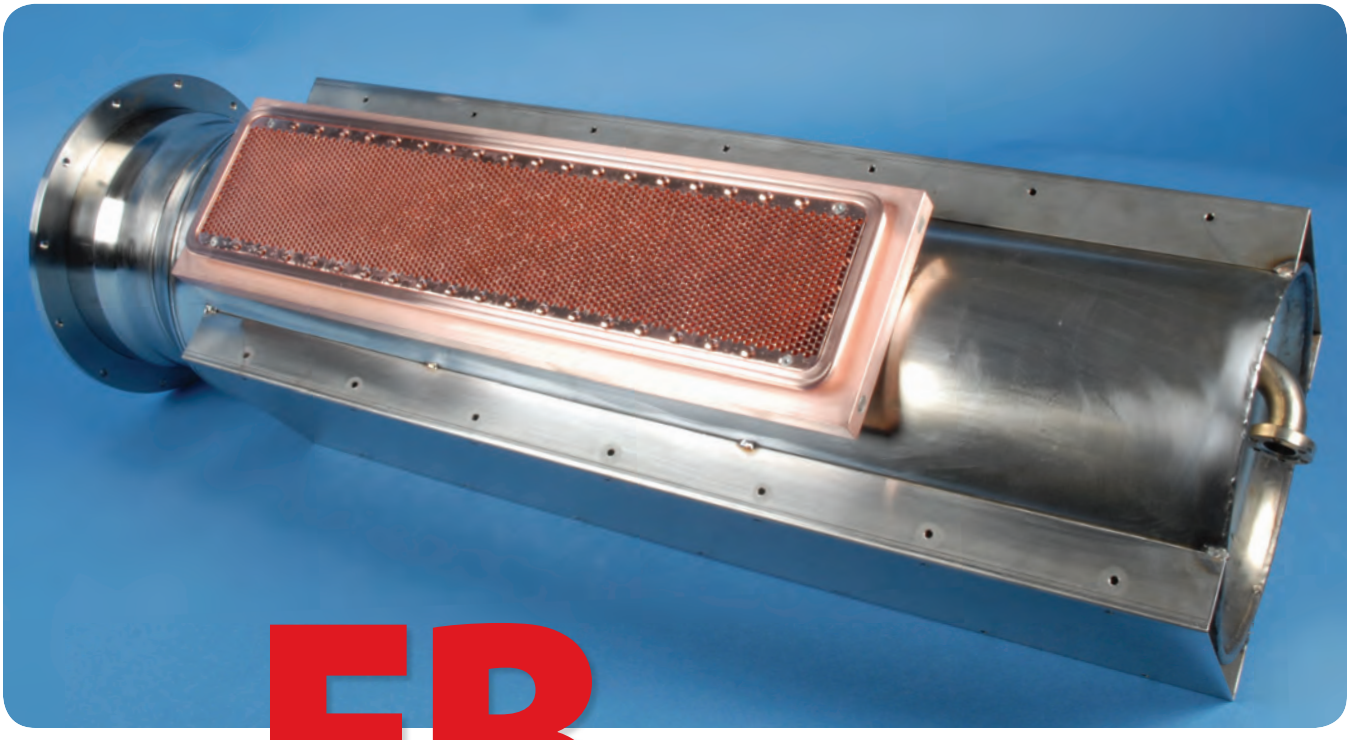


The EB Advantage

Modern EB curing technology can provide a viable, cost-effective solution to complex curing challenges.

BY JOSH EPSTEIN
Advanced Electron Beams

Electron beam (EB) curing is one of the most powerful industrial curing technologies commercially available today. Historically relegated to niche applications, EB curing has long been recognized as an option for addressing the requirements of high-performance coating applications. The recent trends in global competition, rising and volatile energy costs, tightening emissions regulations and an overall drive for environmentally conscious manufacturing practices have led many converters, printers, industrial coaters and manufacturers to look for alternative curing technologies. The past several years have brought rapid changes in EB technology, making EB curing a more practical alternative to traditional curing technologies.

EB Benefits

EB and ultraviolet (UV)-curable chemistries are based on similar reaction principles and typically are grouped together and referred to as "energy curable," "radcure" or "100% solids" technologies. Traditional thermal-based technologies cure with an oxidation process that relies on evaporating a water-based or solvent-based dilutant, leaving the pigment or other functional additives bound in a resin matrix. As part of the curing process, 30 to 80% of the mass of a thermally cured part is evaporated off. Energy-curable chemistries cure by a polymerization process, in which a reactive dilutant is used to provide the viscosity needed to apply the coating. When energy is applied, the dilutant polymerizes or solidifies. Energy-curable chemistries do not lose any mass through evaporation. Manufacturers typically turn to UV- or EB-curable technologies for their lack of volatile organic compounds (VOCs), low energy consumption, low heat requirements, specialty finish effects and ability to be used on a variety of substrates.

Although EB and UV are similar in many ways, EB-based processes offer several distinct advantages. UV-curable

ABOVE: An electron beam emitter.

chemistries rely on a photoinitiator chemical to catalyze the polymerization process. When the photointiator is excited by a UV light, it releases the energy needed for the dilutant to react. EB curing systems deliver energy directly to the chemistry in the form of energetic electrons. EB-curable chemistries are nearly identical to UV-curable, but EB coatings do not require a photointiator. While UV curing is highly dependant on the efficiency of the photoinitiator, EB curing does not require any special additives or catalysts.

Additionally, unlike UV energy, which is concentrated on the surface, energetic electron energy has the ability to penetrate many materials (see Figure 1). Commercial "low energy" electron beams can deliver curing energy up to 200 microns (8 mils) beneath the surface of a coating layer. The ability to penetrate the surface in this manner enables a full through-cure for very thick coating layers and can deliver good substrate adhesion and a high-performance surface finish. EB energy absorption is not affected by the color of the coating or the substrate. Where UV energy can reflect off the surface, EB energy penetrates regardless of surface reflectivity.

EB-curable chemistries are nearly identical to UV-curable, but EB coatings do not require a photoinitiator.

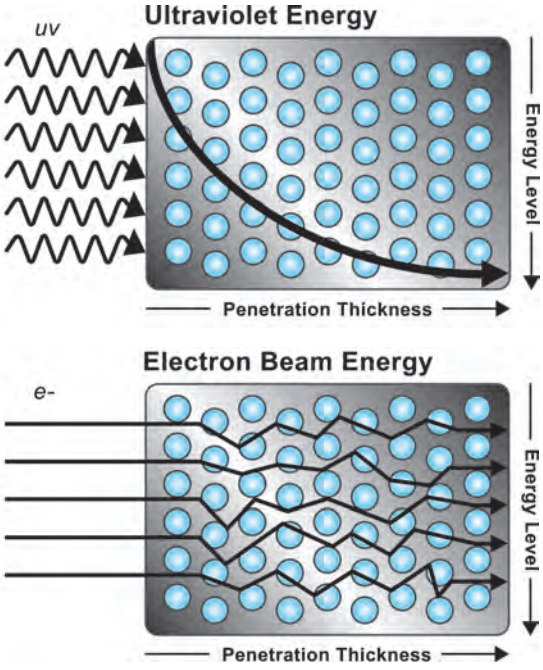


Figure 1. UV vs. EB energy absorption profiles.

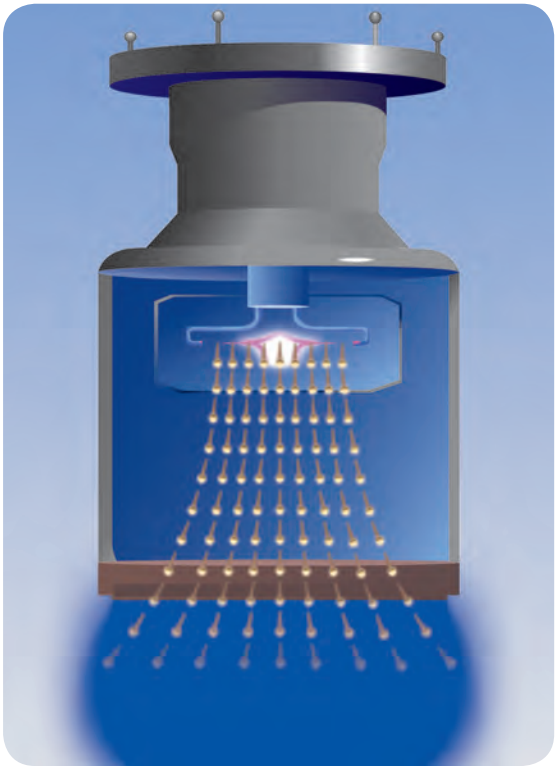


Figure 2. A low-voltage electron beam emitter.

Expanded Appeal

Curing systems based on low-voltage electron beams have been in operation since the 1970s. Most EB technologies work by generating electrons thermionically, passing an electric current through a filament and then accelerating the electrons in a specific direction by applying a voltage potential between the "back" and the "front" of the device. The electrons are created within and accelerated through a vacuum chamber. The electrons pass out of the vacuum through a thin film typically made of titanium. This foil is generally referred to as the electron beam "window." Electron beam generators used in curing applications are designed to create a "shower" or "curtain" of directed electron beam energy that can be used for industrial curing processes. Figure 2 illustrates the basic electron beam design. EB curing systems are composed of the electron beam, a vacuum pumping system to maintain the high level of vacuum, a power and control system, and a product transport and shielding system. Complete systems incorporating all of these elements sometimes are referred to as "self-shielded" EB curing systems.

Adoption of traditional EB curing systems has been limited by the size, cost and complexity of the technology. EB traditionally has been used with great success in wide web package printing and coating applications. While there have been some early adopters of EB curing in industrial wood, metal and plastic coating applica-

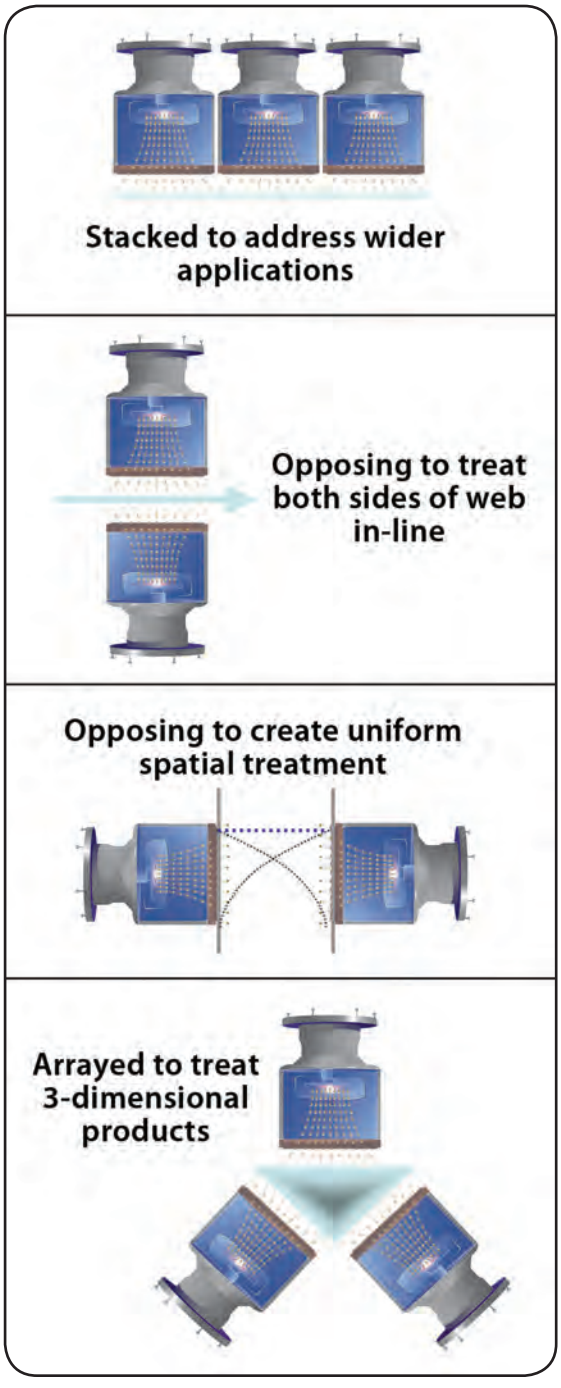


Figure 3. Various configurations of modular electron beam emitters.

tions, the complexity and cost of inline EB curing integration often have outweighed the potential benefits. This cost-benefit analysis is now changing. With rising energy costs and tighter VOC emissions standards, the benefits of energy-curable technologies increasingly are becoming attractive to a wider range of manufacturers. Additionally, the past several years have brought the introduction of smaller, more cost-effective EB technologies. Together, these trends have allowed electron beam curing to be a more commonly considered alternative to traditional thermal curing or UV curing technologies.

A Cost-Effective Curing Solution

In recent years, suppliers of EB curing equipment have made strides in delivering small, low-energy curing systems. Advances in EB window technology, more efficient power systems and novel approaches to maintaining vacuum all have contributed to making EB curing systems more practical. One of the key benefits of smaller electron beams is the ability to integrate EB curing into a wider variety of material handling schemes. While traditional EB curing mostly was limited to wide web-based processing, modern electron beam systems can be configured to address many different product geometries, as shown in Figure 3. Compact EB designs can be integrated directly into a wide range of equipment. Furthermore, smaller, self-shielded EB curing systems can be retrofitted into existing thermal or UV cure lines.

Suppliers of EB curing equipment have made strides in delivering small, low-energy curing systems.

In contrast to traditional wide web-based converting processes, modern EB curing technology increasingly is deployed in a widening array of applications, some of which are described below.

Narrow web printing. Small EB systems allow EB curing for narrow and mid web printing lines to be economically viable. EB curing of complex laminate structures, high-performance protective coatings, and printing with no- or low-photoinitiator inks are some of the potential applications of EB curing for narrow web printers.

Coil coating. EB curing of metal coil coatings offer an energy efficient and environmentally friendly alterative to traditional thermal cure systems. With this application, EB offers a distinct advantage over UV curing, which is less effective when curing the thick coatings used on the metal coil. EB curing can deliver substantial energy savings and productivity improvements, while also eliminating VOC emissions. The combination of these advantages typically justifies the cost of retrofitting an existing line within a short payback period.

Molded part coating. Arraying multiple electron beams along a conveyorized tunnel enables the curing of coatings for molded parts. Protective EB finishes can enhance appearance compared to traditionally cured coatings and improve scratch, chemical and thermal resistance properties.

Advanced opto-electronic applications. EB can provide a solution for many of the processing challenges in the emerging thin film solar and flexible display technologies. Complex film lamination, formation of cast microstructures and curing needs of protective coatings are examples of potential EB applications.

Hybrid UV/EB approaches. Because of the similarities in their chemistries, EB curing systems will cure a UV-curable coating. This fact can be leveraged when designing UV/EB hybrid curing lines. With these configurations, UV curing is used for surface curing in intermediate steps during the process. Since only a surface cure is required, it is possible to lower the power (and resulting heat) of the UV lights, use less photoinitiator and process at high line speeds. An EB curing system is then used for a final through-cure at the end of the line. The penetrating power of EB delivers good adhesion to the substrate, as well as a complete cure that allows for immediate in-line finishing tasks.

While EB curing has been around for decades, many of the applications discussed here are new. Like with any new technology, widespread adoption of EB takes time and requires the vision and foresight of industry leaders. While deploying EB curing in new ways might mean facing application development challenges, the potential payoff in energy savings, pollution reductions, productivity increases, and product differentiations make the projects strategic investments.

COMMON ADVANTAGES OF UV/EB CURING

- No VOC pollution
- Low energy consumption
- Low heat
- Wide variety of substrates
- Specialty finish effects

Josh Epstein *is the marketing manager for Advanced Electron Beams, Wilmington, MA, a provider of compact, cost-effective electron beam solutions for curing, materials processing, sterilization and advanced applications. Epstein can be reached at 978.658.8600 or jepstein@aeb.com. For more information about EB curing, visit* **www.aeb.com.**

A Cure for Wood Alternatives

New UV coating technologies can enhance wood plastic composites, fiber cement siding and vinyl substrates used in the construction industry.

BY KEN BURTON
Finishes Unlimited, Inc.

Wood will probably always be the material of choice for many construction applications, such as decking, siding, fencing, railings and window and door trim. But alternative materials like wood plastic composites, cement fiber and vinyl substrates have made considerable inroads in the past decades. In the field, each has its advantages over wood; however, some also are susceptible to the same deterioration caused by weathering and use patterns that plague wood. Manufacturers, along with academic and industry research facilities, continue to search for ways to produce even better value-added products at a lower cost. They are being cheered on by companies in the distribution and retail business, who constantly seek improved product offerings.

One of the options being examined to meet the challenges for all three materials is the application of UV-cured coatings. UV-cured coating systems are factory-friendly, as they emit no volatile organic compounds (VOCs). They also are nonflammable, produce no hazardous waste and replace other types of coating systems that require far more floor space. In the laboratories and on the test benches of today's coatings professionals, as well as in materials development labs, new UV-cure coatings and application techniques are being perfected that might dramatically enhance the field performance of modern wood alternatives.

Wood Plastic Composites

Homeowners love their decks, as do hotel, restaurant and office building developers who add decks for function space and eye appeal. As a result, decking is considered a $4.6 billion industry, and decking material demand is expected to reach 3.6 billion lineal feet in four years.

Several new approaches are being tested that incorporate the application of a UV-curable coating that will adhere to the surface of the wood plastic composite and provide long-term resistance to fading; increased scratch, stain, abrasion and mar resistance; and prevention of mold and mildew growth. Photo courtesy of Sawdust, Ltd.

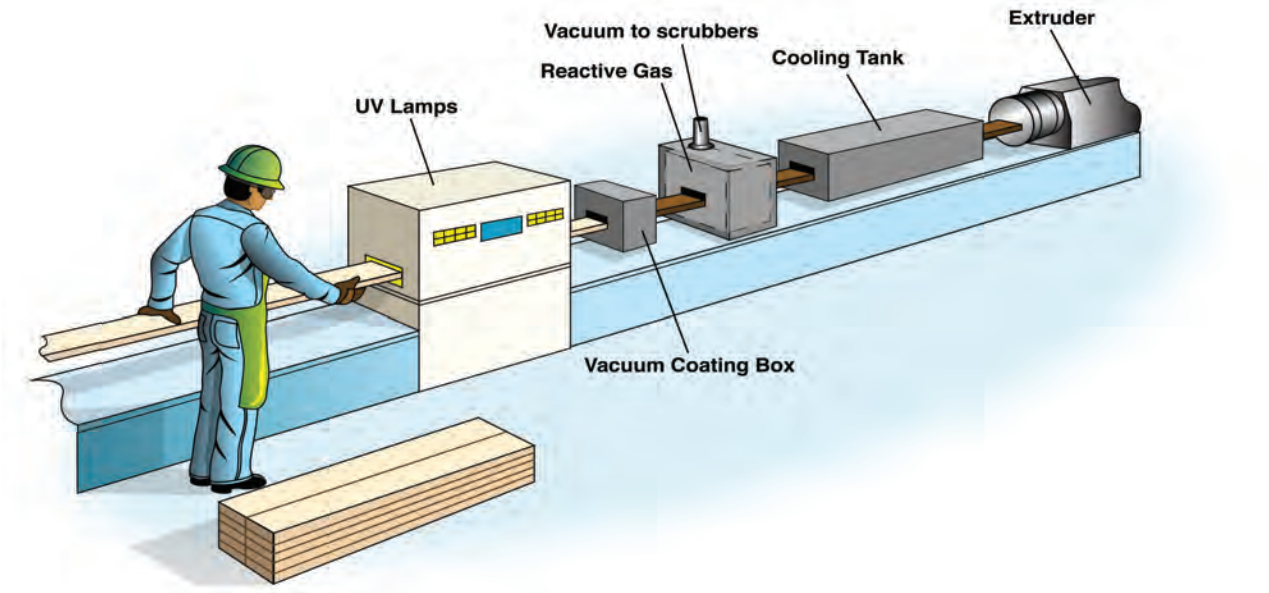


Figure 1. An illustration of the InFin™ Coating Technology for WPC.

Virtually every deck at one time was constructed of wood, but wood decks must be refinished or replaced regularly. Wood plastic composites (WPC) became extremely popular in the '90s as an alternative decking and railing material, and annual sales have continued to increase for both the new construction and the remodeling market.

WPC is produced by creating a blend of plastic, wood flour and/or certain fibers, which is extruded into profiles with many shapes, sizes and lengths, including dimension lumber-type boards. These profiles can be sawed, nailed, screwed and otherwise worked like lumber, with the inherent strength to be used for applications such as decks and fencing. Today, the composite decking and railing market is more than $1 billion annually. While WPC products are more durable than wood, they tend to exhibit poor fade, scratch, stain, abrasion and mold/mildew resistance over time. WPC decks also can retain heat during hot weather.

Several new approaches are being tested that incorporate the application of a UV-curable coating that will adhere to the surface of the WPC. This coating, available in virtually any color and gloss level, provides long-term resistance to fading, increases scratch, stain, abrasion and mar resistance, and prevents mold and mildew growth. It is also available in a clearcoat for application over composites containing pigments.

Historically, extruded WPC boards could not be painted. During the extrusion process, the thermoplastic in the composite rises to the surface, preventing any coating from adhering. As a result, WPC boards are produced to closely replicate the appearance of wood by adding pigments to the composite mixture before extrusion. New UV coating approaches being developed incorporate specialized formulation practices to produce a coating that will adhere to the composite. Depending on the formulation of the composite, a pretreatment step such as fluoroxidation, plasma, corona or flame might be needed. The coating can be applied by vacuum, roll or spray techniques and then cured instantly with UV lamps so that it can be handled immediately. There is no need for any forced-air drying equipment or production floor space to dry the boards.

A new UV coating system has the potential to coat WPC at 100 feet per minute and can be installed inline.

Not only are these coatings highly durable and moisture-resistant, but their broad color palette also offers architects, designers and builders a range of creative options. Also, as the years pass, decks produced with this process can be repainted a totally different color if the home or building owner desires.

An innovative pretreatment option* gaining a great deal of attention is to feed the extruded composite through a chamber, where it is exposed to a reactive gas atmosphere that oxidizes the WPCs surface so it will accept the coating (see Figure 1). The board next is fed through a UV coating chamber, where a patent-pending UV coating can be applied to some or all sides of the board in a single pass, depending on the preference of the manufacturer. It then is cured instantly with UV lamps.

This system has the potential to coat WPC at 100 feet per minute (fpm) and can be installed inline with the extrusion line so that boards can be treated and coated continu-

**InFin™ Coating Technology, jointly developed by Inhance/Fluoro-Seal Ltd. and Finishes Unlimited.*

A patent-pending, UV-cured coating system can allow manufacturers of fiber cement siding to adopt a one-step process regardless of whether they are producing primed only or color- coated siding. Photo by Erin O'Boyle Photographics, courtesy of the Portland Cement Association.

ously. The manufacturer also has the option of locating the system offline or in an entirely different location to allow for the inventory of extruded boards in several locations, which then can be treated and coated as customer orders arrive. This latter option could be increasingly important as the market becomes accustomed to the ability to order WPC boards in different colors. Each order can be quickly treated, coated with the desired color and shipped.

Using a patent-pending UV-curable coating system, a coating in virtually any color can be applied to vinyl substrates. The cured coating is highly resistant to weather, temperature. sunlight and abrasion. Photo courtesy of Mr. Fence.

The process is environmentally friendly. The pretreatment uses small amounts of reactive gas at any given time and is conducted at less than atmospheric pressure, eliminating chemical emissions. All process gases are completely neutralized. The coating is a 100% solids coating containing no solvents; as a result, it contains no flammable elements, or volatile organic compounds (VOCs) or hazardous air pollutants (HAPs) to be emitted into the atmosphere.

Fiber Cement Siding

Cement siding has been used in construction since the early 1900s, but new design and production technology developed during the past decade or so has enabled manufacturers to introduce high-performance siding to meet the more stringent performance and creative demands of the construction business.

Fiber cement siding is a durable, water-, termite- and flame-resistant siding product that is produced by blending cement, sand and cellulose fibers and extruding it into siding boards, which are cured with pressurized steam to enhance their strength and stability. The cellulose fibers prevent cracking. The boards can be embossed with wood patterns or other designs.

Fiber cement siding can be painted without any pretreatment to alter the surface structure. A two-coat process is used, with a primer applied first, followed by a coating to add the desired color. In most instances, the primer is applied at the factory. Depending on the desire of the architect or contractor, the primed board can be shipped to the construction site where the builder paints it to match the desired color scheme of the building being completed. By purchasing primed siding, the contractor is assured that the siding will not absorb moisture while awaiting installation.

Occasionally a manufacturer might ship uncoated siding for priming and coating on-site. On-site coating requires a third step — washing the board before the primer is applied to clean away any dirt and debris that adhered during shipment or on-site storage. Following cleaning, the board must be allowed to dry completely before the primer is applied

Some manufacturers might offer precoated siding in a range of designs and colors and will apply both the primer and the topcoat in the factory.

A patent-pending, UV-cured coating system is available that will allow manufacturers to adopt a one-step coating system regardless of whether they are producing primed only or color-coated siding. For producers applying a color coating in the factory, UV coating systems eliminate the need to apply primer first. The UV topcoats, available in any desirable color, adhere directly to the board without the need for a primer. If a manufacturer wishes to apply primer only before shipping, a UV-cured primer is available that will still accept the topcoat in the field. Not only is

WOOD ALTERNATIVES

the UV coating highly durable and weather-resistant, but it also can be repainted with a different color in future years if the home or building owner chooses.

When the UV coating approach is adopted, the factory is able to dispense with its previous primer and paint application systems, reducing production, materials and labor costs, as well as freeing up floor space. If the UV system is replacing a spray system using solventborne coatings, VOC emissions are immediately eliminated, and indoor air quality is improved. UV-cured boards can be handled immediately for fast shipment of inventory.

Regardless of the material, high-quality appearance, color and field performance are becoming the norm.

Vinyl Substrates

Vinyl siding, fencing, decking and trim products, first introduced decades ago, have continued to grow in popularity among developers, builders and homeowners. Today, vinyl siding is used on a large number of new homes and is the most popular siding in the replacement market.

The initial material cost of vinyl compared to wood is slightly higher in most regions of the country, but the increasing cost of wood is quickly narrowing the gap. And when the lifetime cost of virtually maintenance-free vinyl is compared to the cost of maintaining and/or replacing wood, then vinyl becomes a highly competitive option.

Vinyl for construction materials is produced from a compound consisting of polyvinyl chloride (PVC) resins plus a variety of stabilizers, coloring and processing aids, UV inhibitors, and plasticizers. This compound is fed through an extruder, where it is exposed to heat and pressure to become pliable vinyl. The vinyl is then fed through a die in the shape of the finished product. Vacuum technology is used to keep the vinyl in the proper shape, and water is used to cool it into its final rigid state.

Some producers create vinyl with a single extrusion process, in which, the raw materials are spread throughout the product. More recently, some producers have adopted a co-extrusion process that creates a finished product with two layers of PVC. The outer layer contains a denser concentration of the essential elements, such as the UV inhibitors. The inner layer is essentially the same as the outer layer but with a lowered concentration of UV inhibitors and color pigment. This vinyl is highly resistant to weather and abrasion while having a long lifespan. Like WPC, colors and hues have historically been created by adding pigments during the extrusion process.

A patent-pending UV-curable coating system has been developed that allows vinyl producers to eliminate the coextrusion process and feed the extrusion directly into a UV coating chamber. Here, a coating in virtually any color can be applied. The cured coating is highly resistant to weather, temperature, sunlight and abrasion.

If the producers prefer to provide color by including pigment in the initial extrusion material, a clear UV coating can be applied to provide the necessary protection.

Ultimately, whether wood, WPC, fiber cement or vinyl is used at a construction site is the decision of the architect, the contractor or the building owner. Regardless of the material, high-quality appearance, color and field performance are becoming the norm thanks to modern UV coating technologies. ft

Ken Burton *is president of Finishes Unlimited, Inc., headquartered in Sugar Grove, IL, a leading producer of 100% solids UV-cured coatings, as well as baked enamel and air-dry waterborne coatings. He can be reached at 630.466.4881 or ken@finishesunlimited.com. For more information, visit* **www.finishesunlimited.com**. *More information about InFin Coating Technology can be found online at* **www.paintablecomposites.com**.

Hot Technologies for Efficient Curing

Innovations such as advanced heat seals, sophisticated air management systems and continuous pyrolytic burn-off ovens are improving finish quality and profitability.

BY RICK AQUINO
A.B. Myr Industries

What do finishing professionals expect of their oven systems? The short answer is *everything*. Curing ovens must optimize finish quality, have a low total cost of ownership, increase production efficiency, and cater to ergonomics and human factors.

These expectations are driving today's oven requirements, which include in-line continuous (non-batch) processing, fast heat-up and consistent temperature maintenance, maximized time at temperature to effectively lengthen the usable oven, and contained oven heat and smoke to minimize energy usage and provide a better employee work environment.

Innovations such as advanced heat seals, sophisticated air management systems and continuous pyrolytic burn-off ovens can address these diverse goals and help finishing professionals improve quality and profitability.

Invisible Air Barriers

Effective heat seals are a crucial component of an efficient oven. Some of the most advanced heat seals aren't really seals at all, but rather a system* that creates an invisible air barrier to keep the heated air in the oven without hindering or restricting the work openings. The system draws hot oven interior air and compresses it in scroll fans. Centrifugal fans are used to force the air into the open work openings. The pressurization difference between the factory and the oven interior keeps the hot oven air from entering the factory. This sealing

ABOVE: This oven incorporates an Air Barrier heat seal developed by A.B. Myr Industries. The oven is operating at 800°F, but the air at the oven door exterior is at room temperature.

**The Air Barrier heat seal from A.B. Myr Industries.*

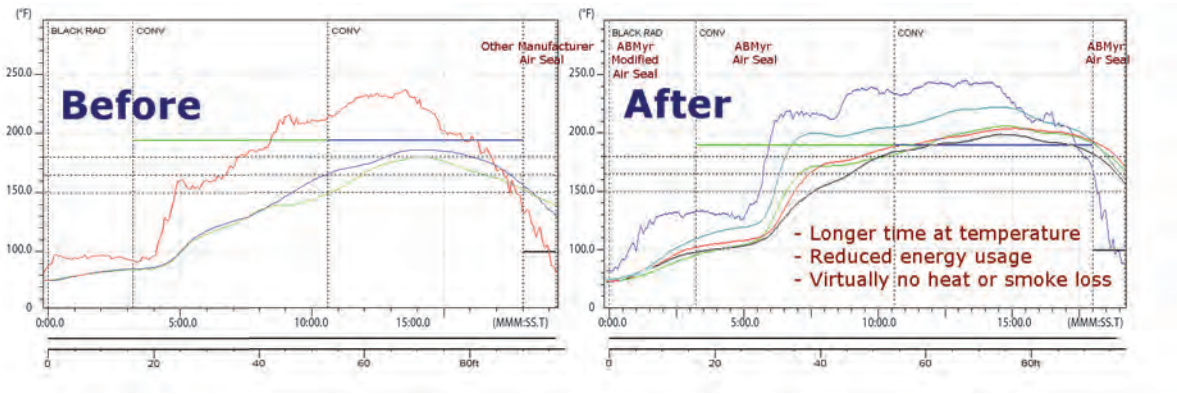


Figure 1. An oven temperature profile before and after the installation of an Air Barrier heat seal.

system can contain up to 90% of the heat that otherwise would escape from the oven.

To further improve oven efficiency, the heat seal system can be used in conjunction with a sophisticated air management system that uses thermal and pressure sensors to monitor the oven environment at critical locations and control the airflow. When used together, these technologies regulate the oven to compensate for changing ambient conditions and automatically maintain the desired internal temperature profile.

Other benefits of using advanced heat seals with an air management system include:

- **Efficient in-line processing.** An effective heat seal system increase the efficiency of in-line, continuous processes by containing the oven heat and smoke that can escape through the work openings at either end of the oven.
- **Increased cycle times and production rates.** In dry-off ovens, a fast temperature ramp-up and controlled air circulation can effectively extend the length of the usable oven to remove surface moisture on parts from the pretreatment process that otherwise would lead to finish imperfections and solvent popping. In powder coating cure ovens, these technologies create a low-velocity, superheated zone to gel the powder rapidly without the use of high-maintenance infrared heaters before the parts enter the high-velocity, energy-efficient convection zones. The combination of an effective heat seal system and sophisticated air management works much better than the conventional "quiet zone" and uses less energy.
- **Longer time at temperature.** An effective heat seal system causes the product to heat up faster, thus increasing oven efficiency. It also maximizes the part's time at temperature, thus enabling greater production rates, shorter oven lengths and reduced oven temperatures (see Figure 1).
- **Self-balancing**. Using an effective heat seal and air management system allows the oven to "self-balance," automatically compensating for changing ambient conditions to maintain the desired internal temperature profile.
- **Real-time temperature profiling.** Some air management systems incorporate real-time temperature profiling, which allows the oven to be adjusted to meet incoming product or production requirements.
- **Reduced energy costs.** Using advanced heat seal and air management systems can cut energy use by 50 to 70% and provide a quick payback.

Continuous Pyrolysis

In electrostatic paint operations, the parts being painted must be cleaned thoroughly to maintain electrical conductivity. Traditionally, a DC electrical current is sent through

Using an effective heat seal with a sophisticated air management system allows the oven to be regulated to compensate for changing ambient conditions so that the desired internal temperature profile is maintained.

the fixture to the metal part being painted. Oppositely charged airborne paint particles are drawn to the metal part and deposited on its surface, as well as on the fixture holding the part. A single layer of paint on a fixture can reduce its conductivity by half. Multiple layers of paint on the fixtures act as an effective electrical insulator, thus preventing the electric current from reaching the part being painted and impacting the quality of the finish. Additionally, the layered paint tends to powder and flake over time, dropping onto the parts being painted. Both factors — reduced and unpredictable electrical conductivity and paint flaking — can significantly reduce the finish quality.

Because the system eliminates the batch oven process, it provides substantial labor and energy savings.

To counter this problem, pyrolytic burn-off ovens are used. In these hot chambers, fixtures catch fire, and the coated materials are literally burned off. With this process, however, come serious drawbacks, including melting, warpage, metal fatigue and a shortened fixture life.

The advanced heat seal system can be used in pyrolytic cleaning ovens to create high-humidity/low-oxygen oven atmospheres. Such atmospheres allow thorough, fire-free cleaning of painted fixtures, thereby ensuring the proper conductivity and grounding for powder coatings. Modern pyrolytic ovens use automated controllers to monitor and adjust the cycle time and temperature to better control the cleaning process.

A more recent innovation** uses a continuous (rather than batch) design, along with a patented process that establishes a controlled low-oxygen atmosphere with water-vaporized air to inhibit combustion and increase the air's BTU capacity. This design enables optimal pyrolysis at lower oven temperatures or reductions in the cleaning cycle at the same temperature. The system also reduces cool zones where inadequate heating temperatures are achieved, and it is well insulated to reduce heat loss.

Temperature spikes, typical in burn-off ovens, are eliminated in the new system, ensuring that the fixtures do not become too hot and melt or warp. The elimination of temperature spikes extends service life and negates the need to water spray the parts to control the fires, thus minimizing ash and cleanup.

Because the system eliminates the batch oven process typical of industry standard pyrolysis ovens, it provides substantial labor and energy savings. Continuous material flow processing provides tremendous production efficiencies compared to batch processing because it avoids the need to heat and cool the oven repetitively. Production rates, capacities and efficiencies are significantly improved.

Today's ovens must provide in-line, continuous processing; fast heat-up and consistent temperature maintenance; maximized time at temperature to effectively lengthen the usable oven; and contained oven heat and smoke to minimize energy usage and provide a better employee work environment.

The Bottom Line

Using advanced technologies to upgrade or replace the existing ovens in a finishing system can reduce energy costs by 50 to 70%, increase product quality and first-pass yield rates, improve production capabilities, and create a safer and more pleasant work environment. Further, investing in such innovations can provide a quick return on investment and yield significant savings year after year. ft

Rick Aquino *is the vice president of sales for A.B. Myr Industries, an industrial engineering firm based in Belleville, MI, that specializes in finishing operations. Aquino is a veteran of the finishing industry with more than 25 years of experience in powder and liquid coating systems. He can be reached at 734.941.2200. For more information, visit* **www.abmyr.com**.

***The Pyrolytic Coating Gasification Oven (CGO) from A.B. Myr Industries.*

Baking Soda Blasting

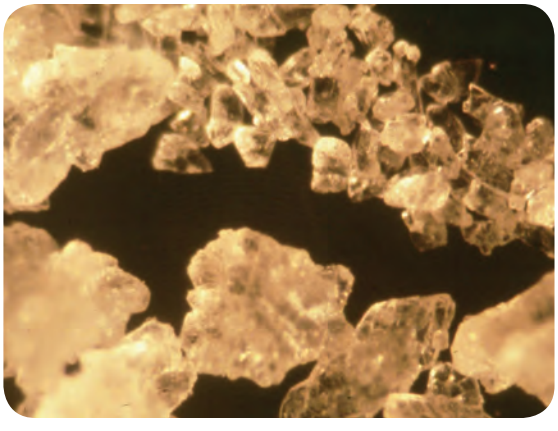
Baking soda-based abrasives can be used to strip and clean parts quickly, safely and cost-effectively.

San Joaquin Helicopters is an FAA-certified repair station in Delano, CA, that offers services for contracted helicopter maintenance. In 2005, Steve Randalls, director of maintenance, and Larry Bynum, component overhaul shop manager for the company, were trying to improve the process for stripping and cleaning aircraft components and parts. The challenge was to remove a polyurethane paint from a magnesium part without removing the chromate conversion coating. The process being used at the time was ineffective and time consuming. It consisted of putting parts in a paint stripping system for 16 to 18 hours, followed by a pressure washer rinse to remove the paint, which took another 15 minutes. Unfortunately, the stripper also removed the magnesium film treatment, and a new conversion coating had to be applied.

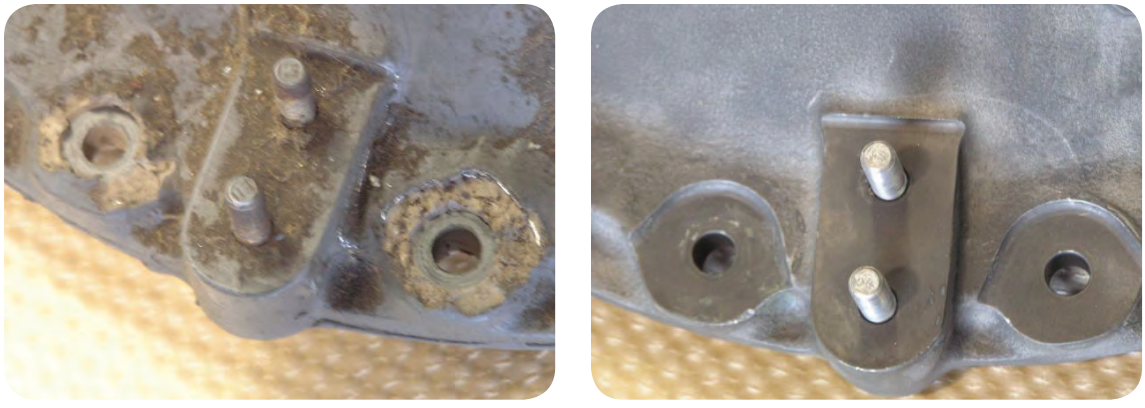
This chemical removal process also required that the solid wastes be pumped to a holding vessel to remove the sludge, and then the hazardous sludge had to be manifested and hauled away several times a week. Randalls was investigating options on the Internet when he came across a website explaining the benefits of using a baking soda-based abrasive for cleaning and depainting. Soon Randalls was in touch with a local California distributor representative, Bob Strohmeier of International Surface Preparation, who would demonstrate the process for him.

A Carefully Engineered System

Initial tests showed that ARMEX® baking soda-based blast media manufactured by Church & Dwight Co., Inc., makers of ARM & HAMMER® products was effective in removing the paint and leaving the chromate conversion coating intact. The tests provided an early and obvious in-



Baking soda crystals magnified.



Before (left) and after photos of a magnesium part demonstrate the effectiveness of the baking soda-based blast media.

dication that the baking soda-based stripping process was going to eliminate costs and save time. But there was more work to be done. The team moved on to specify the necessary equipment and utilities to run the system.

There are a number of differences between stripping with a baking soda-based abrasive and a more conventional, harder grit, like plastic or glass beads. The baking soda particle is very soft, having a Mohs hardness of only 2.5. It is also extremely friable, so that upon impact the particle shatters completely, releasing all its energy on the surface. As the particle breaks apart, the smaller particles work to shear off the coating. The benefit inherent in this action is that it has a minimal impact on the surface material — in this case, the chromate coating. Baking soda-based abrasives can be used to strip in layers; they will not pit or peen a surface, nor will they cause crack closure. However, this breakdown of the particle and resulting dust can cause a whiteout in some glove box units, making it difficult to see the workpiece. A system engineered specifically for soda is required to ensure good visibility.

Upon impact the particle shatters completely, releasing all its energy on the surface.

For San Joaquin Helicopters, Strohmeier recommended a BioBlast DBS 4848 — a fully contained glove box blast unit specifically designed to handle soda. The system drops more than 95% of the waste directly into a drum for easy disposal and sends only very fine particulate to the dust collector. Baking soda is a one-pass media, meaning it cannot be recycled.* The elimination of a recycling mechanism is a unique distinction of a soda blasting cabinet.

The blast unit was equipped with an Accustrip System Model 11SX with a Thompson Media Valve, using either a #4 ARMEX performance nozzle or fan nozzle, depending on the part, and operating at about 30 psi. A 50-hp compressor was sufficient to do the job, and an air dryer was included on the compressor to ensure the best quality air to run the system, which operates an average of 8 hours a day. A silencer was added to the dust collector to minimize noise.

ARMEX Maintenance Formula XL was chosen for this job because it contains a moderate flow aid and the largest particles available, making it good for penetrating painted surfaces.

Successful Stripping

Overall, the new process is a success on many levels. There is no longer a bottleneck waiting for the parts to soak in a chemical.

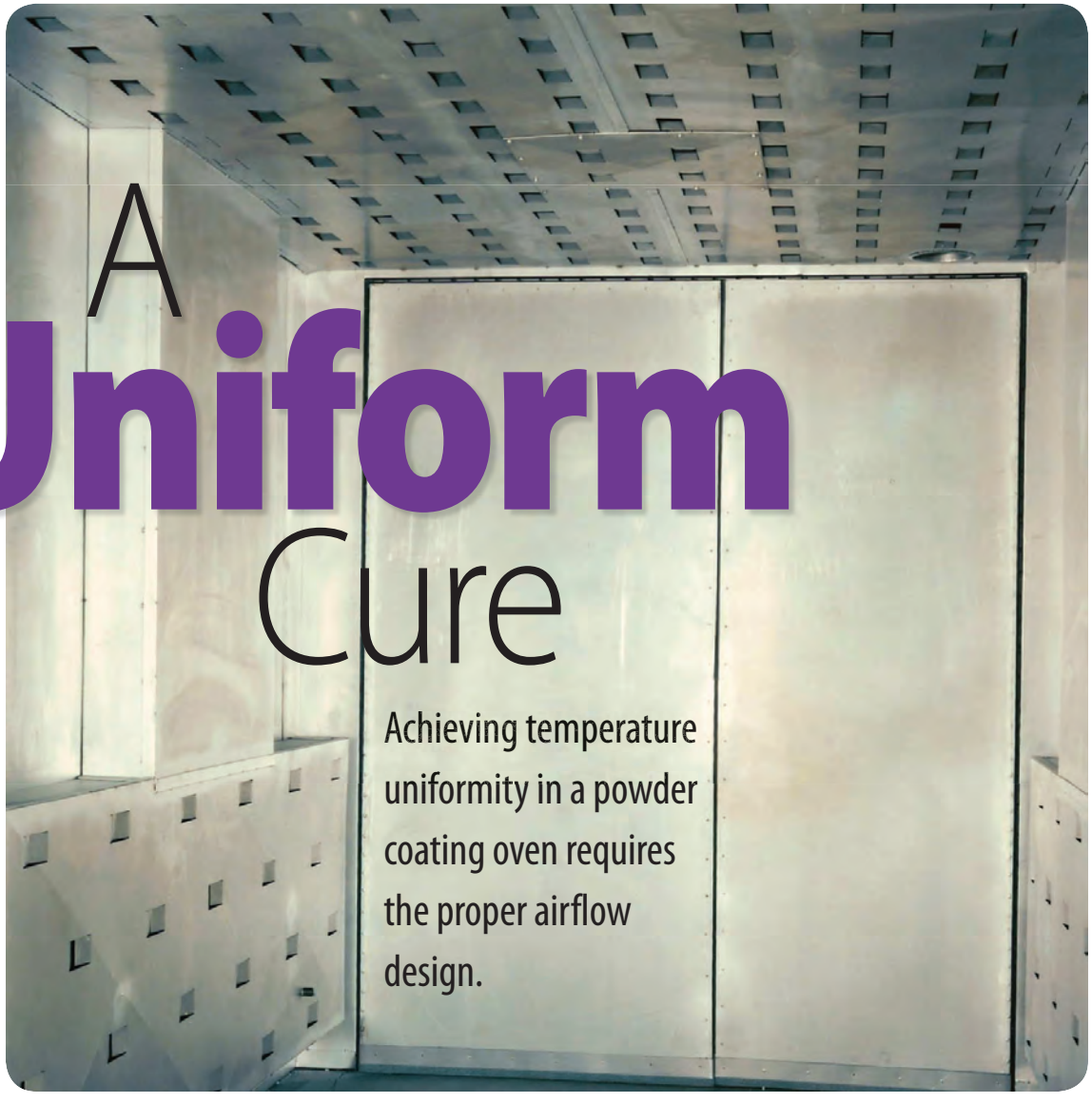
"We've cut the cleaning time in half for most jobs and by 10 to 15% more on others. As for the hazardous waste issue, there is a related savings of about 60 to 70% in cost for the material, and we cut our waste stripper removal by more than two-thirds," said Randalls.

In addition, the operators are no longer required to wear protective clothing and air-fed hoods because the media is benign and the whole process is contained.

San Joaquin has completely transitioned to the new process and has committed to a long-term overhaul project that it now can be assured of doing efficiently, safely and profitably. ft

For more information about baking soda-based abrasives, call 800.332.5424 or visit **www.armex.com**.

*Baking soda is environmentally benign and can be landfilled as a nonhazardous industrial waste. Some users choose to put it through their wastewater treatment system, as it is 100% water soluble and can act as a buffer, reducing the need for additional waste treatment chemicals.



A Uniform Cure

Achieving temperature uniformity in a powder coating oven requires the proper airflow design.

BY JEFF KENT
Wisconsin Oven Corp.

Veterans of the finishing industry agree that temperature uniformity and proper airflow design have a large impact on obtaining consistent, top-quality curing results for powder coatings. But while these characteristics are closely related, it is important for buyers to evaluate them separately. You can buy an oven with excellent empty oven chamber temperature uniformity and still not obtain acceptable results if the airflow is not designed for the way you load your parts inside the oven.

Oven temperature uniformity is defined as the overall temperature variation from a given setpoint. Acceptable uniformity tolerances are stated as a deviation — for example, ±10°F, which means that the temperature of all points that are measured within the work chamber need to be within a 20°F band around a specific setpoint.

Temperature tolerances within the work chamber seem to become more stringent each year. Back in the days when most finishing was liquid-based, uniformity was rarely an issue. The vast majority of liquid-based coatings 15 years ago would tolerate temperature variances of ±15 to 25°F. It seemed like any old box with some heat would provide a satisfactory cure. Today's powder-based coatings, as well as some of the specialty liquid paints, require a much tighter tolerance. Most powder coatings require a tolerance of ±10°F from setpoint to obtain ideal curing conditions.

ABOVE: An example of an oven with combination airflow.

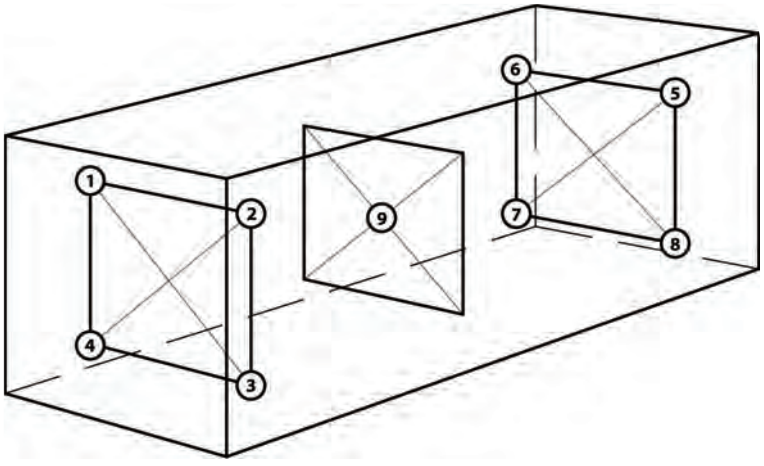


Figure 1. In a nine-point survey, one thermocouple is located near each corner of the work chamber and another is located in the center.

Uniformity is typically measured through a web of thermocouples located inside the work chamber. The most common arrangement is a nine-point survey, in which one thermocouple is located near each corner of the work chamber, and another is located in the center (see Figure 1). After the oven is heated to the required temperature and allowed to come to equilibrium, the points are recorded, most often with a chart recorder. If there are points outside the acceptable tolerance, adjustments are made to bring the points into spec.

There are many different features and designs that influence uniformity, including the thermal insulation, accuracy of the temperature controller and thermocouple, thermocouple placement, location of exhaust outlets and fresh air inlets, through-metal heat transfer, and chamber pressure. Although each parameter affects the ability of the equipment to achieve a given temperature tolerance, factors such as the air volume, distribution of the air through the work chamber, and shell losses play a key role in keeping the heat uniform within the work chamber, ensuring that each area within the oven receives the same air temperature regardless of its location.

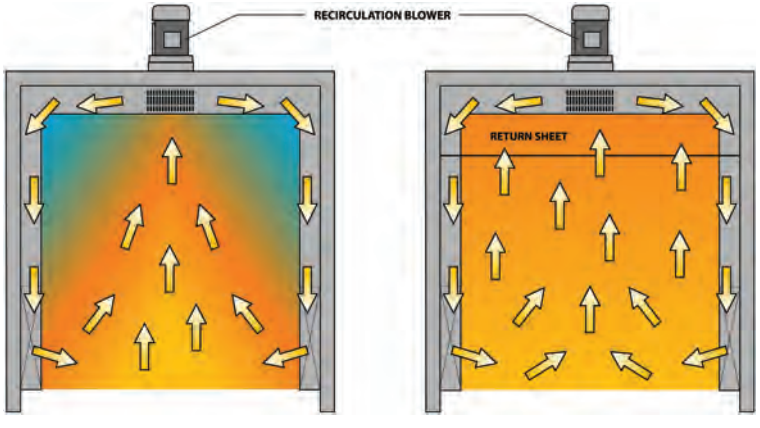


Figure 2. Illustrations of combination airflow. The oven on the right features a return sheet, which distributes the return air over the entire ceiling of the chamber.

Airflow Volume

Airflow through the oven is typically stated as either cubic feet per minute (CFM) or as the number of air changes (CFM divided by the internal volume of the work chamber). The more air changes there are, the faster the air flows through the chamber, resulting in increased air circulation and decreased heat loss. However, caution needs to be given to avoid too much velocity through the chamber, which can dislodge powder from the surface of the product.

Air Distribution

The next consideration is how the air is distributed into the work area, and how it is collected from the chamber on its way back to the heating plenum. An oven with more CFM (a greater number of air changes) will not always have better temperature uniformity. Unless the air is distributed evenly throughout the chamber, and then returned to the heating plenum in a controlled manner, uniformity will suffer. Airflow means heat. If you have areas within your chamber that have dead air, they will not reach the same temperature as the areas where there is airflow. It sounds obvious, but this fact is often overlooked in oven design.

Airflow volume, air distribution and insulation are factors that affect temperature uniformity in work chambers.

A common type of airflow pattern used throughout the finishing industry is combination (or uni-flow) airflow, where air is introduced into the work chamber along each lower side of the work chamber near the bottom. This design provides a combination of horizontal and vertical-upward airflow through the chamber.

Both schematics in Figure 2 illustrate combination airflow, but the oven on the right has a return sheet, which distributes the return air over the entire ceiling of the chamber and helps ensure that the air flows in a more vertical direction after it exits the supply plenum. Even a partial return plenum is better than none. Equipment without a return sheet will be prone to cool areas, as shown in the schematic on the left.

Another common batch oven design is where the heating plenum is located on the rear of the oven (see Figure 3). Again, the addition of a return sheet helps ensure even airflow through the entire work chamber. The oven on the bottom has a return sheet, which distributes the return air over the entire ceiling of the chamber. Equipment without a return sheet will be prone to cool areas, as shown in the schematic on the left.

Many finishing shops coat a variety of products, which can range from small parts (measured in inches) to much larger parts (measured in feet). In many cases, combination (uni-flow) airflow will provide the necessary flexibility to handle this wide range of parts. However, if the majority of parts are cured on a multi-tiered rack, where air cannot easily rise vertically upward through the tiers, then an oven with horizontal airflow will be a better choice. Ovens with horizontal airflow will typically have a supply duct located on one entire side of the work chamber, and a matching return duct located on the opposite side.

Shell Losses

In a house, areas that are not well insulated (i.e., windows, doors, etc.) allow a greater transfer of energy than well insulated areas. The same is true of ovens. Areas that are not well insulated, or with large amounts of through-metal, will transfer heat energy out of the equipment. Such heat transfers not only can create problem areas regarding uniformity, but they also make the oven less energy efficient, which means it will cost more to operate the equipment. Tongue-and-groove panels with punched rails are a common way to reduce the through-metal area, as well as the overall shell losses.

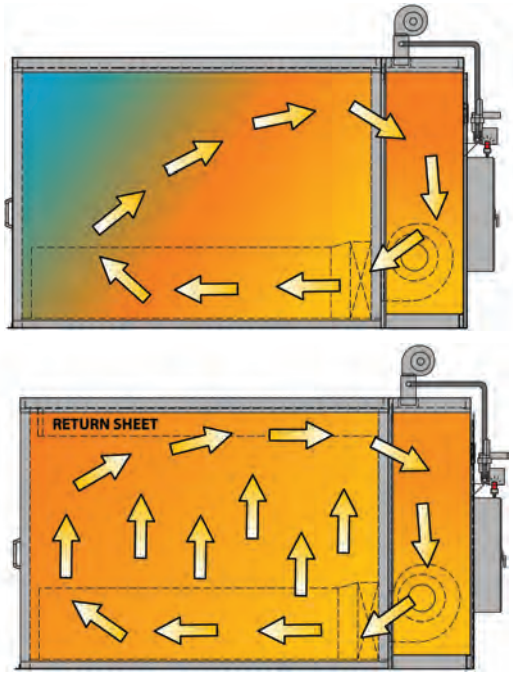
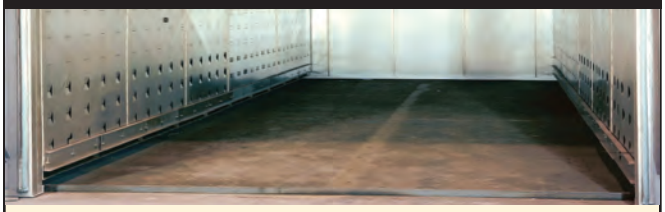


Figure 3. A batch oven with the heating plenum located at the rear. The return sheet on the bottom oven distributes the return air over the entire ceiling of the chamber.

DEFINING "QUALITY"



"Quality" is a word used nearly every day by nearly every individual involved in the finishing industry. Unfortunately, "quality" means different things to different people. Some finishing shops might use excellent temperature uniformity as their quality measure. Others might put an emphasis on durability, heat-up rates, or service. Yet others will use the initial cost investment or the length of warranty as a way to gauge quality.

Regardless of the criteria, every buyer should have a clear idea of what they are looking for in a quality piece of equipment. If you are looking to buy a new oven and currently have one, talk with the finishing operators and the supervisor. What do they like about their current oven? What would they like to be different? If the existing oven has any quality issues, what are the causes?

Based on the answers to these questions, you should have a good idea of what your quality measurements will be when you begin to look for your next oven. Simply make a list of items in the order of importance that you feel adds quality to an oven. Bring these points to the attention of the oven vendors you will be considering, and document what each vendor offers in each area. This information will give you a solid basis for comparison when making your final decision.

The quality and quantity (thickness) of the insulation must be considered. A general rule of thumb to follow is 1 in. of 6-lb density insulation for every 100°F oven temperature. An oven rated for a maximum continuous temperature of 300°F typically will have 3 in. of insulation. Some companies use a higher-quality, more dense insulation to reduce the insulation thickness. For instance, 4 in. of 6-lb density insulation is sufficient for 500°F ovens.

A Quality Finish

Airflow volume, air distribution and insulation are a few of the key factors that affect temperature uniformity in work chambers. If you buy an oven with acceptable temperature uniformity and the proper airflow design, you will be on your way to maximizing your production rates and improving your product quality.

Jeff Kent *is vice president of operations for Wisconsin Oven Corp., East Troy, WI, a designer, engineer and manufacturer of industrial ovens and other heating equipment. For more information about oven design, call 262.642.3938, e-mail sales@wisoven.com or visit* **www.wisoven.com.**

Decorative Trivalent Chromium Plating

With corrosion protection that is better than standard hexavalent chromium deposits and equal to hexavalent microporous chromium deposits, trivalent chromium deserves a closer look as a decorative plating option.

BY MARK SCHARIO
Plating Process Systems

The first commercial trivalent chromium bath, based on a sulfate/chloride electrolyte, was introduced by Albright & Wilson in 1975. Since then, the long-term corrosion protection of trivalent chromium over multilayer nickel deposits has been proven repeatedly. Tests conducted by ASTM have shown that trivalent chromium deposits perform better than standard hexavalent chromium deposits, better than microcracked hexavalent chromium deposits and as good as microporous hexavalent chromium deposits. And the field performance of trivalent chromium has confirmed these results. The trivalent chromium process has been used on bumpers for the over-the-road truck market for more than 15 years, where it has shown an indefinite electrolyte life, process stability, ease of use and excellent exterior corrosion performance. The process also has been used in the custom motorcycle market, where its improved covering power and uniform thickness have eliminated the use of auxiliary anodes for plating difficult geometries.

With the recent move away from hexavalent chromium due to employee safety concerns and environmental regulations, trivalent chromium deserves a closer look as a decorative plating option.

Trivalent Chromium vs. Hexavalent Chromium

Hexavalent chromium offers a lower cost per ampere hour compared to trivalent chromium. However, increasingly stringent regulations limiting hexavalent-chromium use and exposure have forced many electroplaters to search for an

ABOVE: This faucet is plated with TriOnyx®-Black, a black trivalent chromium.

This faucet is plated with TriOnyx Stainless, which imitates a stainless color.

alternative. Trivalent chromium is non-carcinogenic, has no lead components for disposal and easily meets air pollution requirements, and thus provides a compliant, effective option.

Trivalent-chromium also offers other benefits over hexavalent-chromium, such as no burning or whitewash, tolerance to current interruption, improved covering power, microporosity as plated and no need for filming anodes. It contains substantially less chromium compared to hexavalent-chromium and does not require the use of lead for anodes, thereby reducing waste treatment requirements for both chromium and lead. Simple pH, specific gravity and amp-hour meters are the only solution controls needed, compared to the complex chromic acid, sulfate and ratio analysis required with hex-chrome.

These components are plated with TVC®, a white trivalent chromium.

While trivalent chromium is intolerant to impurities, recently developed ion exchange resins allow impurities to be removed easily. Trivalent chromium also offers improved thickness distribution with less macro-cracking compared to hexavalent-chromium.

Recent Innovations

Recent innovations have produced trivalent chromium deposits in colors that cannot be distinguished from hexavalent chromium deposits. Trivalent chromium deposits that match black chromium, black nickel, titanium, stainless steel and platinum also have been developed. These colored processes have replaced the use of physical vapor deposition (PVD) coatings, providing exceptional corrosion protection at one-tenth the cost of PVD.

Operating Parameters

The main operating parameters for sulfate/chloride electrolyte-based trivalent chromium include temperature, agitation, pH, and cathode and anode current density.

Temperature. The temperature is usually maintained between 80-100°F. Higher temperatures favor a faster plating rate at the expense of reduced coverage, while lower temperatures favor a whiter deposit color.

Agitation. Agitation is necessary to replenish the cathode film and maintain temperature uniformity and is usually accomplished with mild air. Generally, lower agitation favors increased coverage and a reduced plating rate.

pH. The pH of the solution affects both the plating speed and the low current density coverage and typically is maintained between 2.5 and 3.5. A low pH produces the highest plating speeds but at the cost of some low current density coverage. Conversely, a high pH will result in slower plating speeds but with some improvement in low current density coverage.

Cathode current density. The cathode current density should be as low as possible while still producing satisfactory work. A low cathode current density will reduce any requirements for cooling, improve rectifier capacity and optimize the consumption of additives.

Increasing the current density will produce good deposit distribution (throwing power) but might not result in improving deposit thickness because the cathode efficiency decreases with increasing current density. Typically, chromium will be deposited at a rate of approximately 4-5 millionths of an inch per minute (0.10-0.125 μ/min), regardless of the cathode current density. The typical cathode current density range is 8 amperes/square decimeter (ASD) and up.

Anode current density. Special trivalent chromium graphite anodes are typically used, and these last indefinitely. The anode current density usually is maintained below 5 ASD.

Solution Composition

Most sulfate/chloride trivalent-chromium solutions consist of makeup salts, the complexing agent and mist suppressants.

Makeup salts. The makeup salts contain the chromium salts, conductivity salts and other specialty compounds. This material is usually added in amounts specified by the manufacturer. A typical makeup quantity is 400 g/liter. The concentration is easily maintained by specific gravity or chemical analysis.

Complexing agent. Trivalent chromium must be plated from a complex, which requires a complexing agent. This component is maintained on an amp-hour basis and is augmented with chemical analysis.

Mist suppressants. Mist suppressants are usually added to minimize misting. These materials sometimes improve deposit uniformity and can add some metallic impurity tolerance to the process.

Effective Protection

Trivalent chromium deposits have been used for more than 30 years. They offer corrosion protection that is better than standard hexavalent chromium deposits and equal to hexavalent microporous chromium deposits, both in real-time corrosion studies and in actual use. Electroplaters have used the process for its operating advantages in the past. However, as safety and environmental regulations force remaining hexavalent chromium electroplaters to switch to alternative processes, trivalent chromium presents an increasingly attractive option.

Mark Schario *is vice president of Plating Process Systems, Inc., Mentor, OH, a supplier of metal finishing processes and associated products. He can be reached at 440.951.9667 or marks@platingprocess.com. For more information about trivalent chromium, visit* **www.platingprocess.com.**

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"Troubleshooting Trivalent Chromium"

Check out the online version of this article to find solutions to common problems experienced with trivalent chromium plating, as well as an at-a-glance chart that compares trivalent chromium with hexavalent chromium.

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How Low Can You Go?

Recent developments in low-cure cathodic epoxy electrocoat finishes are helping automotive OEMs reduce energy consumption and increase production throughput.

BY GRANT FRY AND TAB SEMANISION
DuPont Performance Coatings

For decades, cathodic epoxy electrocoat primers have been a major tool in preventing the corrosion of metal surfaces. The combination of modern e-coat paint formulations and application equipment provides an efficient, environmentally friendly, cost-effective coating solution for many applications. E-coat is widely recognized as one of the most efficient coating processes. However, in today's ultra-competitive environment, the quest for improved efficiencies is relentless. Recent increases in energy costs, the desire to process more parts through the same system, and concerns for the environment have led to an interest in electrocoat materials with lower cure temperatures. Fortunately, new developments are meeting the market demand for a lower-temperature cure with a high-performance cathodic epoxy electrocoat finish.

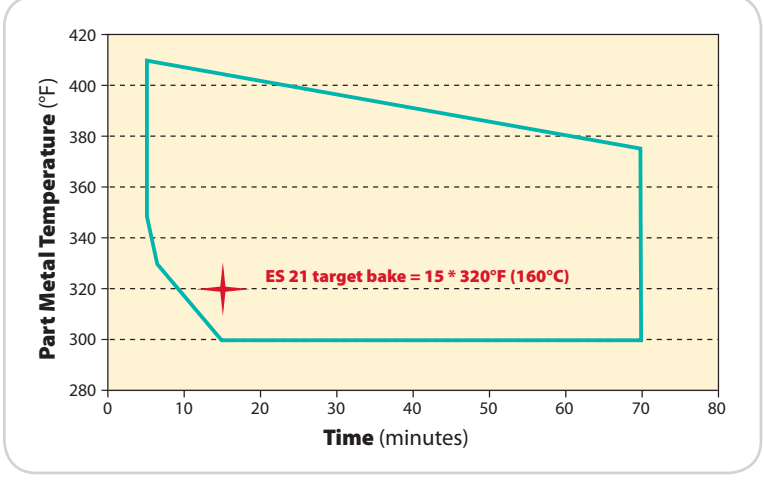


Figure 1. The cure window for the low-cure-temperature cathodic epoxy e-coat.

Coating Development and Performance

The chemistry of cathodic epoxy electrocoat crosslinking involves unblocking or removing alcohol from the isocyanate crosslinker, allowing it to react with functional sites on the backbone resins to form a fully crosslinked film. This unblocking mechanism plays an important factor in determining the temperature required to cure the film. For most commercially available cathodic epoxy electrocoat products used in typically designed processes, part temperatures of 350-400°F (177-204°C) for 10 to 20 minutes are required to cure the film sufficiently.

DuPont has developed a new mixed metal oxide catalyst chemistry that allows the alcohol to unblock more efficiently at lower temperatures. This new catalyst system*

*This new product is available from DuPont as ElectroShield™21.

allows cure temperatures required in typical electrocoat processes to be lowered by 20-40°F while maintaining excellent film properties. The new electrocoat primer expands the lower end operating bake window compared to currently available commercial products. Target bake conditions for the low-cure coating are 15 minutes with the part temperature at 320°F (160°C), and low-end cure temperatures as low as 300°F (150°C) are possible. Figure 1 shows the cure window for the new coating.

The cure response of a coating can be verified by measuring the gel fraction of the polymer system — the percentage of polymer chains that have reacted and are crosslinked to form the coating film. The higher the gel fraction, the better the film is cured. The low-cure cathodic epoxy reaches a >90% gel fraction after 15 minutes at 300°F compared to standard e-coat primers, which reach about 66% gel fraction at that time and temperature. Figure 2 shows gel fraction test results for the new coating and a commonly used control material.

The development of this new e-coat was a global effort. Research chemists and engineers working at laboratories in Wuppertal, Germany, Sao Paulo, Brazil and Mt. Clemens, MI, collaborated on this technology, with the goal of ensuring that this new product would meet the needs of finishing professionals on a worldwide basis. Except for the lower cure temperature, the process operating targets and e-coat bath chemistry operating targets of the new coating are consistent with the existing DuPont cathodic epoxy formulation,** so few or no modifications are required to use the new coating in existing systems. Film properties meet or exceed targeted film properties. The new e-coat is heavy-metal-free, and its volatile organic compound (VOC) content is low, at less than 0.4 lb/gal. Finally, the new coating is "pour-over" capable with all existing cathodic epoxy electrocoat materials.

The new product meets automotive original equipment manufacturer (OEM) specifications, and two automotive OEMs are currently using the coating in North American electrocoat tanks.

Potential Benefits of Lower Cure Electrocoat

Lower-cure-temperature requirements provide several potential advantages to the e-coat finisher, including energy savings, improved process throughput and an improved ability to process parts with heavy metal areas.

The potential for energy savings is obvious. Simple energy consumption models show that lowering oven setpoint temperatures by 30°F (17°C) in a typical e-coat cure oven should yield a reduction in natural gas or electrical energy consumption of about 8%. Exact energy savings will vary depending on many factors, including oven design, part mass and part geometry.

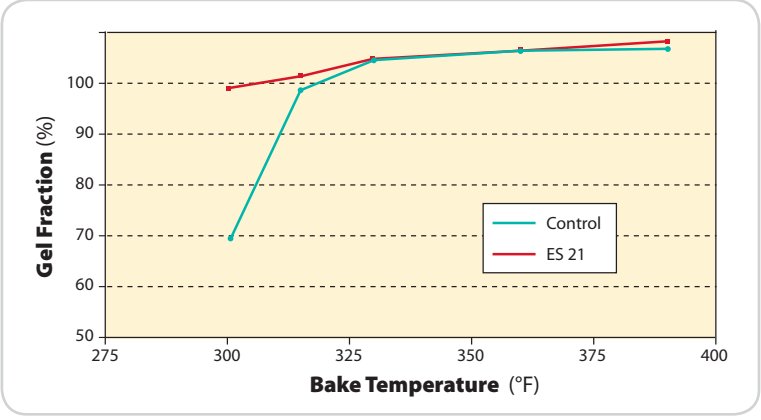
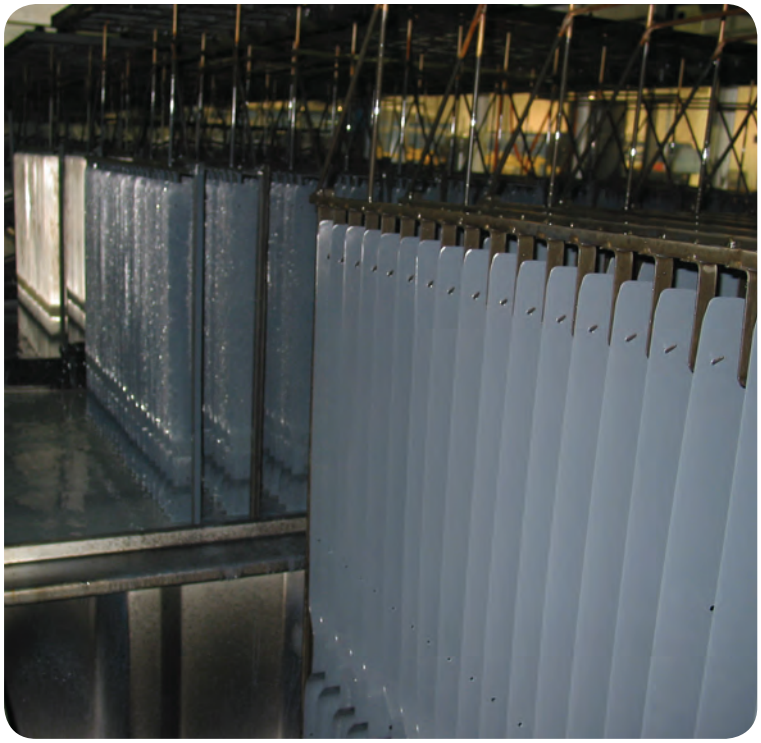


Figure 2. Gel fraction test results for the new e-coat compared to a commonly used control material.

Another advantage of lower-temperature-cure coatings is the potential to increase the mass of parts processed through the e-coat cure oven while using about the same amount of energy. This ability allows the potential for increased rack density or increased line speed. Simple models show that an oven set at 400°F (204°C) with part mass of 100% will consume about the same amount of energy as an oven set at 370°F (188°C) with part mass of 110%. Again, precise oven capacity and energy consumption will vary depending on many factors. Careful consideration



Recent increases in energy costs, the desire to process more parts through the same system, and concerns for the environment have led to interest in electrocoat materials with lower cure temperatures. Photo courtesy of Burkard Industries.

**CorMax® VI.

should be given to all areas of the e-coat system prior to increasing rack density or increasing line speed.

Finally, lower-cure-temperature coatings can allow parts with heavy metal areas to be processed through a typical system without having to raise the target setpoint of the oven or slow down the line speed. An under-cured e-coat can cause poor corrosion or other key physical property performance on the part. The new low-cure cathodic epoxy e-coat has a broader low end cure window, which can help provide better cure on heavy metal areas of parts that take longer to heat.

A Technology Advantage

Modern cathodic epoxy electrocoat coating formulations combined with well-designed application processes are widely recognized as one of the most efficient coating systems available. Competition in the electrocoat finishing business is intense. The successful coater must strive for continuous improvement to survive or thrive. Lower-cure-temperature cathodic epoxy paint formulations offer several potential areas for process improvements that can yield significant economic benefits. ft

Modern cathodic epoxy electrocoat coating formulations combined with well-designed application processes are widely recognized as one of the most efficient coating systems available.

Grant Fry *is a senior research associate for DuPont Performance Coatings, Mount Clemens, MI. He can be reached at GRANT.C.FRY@usa.dupont.com.* **Tab Semanision**, *GIT manager for DuPont Performance Coatings, can be reached at 248.583.4543 or Tab.E.Semanision@usa.dupont.com. For more information about low-cure cathodic epoxy e-coats and other automotive coatings, visit* **www.performancecoatings.dupont.com.**

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"Select Film and Corrosion Properties of the Low-Cure E-Coat"

Find a table listing the basic properties of the new e-coat in the online version of this article.

Abrasives for Better Blasting

Whether you're blasting buildings, bridges, water storage tanks, pipes or other outdoor structures, choosing the correct abrasive can help ensure that you achieve the best possible results.

BY RANDY FOX
Blast/Coat Systems, Inc.

When it comes to abrasives used for general purpose repair and maintenance, paint and rust removal, maintenance applications requiring reduced profiles, new construction, or cleaning surfaces to create a smooth finish, the choices are many. Should you use slag, garnet, steel grit or some other type of abrasive? The choice depends on the application and your objectives.

Back in the Day: Silica Sand

Before the days of regulation by the Air Quality Management District (AQMD), Occupational Safety and Health Administration (OSHA) and others, silica sand was the abrasive of choice. An aggressive aggregate, silica sand proved to be a low-cost and readily available abrasive. All one needed to do was pick up bags of silica sand at a local hardware store and start blasting away.

However, as the federal government became more involved and the abrasive blasting industry became more regulated, silica sand became a health and environmental outlaw.

Why? Three words: crystalline silica dust. This substance is the byproduct of blasting with silica sand. Studies conducted by the National Institute for Occupational Safety and Health (NIOSH) show that inhaling finely divided crystalline silica dust in significant quantities (such as those used in abrasive blasting applications) can lead to a disease called silicosis or, in rare cases, cancer.

Silicosis, also known as grinder's disease or potter's rot, is a form of occupational lung disease caused by the inha-

ABOVE: Lead paint is removed from an elevated water tank. Photo courtesy of Eagle Industries.

BLASTING ABRASIVES

Garnet, a chemically inert and nonmetallic mineral, is probably the most used reclaimable abrasive.

lation of crystalline silica dust. It is marked by inflammation and scarring resulting in nodular lesions in the upper lobes of the lungs, and it is characterized by shortness of breath, fever and cyanosis (bluish skin). The dust becomes lodged in the lungs and is a continuous irritant because silica does not dissolve over time.

Even with all of the studies, health issues and government warnings, blasting with silica sand is still a somewhat common occurrence today.

Slag: A Suitable Silica Substitute

As word got out about the detrimental effects of blasting with sand, the need to find an alternative abrasive with little or no silica content was apparent. Thus, the switch was made to slag as the primary abrasive for one-time usage.

Black Beauty®, Sharpshot®, and Green Diamond® are just a few of the commercial names for various types of slag, a.k.a. "dirt" or "sand." Angular in composition and relatively inexpensive, slag is available in different grit sizes and provides quick cutting due to its aggressive makeup. Slag abrasives are byproducts resulting from the processing of natural materials — for example, coal slag comes from the combustion of coal in the generation of electricity, copper slag from copper mine excavations, and nickel slag from nickel mine excavations.

Most slags contain less than 1% of free silica content and offer advantages such as a low moisture content, a high degree of etch for the permanent bonding of coatings, the ability to be readily used in standard equipment, inert properties, fast cutting due to sharp, angular edges and high hardness. Slag also is economical, long lasting and generates minimal dust during blasting.

Slag comes in many different grits, from coarse to extra fine. The selection depends on the type of material being blasted and the desired finish.

- *Utility grade* is coarse and is used for tough blasting jobs.
- *Medium grade* is used for general-purpose repair and maintenance blasting.
- *Fine grade* is used for new construction, light paint and rust removal, and for special maintenance applications requiring reduced profiles.
- *Extra fine grade* is used to clean surfaces and create a smooth finish. This grade typically is employed in brush-off blast applications or in high-pressure water blast systems.

Reclaimable Abrasives

While slag is great for one-time usage, there are instances when a one-time-use abrasive isn't physically or economically feasible, such as blasting on an island where material has to be brought in on a barge or boat. In such cases, an abrasive is needed that can be reclaimed and reused a designated number of times before it physically breaks down and no longer provides the specified profile required for the job.

In an outside blasting operation, unless there is some type of reclaiming system, the abrasive media is simply scooped up, run through some sort of screening system to filter out debris, and put back into the blast pot to be used again.

Probably the most used reclaimable abrasive is garnet. A chemically inert and nonmetallic mineral that is low in free silica content, garnet is a superior blasting media due to its hardness, high specific gravity, low heavy metal content, low dusting and recyclability. Garnet can be reclaimed and reused four to eight times, depending on such variables as the material being blasted, air pressure, blast nozzle size, etc. Garnet is available in many grades:

- #8/12, #16 and #25 are coarse grits used in heavy duty blasting for maximum cutting power, profile and speed.
- #36 and #30/40 provide the standard in control and optimum profile for coatings applications requiring more precision. The resulting surface cleanliness is excellent.
- #50 and #60 are for lighter and less rigorous applications on softer materials, such as aluminum.

BLASTING ABRASIVES AT A GLANCE

SLAG - Byproducts resulting from the processing of natural materials, with little or no silica content. Useful for one-time applications where reclaim is of little consequence.

GARNET - A chemically inert and non-metallic mineral for applications requiring reclaim.

STEEL - Used in recovery systems and for lead-based paint removal.

Another way to accomplish reclaim is to use a portable mechanical abrasive recycling system, sometimes referred to as a blast machine. This type of system uses steel grit as the blasting media. The structure is first blasted, then a separate vacuum hose is used to suck up the abrasive and blasted debris into the machine. The abrasive is then separated from the debris and sent back into a hopper to be reused.

The advantage of using a large blast machine is in the recycling capabilities of the abrasive. Though steel grit is costly, it can be recycled 200 times or more before it breaks down. The disadvantages of using a blast machine include the high startup costs of the machine, the high initial cost of the abrasive, and the transportation costs and time required to move the unit to and from the jobsite. The location of the jobsite also needs to be taken into consideration — the blast machine is not very mobile and therefore isn't practical for use in remote locations. The use of a blasting machine is feasible on large blast jobs, but it is not as conducive to small jobs where time is of the essence.

Lead Abatement

Some outside blasting jobs require the removal of lead-based paint from water storage tanks, bridges, etc. Many types of lead abatement products are available, including products that are blended with the blasting media, sprayed, rolled or brushed on prior to blasting, or sprayed on while blasting.

For example, a complex calcium silicate additive* can be incorporated into a typical abrasive medium to create an "engineered abrasive" that is suitable for removing lead-based paint systems from most surfaces. When water is added, the lead in the residual waste is chemically stabilized so that it does not exhibit the Resource Conservation and Recovery Act (RCRA) toxicity characteristic (5.0 mg/L) for lead.

Another water-based formula** uses a patented treatment chemistry to convert lead to a highly insoluble inorganic compound. The chemical dosage can be tailored to treat any level of lead cost effectively below the RCRA toxicity characteristic or the universal treatment standard (0.75 mg/L). The treated material remains stable under all "real world" and standard laboratory leaching tests. Once blasting is complete, the combined waste debris can be tested for lead content and disposed of at a landfill.

Because the formula is water-based and pH neutral, it does not create any worker contact, wastewater or material handling problems. Sediment treated with the premium version of the product is nonhazardous and can be managed as a RCRA Subtitle D solid waste. The product therefore provides significant cost savings through reduced testing, transportation and disposal costs. Additional savings are realized by eliminating the preparation and tracking of hazardous waste manifests.

When all is said and done, there are many choices for abrasives for outside blasting applications. Choosing the correct abrasive for your particular job can make all the difference in achieving a cost-effective, high-quality finish.

A ship in dry dock is blasted and painted under full containment. Photo courtesy of Eagle Industries.

A NOTE ABOUT CONTAINMENT

Some outside blasting jobs require the blasting area to be contained. Containment is achieved by erecting a frame that allows a material to be draped over it to enclose the blasting area. Commonly used containment materials include nylon and vinyl netting, screen, tarps, and shrink-wrap.

Scaffolding placed within the containment area allows the blasters to move freely. As one area is completed, the containment system and scaffolding are simply moved to the next area to be blasted.

Randy Fox *is inside sales/marketing manager for Blast/Coat Systems, Inc. (BCS), Rancho Cucamonga, CA, a supplier of abrasive blasting media for contractor, industrial, manufacturing and government applications. BCS is the exclusive distributor in California for Eagle Industries containment products, Enviro-Prep® lead abatement products and Sharpshot® copper slag. Fox can be reached by e-mail at randy@blastcoat.com. For more information about blasting abrasives, visit* **www.blastcoat.com.**

*Blastox®, manufactured by the TDJ Group, Inc., Cary, IL.
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MATERIALS

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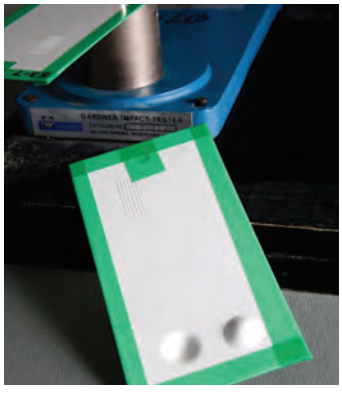

Waterborne Acrylic Topcoat

PPG PROTECTIVE AND MARINE COATINGS (PMC): Pitt-Tech Plus is a new waterborne acrylic topcoat with a VOC content under 100 g/L, making it ideal for areas with stringent regulations. It has been formulated for direct-to-metal applications and primer use on multiple substrates, including steel and concrete. Available in gloss, semi-gloss and satin sheens in four bases, the coating is designed to provide excellent color, gloss retention and corrosion resistance. It can be ordered in 5- and 1-gallon containers and can be applied by brush, roll or spray. Call 800.441.9695 or visit www.ppgpmc.com.

Mildew-Preventive Polyurethane Coating

INTERNATIONAL PAINT LLC (AN AKZO NOBEL COMPANY): The new Interthane 990 UHS is a low-VOC polyurethane technology that contains additives to help prevent the growth of mildew on the surface of exposed coated steelwork. The high-performance, two-component white acrylic polyurethane was specially designed as a solution for the booming petrochemical ethanol market to address ongoing issues with mildew buildup on exterior steel tanks due to splashes, spills, fumes and overfill of the slow evaporating chemical. The new product is formulated for both new construction and maintenance applications and is designed to offer durability, gloss and color retention. Call 800.525.6824 or visit the company online at www.internationalpaint.com.

Synthetic Wax Emulsion

HEATBATH CORP.: Durawax is a multipurpose synthetic wax emulsion that can provide excellent coverage over bare steel or conversion coatings such as black oxide and phosphates. The silicone-free product forms a hard, shiny, dry film that reportedly enhances surface appearance and durability. Applied over black oxide at 50% by volume, it delivers more than 400 hours of corrosion protection when subject to 100% relative humidity (ASTM D2247.) It also can be used as a dry film lubricant for torque reduction and other purposes, as well as an emulsion for weatherproofing military implements. Call 413.452.2000 or visit www.heatbath.com.

Gloss-Retentive Nanocoatings

NANOVERE TECHNOLOGIES: Zyvere nanotechnology-based coatings are permanent, self-cleaning and car key resistant. According to the

MATERIALS

company, the coatings provide 100% gloss retention even after five years. The coatings reportedly offer 53% higher scratch resistance compared to conventional topcoats, along with a 6H pencil hardness; 60% better cleanability; and 476% higher chemical resistance. The nanocoatings were specifically designed to be applied over automotive OEM coatings, aftermarket finishes, aerospace paint, industrial coatings and marine coating surfaces. Call 877.998.3737 or visit www.nanocoatings.com.

Chrome-Free Aircraft Coating

SHERWIN-WILLIAMS AEROSPACE COATINGS: This company now has two complete coating systems — including pretreatment, a corrosion protective primer and a topcoat — certified with SAE International's Aerospace Material Specification 3095 (AMS 3095) for Airline Exterior Systems. The new certification includes CMO483928 with a traditional high-solids chromated epoxy primer, and CMO481968 high-solids chrome-free epoxy primer/surfacer (for an environmentally preferred option). According to the company, the latter formulation is one of the first chrome-free systems to achieve AMS certification. Both systems are finished with Jet Glo Express™ polyurethane topcoat for global aftermarket use as complete painting systems for commercial airline fleets. Visit the company's website at www2.sherwin-williams.com/aerospace.

Energy-Saving Green Pigments

THE SHEPHERD COLOR CO.: Dynamix™ Green 30C612 and Dynamix Green 30C678 "stir-in" inorganic color pigments are part of the Arctic® range for coatings and can be used in color matches to maximize total solar reflectance (TSR), minimize heat buildup and reduce overall energy costs. Dynamix™ Green 30C612 (C.I. Pigment Green 50) is a yellow-shade green, and Dynamix™ Green 30C678 (C.I. Pigment Green 26) is a dark green. Both pigments require only simple mixing. Complete dispersion can be achieved in as little as five minutes, depending on the intensity of the mixing equipment. The pigments are compatible with solventborne and waterborne coatings systems, as well as 100% solids systems and UV-cured coatings. Visit www.shepherdcolor.com.

EQUIPMENT

EQUIPMENT
Ultrasonic Cleaning Machines

ALMCO, INC.: This company has developed an easy-to-operate, high-frequency ultrasonic cleaning machine with an agitated immersion feature that provides significant cleaning power. Two heavy-duty models of the new machine can move a load of parts through 60 vertical 4" strokes per minute while ultrasonic energy and the surging action of the cleaning fluid removes dirt from cracks and crevices efficiently. A third benchtop model offers the ultrasonic technology without the agitation feature. All three units offer continuous operation; a cleaning tank with insulated double-wall construction; an adjustable thermostat for cleaning fluid temperature; and Vibra-Bar© transducer modules that are guaranteed not to crack, depolarize or detach from the radiating surface for 10 years. Call 800.521.2740 or visit www.almcoinc.com.

Lightweight HVLP Spray Gun

WALMEC NORTH AMERICA: The Slim HVLP spray gun was developed for primers and primer surfaces. The gun is lightweight and ergonomically designed. It has an 80% transfer efficiency and a low air consumption rate of 6.6 cfm. The gun has a chemically nickel plated, polished body; an aluminum air cap; and a stainless steel needle and nozzle. It is equipped with an air regulator and gauge and comes in nozzle sizes 1.3, 1.5, 1.7, 1.9 and 2.2. The gun comes in a rigid plastic case that contains all the necessary accessories for proper cleaning and maintenance. Call 386.304.0231 or visit www.walmecna.com.

Dust-Absorbent Sanding Disc

WEBB ABRASIVES: This company has partnered with Joest to release the Joest Superpad P sanding disc, which is perforated across its entire surface. This patented design reportedly allows for continuous dust extraction and prevents filling and clogging of the disc. As a result, the sanding pad wears more evenly over the abrasive surface and lasts up to four times longer than conventional discs, the company reports. The product features a heat-resistant foam backing that extends use of the product by providing a cooler sanding surface. The product fits on all hook and loop manual sanders, regardless of hole configuration patterns or sander suction removal capabilities. Visit www.webbabrasives.com.

Gas-Fired Batch Ovens

WISCONSIN OVEN: This company recently designed and manufactured three gas-fired batch ovens to cure ceramic coatings on assorted parts for the aerospace industry. Each oven has combination airflow, work chamber dimensions of 6' wide x 7' long x 8' high, and a 650°F maximum operating temperature. Using three batch ovens instead of a larger continuous oven helps the plant keep up with growing production demands. Each oven is used for two processes: preheating, with low-temperature operation capability from a gas heated oven; and curing at 650°F (normal curing temperature). The plant also added the company's energy-efficient E-Pack™ oven upgrade, which includes thicker wall panels, higher efficient motors, a door limit switch, and a few other energy-saving items that will reduce operating costs. Call 262.642.6023 or visit www.wisoven.com.

EQUIPMENT & LITERATURE

Manual Powder Spray System

NORDSON CORP., INDUSTRIAL COATING SYSTEMS DIV.: The new Encore manual powder spray system features a plug-and-play design for ease of use and greater productivity. It includes a lightweight gun with On-Gun controls and display, an efficient pump, and flexible controls with digital closed-loop flow control. The back

of the gun features a keypad and display that includes a Mode Selection button with icons, a brilliant blue LED display that indicates values in each mode, and a Gun Purge button. The gun also features PowerPurge™ technology, which cleans the powder path from the base of the handle completely through the gun, providing consistent spray patterns and powder deposition, plus an extra measure of protection against color contamination when changing colors. The pump is designed to provide higher flow rates, with less air consumption, than other conventional systems. Visit www.nordson.com.

Atomizing Air Filtration System

MARTECH SERVICES CO.: The Solution cleans, dries and heats the atomizing air from an existing compressed air source to allow the air to meet spray paint requirements. The four-stage filtration is outfitted with an automatic moisture discharger, and the clean air is further filtered to remove moisture content for super-dry air. A controller with digital outputs allows user to set the temperature of the atomizing up to 165°F. The system reportedly works well with both waterborne and solvent-based paint systems. Call 800.831.1525 or visit www.breathingsystems.com.

Dry Ice Blast Cleaning Equipment

COLD JET, LLC: The new Aero Series dry ice blast cleaning systems are designed to provide economical dry ice cleaning in an environmentally friendly format. The new models include the electric-pneumatic Aero 40, Aero 80, Aero 80-DX and Aero 80-HP, and the pneumatic-powered Aero C100, which reportedly cleans twice as fast as other pneumatic systems on the market. All systems use nonabrasive media that won't damage surfaces or equipment. The media, dry ice pellets or particles, create mini-explosions on the surfaces being cleaned, lifting away dirt and contaminants. The media does not leave any secondary waste, as the dry ice pellets or particles sublimate – convert from solid to gas – upon impact. Call 800.337.9423 or visit www.coldjet.com.

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Finishingad index

Ask Joe Powder

Dear Joe,

How important is TiO_2 in color matching? If we use rutile 828 (Tronox®) instead of Ajantox® while making powders, will we experience a difficulty in color matching between the two grades? Also, is there a test that can allow us to determine a product's lifespan without corrosion — i.e., how much corrosion resistance can be expected if a coating passes 500 hours of salt spray testing?

Dwivedi

Dear Dwivedi,

TiO_2 will make a difference in color. There are inherent differences in TiO_2, depending on the process, treatment and particle size distribution. However, adjusting the color of your powder normally requires only a slight change in the tint concentration.

As for the salt spray comparison to actual corrosion resistance, no clear-cut correlation exists. There are far too many variables in the real world. Nonetheless, salt spray testing (ASTM B-117) is a good comparative tool for measuring the differences between various formulas, substrates and metal preparation processes.

Dear Joe,

We are experiencing a problem with powder coating coverage on the inside corners of a light reflector with a depth of about 6 in., similar to the inside of a bowl. I think the correct term is Faraday cage penetration. We currently apply our powder coating to the inside of the reflector using two flat blades that are mounted in slots to form a crisscross pattern. These blades separate the inside of the reflector into four sections, like a pie. We have tried applying two to three coats but have had little success getting coverage where the blades meet the inside reflector walls. We have tried reducing our kV setting to 40-60 kVs, still with little or no success. Would the gun design play a role in this area, if the gun nozzle were mounted on an extended arm to enable the gun to reach deeper inside the cavity of each section? We are using a bullet-type nozzle tip as recommended. Also, what size powder do you recommend?

Bill Araujo

Hello Bill,

This is a common problem. You have approached it correctly by reducing your kVs (actually your current) and trying different nozzle types. I suggest that you go even lower in kVs (down to 30-35). If this doesn't improve the coverage, then I would definitely try another powder. Excess fines (<10 microns) can exaggerate a Faraday penetration condition. Less than 5% of the particles should be below 10 microns in size. Many off-the-shelf powders have up to 12% of particles less than 10 microns.

One last thing — ensure that you have a good ground on your parts. Poor grounding will make Faraday coverage impossible.

Powders can be formulated to approximate the appearance of anodized silver.

Hi Joe,

We have been asked to powder coat steel parts to match an aluminum anodized hinge. So far we have not had much success. Do you think we're spinning our wheels trying to match a powder to a plating finish? I know that the "chrome" powders that are available really don't achieve a chrome plating finish. Would I be better off asking the customer to revise the specification to allow us to powder coat both the steel parts and the hinge if they want everything to match?

Jim

Hi Jim,

Powders can be formulated to approximate the appearance of anodized silver. It won't be an exact match, but it will come pretty close. The powder coating will provide a low-gloss metallic effect and probably will have to be formulated specifically for your application, rather than being off-the-shelf from a color card. Depending on the environment to which the coating will be exposed, a low-gloss clearcoat might be required for extra durability. You might want to consult a powder coatings supplier for assistance.

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

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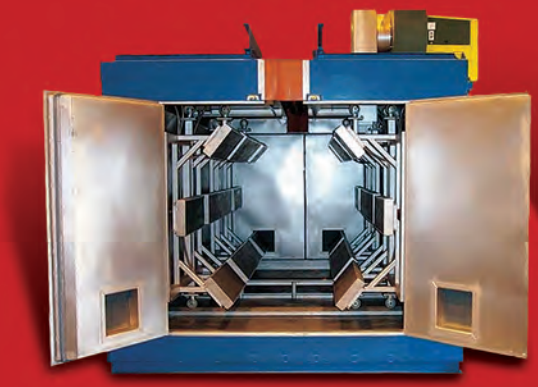

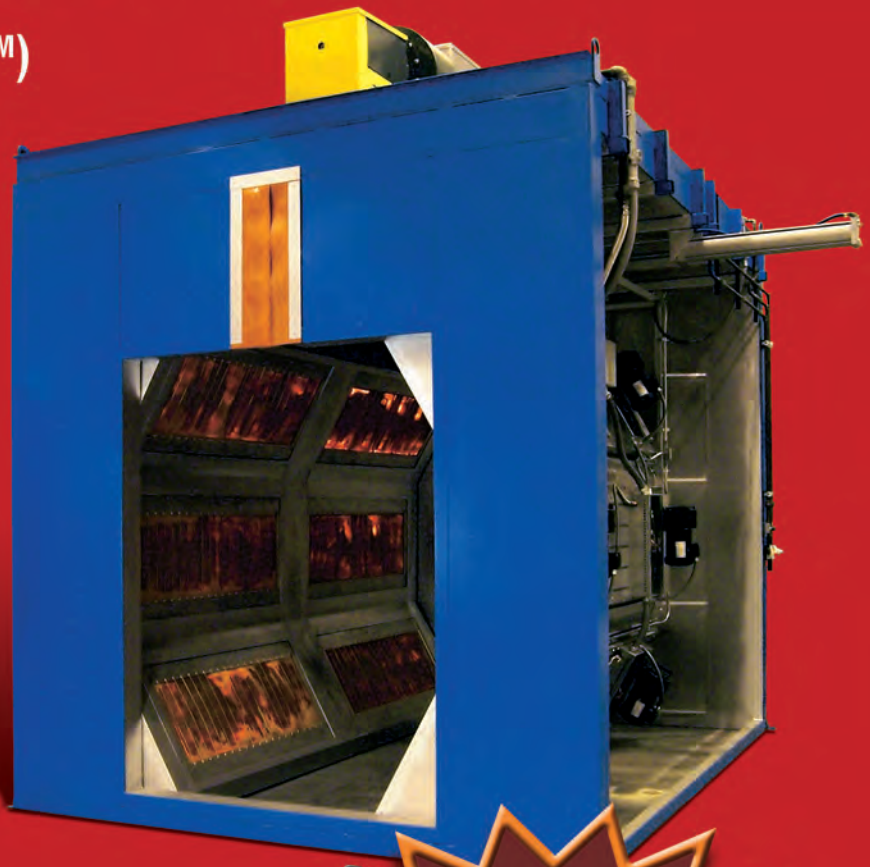

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