Technologies and Processes for the Advancement of Materials

Thermal processing

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FEBRUARY 2020
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FROM THE EDITOR ///

Thermal Processing contributor passes away

It's always upsetting when we lose a voice in the industry, but it's exponentially so for me when we lose a voice who was always eager to share his knowledge with *Thermal Processing's* readers.

That unfortunate event happened in December when the founder of Controlled Thermal Processing and multiple contributor Rick Diekman suddenly passed away on Christmas Eve.

I had the pleasure of working with Rick on several articles over the years, and his expertise with cryogenics was a welcome addition to more than a few issues. I found him to be, not only knowledgeable, but friendly and ambitious. According to his colleagues, he was always guided by the facts while resisting myth and hyperbole. I, too, found that to be the case when editing his articles. He was passionate about cryogenics, but also matter-of-fact when it came to explaining the process.

Speaking for the entire *Thermal Processing* family, I want to send my heartfelt condolences to his friends and family. You will definitely be missed. You can read more about Rick's accomplishments in this issue's Update section.

You'll also find several other articles of interest as you make your way through our February issue.

In our Focus section, an expert with Morgan Advanced Materials takes a look at the future of kiln lining. And Michael Rumfola, president and owner of INEX Inc., shares his insights on the need to embrace industry change.

Sometimes that change occurs with advances in technology, and in our company profile feature, I talk with Pete Martin with CAS DataLoggers on how his company is using customized data acquisition systems to keep track of data.

You'll find all that and much more in this issue. I hope you find it useful as you look for new and innovative ideas to aid you in your personal heat-treat world.

Have a fantastic February, and, as always, thanks for reading!

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Rick Diekman, above, and Jay Leno worked together to produce a video about cryogenics. (Courtesy: Controlled Thermal Processing)

Controlled Thermal Processing founder Rick Diekman dies

Rick Diekman, founder of Controlled Thermal Processing, died December 24, 2019.

Diekman was a trained, experienced mechanical engineer and stress analyst who worked to get the facts out about the developing field of cryogenic treatment. He was first introduced to cryogenics when he was tasked with finding extended tool life when he worked for Fel-Pro. His experiences there convinced him to open what is now Controlled Thermal Processing.

His most visible legacy of the 25 years of his life is the CSA database of research publications pertaining to cryogenic treatment of materials, according to colleagues Jeffrey Levine and Bentzion Ben-Ami. It remains a resource for all who wish to further the research or who are looking for guidance in a specific application. Diekman served on the board of the cryogenic subcommittee of the ASM heat-treating society. While there, he was asked to write the definition of cryogenic processing, which is used to define the process today. He arranged technical partnerships with Air Liquide and gave presentations to the U.S. Army Corp of Engineers. He was involved in the testing that convinced the West Coast division of the U.S. Postal Service to use cryogenics to save money using the efficiencies cryogenic processing provides. During his time with the U.S. Postal Service, Deikman visited Jay Leno's Garage and made an informative video with Leno about cryogenics.

Levine and Ben-Ami say Diekman worked with customers to assess failure modes of their tooling, components or products to help them find solutions to improve or eliminate the problem.

"Of course, we hoped that cryogenic treatment would play a role in any solution; but, he never let our desire to sell our service or our cryo-processors color his advice," said Levine. "As a dedicated engineer, Rick always rendered his best technical assessment. He honored and respected the science. Rick was always guided by the facts; he resisted myth and hyperbole. His stick-to-itiveness in spite of many years of rejection for trying to introduce a disruptive technology is why we are here today. We have lost a valued member of our community and he will be missed."

MORE INFO www.ctpcryogencis.com

ECM Technologies promotes Vincent Esteve

ECM Technologies, innovative heat-treating vacuum furnace manufacturer, promoted Vincent Esteve to business development manager at the ECM USA, Inc. subsidiary in Pleasant Prairie, Wisconsin. Esteve's primary functions will include overseeing business sales and marketing development in North, Central, and South America with a focus on further expanding the ECM brand into innovative markets such as 3D additive manufacturing, vacuum induction melting, vapor phase aluminizing, brazing, and other vacuum furnace applications now offered by ECM Technologies. This also includes rapid thermal process and annealing furnaces and R&D laboratory equipment. He will develop and execute comprehensive strategic sales and marketing plans for established business markets, including but not limited to automotive, aerospace, nuclear, and energy. The new ECM Technologies' robotics division will also be a key product offering introduced to all territories.

Vincent Esteve

Esteve joined ECM Technologies in 2013 as an area sales manager in charge of India,

SEND US YOUR NEWS Companies wishing to submit materials for inclusion in Thermal Processing's Update section should contact the editor, Kenneth Carter, at editor@thermalprocessing.com. Releases accompanied by color images will be given first consideration.

Southern Europe, and Latin America. In 2016, he transferred to ECM USA, Inc. in Kenosha, Wisconsin, with a focus to expand ECM into the North and Latin American heat-treat markets. Before joining ECM Technologies, he worked in sales for Kaliop (London, U.K.), and engineering development for Anotech and CNES (French Space Center) in Toulouse, France. He received his two Master's degrees in engineering and material science from the French School Of Mines of Ales (IMT Mines Alès), and in international business, trade and commerce from INSA (Institut national des Sciences appliquées de Toulouse).

ECM Technologies is an innovative low-pressure vacuum furnace manufacturer with headquarters in Grenoble, France. With subsidiaries and ventures around the world, ECM's global presence is well known in the automotive, aerospace, nuclear, energy, electronic, induction, and 3D additive industries. With a versatile product line, ECM's products are ideal for heat-treatment processes ranging from rapid thermal processing (RTP) with the JIPELEC™ JetFirst furnace to low-pressure vacuum carburizing (LPC) with the ICBP® 1299 DUO (dual chamber vacuum furnace).

MORE INFO www.ecm-usa.com or www.ecm-furnaces.com

Blue M ships mechanical convection oven

This Blue M Class A mechanical convection oven will allow the customer to process products containing flammable vapors inside the oven while maintaining safe operating conditions. (Courtesy: TPS)

Thermal Product Solutions, a global manufacturer of thermal-processing equipment, has shipped one Blue M Class A mechanical convection oven to a company in the oil and gas industry.

This Blue M convection oven has a designated temperature range of 15°C above ambient to 82°C due to the large solvent load in the chamber. The interior of the work chamber itself has dimensions of 25 W x 20 D x 20 H. The oven will allow the customer to process products containing flammable vapors inside the oven while maintaining safe operating conditions. It features special construction that evacuates solvent vapors from the chamber as well as reducing ignition sources.

Special heaters were installed to increase the heat output inside the chamber. This allows for a larger exhaust rate while maintaining ramp times and temperature within the working chamber. The horizontal air movement from left to right maximizes heating rates within the oven chamber.

"This particular oven was designed and reinforced to operate in an inverted position. The entire conditioning system, including the exterior exhaust system, was modified to incorporate the design change," said Jonathan Young, product manager.

Features of this Blue M Class A oven include:

› Differential pressure switches on the circulation and exhaust blowers.

› Fully welded 304L stainless steel interior liner.

› Quick access for simple inner chamber cleaning.

› Safety door switch which de-energizes the heaters and circulation upon opening the door.

› Emergency power-off push button.

› Special inverted design to accommodate customer request.

› Additional heat to allow for additional solvent load in the chamber.

› Watlow PM temperature controller and high limit.

› Powered exhaust for removal of solvent vapors.

› UL labelled control panel.

› NFPA 86 Class A construction for safe use with flammable vapors.

MORE INFO www.thermalproductsolutions.com

CCAI adds Jason Lippert to Women in Finishing FORUM

The Chemical Coaters Association International (CCAI) has added Jason Lippert, CEO of Lippert Components, to the Women in Finishing FORUM program. The event is

May 6-8 in South Bend, Indiana.

As part of a comprehensive agenda, FORUM attendees will tour Lippert Components Inc.'s finishing operations followed by a presentation from Lippert. His presentation, "World-Class Operations Driven by a Culture of Caring," supports Lippert Components' mantra of 'Everyone Matters.' Their focus on leadership and culture development has made an impact on quality, safety, efficiency, and innovation in the company. Attendees will also hear how the leadership at Lippert Components engages people's mental and physical health.

Jason Lippert

Women in Finishing (WiF) provides a platform that fosters professional and personal development for women who have chosen or are pursuing a career in the industrial finishing industry. The Chemical Coaters Association International (CCAI) is a technical and professional organization that provides information and training on surface coating technologies.

MORE INFO www.womeninfinishing.org

Bodycote agrees to buy Ellison Surface Technologies

Bodycote, the world's leading provider of heat treatment and specialist thermal processing services, has entered into an agreement to acquire Ellison Surface Technologies, creating one of the world's largest providers of thermal spray and engineered coating surface technology services to the aerospace industry.

Ellison's business, based in North America, is highly complementary to Bodycote's existing surface technology business. It is primarily focused on the aerospace market. The company will be integrated into Bodycote's surface technology and aerospace business, which itself has seen strong structural growth in recent years.

Ellison's business generated revenues of $50 million in 2018, and anticipated revenue for 2019 will be $58 million. Its growth reflects the fact that Ellison has been successfully gaining share in the civil aviation business, which will also provide a solid foundation for further growth in future years. The cooperation between Bodycote and Ellison will enhance their service offering to aerospace customers. Ellison employs approximately 400 people at six sites across the United States, Canada, and Mexico.

Stephen Harris, group chief executive of Bodycote plc, said, "Ellison's business is one that we have long respected and is a perfect strategic fit for Bodycote's aerospace and specialist technologies' businesses. Ellison has been successful in winning new business in recent years and it will be very complementary to Bodycote's existing surface technology business."

Combining Ellison's thermal spray and engineered coating surface technology services with Bodycote's services and global infrastructure enhances the combined organization's ability to deliver industry-leading solutions that address aerospace customers' heat treatment and specialist thermal processing requirements.

Completion of the transaction is contingent on various regulatory filings' processes; it is anticipated that the transaction will complete during the first quarter of 2020.

MORE INFO www.bodycote.com

The Ipsen Stack Titan® H6 vacuum furnace (Courtesy: Ipsen)

Stack Metallurgical Group expands with Ipsen furnace

Ipsen USA installed a Titan® vacuum furnace at Stack Metallurgical Group's location in Spokane Valley, Washington. Stack Metallurgical Group is Nadcap accredited and the Northwestern United States' largest commercial heat treater.

Formerly known as Inland NW Metallurgical Services, Stack Spokane is one of the company's four locations offering a range of metal processing services. Installation of the Titan® H6 2-bar vacuum furnace was completed in late 2019 and will be used to process critical aerospace components.

Stack operates four Ipsen furnaces in Spokane and a dozen more in Portland. From stress relieving, normalizing, annealing, and hardening, Ipsen has supplied Stack with numerous furnaces to meet just about any heat-treating need.

"It was an easy choice adding another Ipsen furnace to our offering," said General Manager Ron Decker. "We count on Ipsen for a versatile product that delivers great results."

Titan® furnaces achieve powerful performance using innovative technology and pre-

dictive maintenance capabilities all while maintaining a global platform, small footprint, and short delivery times. This Titan® H6 has a graphite hot zone, load size of 36" wide x 36" high x 48" deep and can process up to 3,000 pounds.

MORE INFO www.ipsenusa.com

Nitrex acquires G-M Enterprises to bolster portfolio

In January, Nitrex, a lead provider of fully integrated heat-treating solutions and technologies globally, acquired G-M Enterprises, a strong player in the vacuum furnaces market. It is headquartered in Corona, California.

The acquisition is in line with Nitrex' strategy to further expand its integrated heat-treatment solutions offerings to customers while strengthening its products portfolio. For the past 30 years, G-M Enterprises has earned the reputation as a leading technological supplier of vacuum furnaces solving challenges for customers in the aerospace, power generation, energy, MIM sintering, and commercial heat-treating industries. The acquisition represents a great fit with Nitrex, as both share the same goal of providing technologies that improve customer workflow and efficiency while maximizing the life span and quality of engineered parts and components.

"This acquisition will allow Nitrex to bolster its turnkey solutions business by bringing a new, innovative, and broader mix of heat-treatment systems to our customers," said Jean-Francois Cloutier, Nitrex CEO.

"G-M Enterprises is a strong performer in the vacuum furnaces market. The company has an outstanding growth opportunity, and under Nitrex we will build on that potential even further, using our global customer base and service footprint. We also look forward to welcoming the entire G-M Enterprises' team into the Nitrex family," Cloutier said.

"At G-M Enterprises, we are always looking for new ways to provide customers with the best services and product offerings. Joining forces with Nitrex and becoming part of its family of companies will ensure we keep pace with our customers' evolving needs and expectations," said Suresh Jhawar, G-M Enterprises president. "What this means for the future of G-M Enterprises is an opportunity to enhance our products and services, expand our international presence further by leveraging the resources, expertise, and capital of Nitrex. These advancements will deliver more value to our customers for years to come."

MORE INFO www.nitrex.com.

In January, Nitrex acquired G-M Enterprises. From left, Veena Jhawar, G-M Enterprises COO; Jean-François Cloutier, Nitrex CEO; and Suresh Jhawar, G-M Enterprises president.

TPS ships Gruenberg vivarium sterilizer to lab animal industry

Thermal Product Solutions, a global manufacturer of thermal-processing equipment, has shipped a Gruenberg vivarium sterilizer to the lab animal science industry.

Trim panels were fitted to cover the area between the wall opening and the unit so that a flush appearance was achieved. The trim panels are held in place by magnets on the back of the panel to simplify the installation. This provides an impassable barrier to rodents on the top and sides of the unit.

A pneumatically locked, single-load door was provided with a viewing window for clear visibility into the working chamber. The quadruple insulated window is cool to the touch and has a protective panel to shield from damage. Interior lighting was also added to increase visibility inside the chamber.

Seamless-tubular incolloy type heaters, that produce a high energy, efficient output, supply the electric heat. The heaters are suspended in the plenum, adjacent to, but separate from the process chamber, so that work in progress and operators are protected. Terminal ends are inserted through the walls of the unit and use sufficient dead zones so that heat is not generated beyond the plenum. A high-volume, horizontal airflow system is installed in the unit to ensure uniform heat distribution throughout the work chamber and optimize efficiency. This dry heat technology will not degrade cages and significantly reduces overall maintenance costs compared to autoclaves.

A 10-inch touchscreen HMI with PLC were installed to control the sterilizer. The control console was designed to be free standing with a wiring harness for ease of relocation and accessibility. The HMI supports data logging so that cycle data may be analyzed for research or quality purposes. A communications module was also added to the controls for quick access to Ethernet and USB ports to connect to the HMI interface.

"The sterilizer featured modular construction which allows the customer to work around their architectural restrictions while maximizing chamber space. The interior and exterior feature a stainless-steel finish for ease of cleaning and maintaining

The Gruenberg vivarium sterilizer features modular construction which allows the customer to work around their architectural restrictions while maximizing chamber space. (Courtesy: Gruenberg)

sanitary conditions," said Jonathan Young, Gruenberg product manager.

Features of this Gruenberg sterilizer include:

› Stainless steel 304 with a #4 finish exterior.

› Fully welded 304L stainless steel interior liner.

› Protective chamber side rails.

› Plate floor.

› Pneumatic door lock with interior override.

› Interior lighting.

› Vermin seals.

› Modular construction for ease of installation.

› Intake and Exhaust HEPA filtration.

› Powered exhaust for fast and effective cooling.

› UL labelled control panel.

› HMI with PLC controls.

› Disconnect switch.

› Communications interface module.

MORE INFO www.thermalproductsolutions.com

Ipsen adds academy-trained technicians to field service

Ipsen has completed its 2019 Corporate Academy class. Seven graduates will step into their full-time roles as field service engineers (FSEs) after several months of training and a comprehensive exam. The program is part of a strategic initiative to continue growing service capacity across the globe.

Ipsen employs a large, skilled aftermarket team. With local FSEs, customers have better access to on-site inspections, evalua-

The Ipsen Corporate Academy program is part of a strategic initiative to continue growing service capacity across the globe. (Courtesy: Ipsen USA)

tions, repairs, installation, and support for their heat-treating and auxiliary equipment.

"Since the launch of the Corporate Academy, we have differentiated ourselves from the competition to establish Ipsen as the clear market leader in service," said Ipsen Service Manager John Worley.

The next class began in January 2020, with another starting in April 2020. Ipsen plans to add ten more trained technicians to the field this year. During this five-month training, participants are taught core values, culture, and fundamental job skills through classroom presentations, hands-on troubleshooting experience, and on-the-job field training.

Graduates of the 2019 class were grateful for the unique learning opportunity.

"The Ipsen Corporate Academy was a very engaging experience," said one graduate. "Ipsen has given us a great platform to head out into the field."

"The level of training is well above and beyond any company I have worked for," said another graduate.

Ipsen is recruiting candidates with mechanical and electrical experience or education who want to improve their skills in vacuum furnace technology, design, installation, service, and troubleshooting. These positions may require relocation, as well as domestic and occasional international travel.

MORE INFO www.ipsenusa.com

Sandvik names sales manager for Nordic region

Sandvik Materials Technology appointed Erik Bäck as the new sales manager for the Nordic region, following the retirement of Björn Larsson who left the company at the end of 2019.

Bäck has been with Sandvik for 14 years. He started his career in marketing and product management and studied for his thesis while working in the marketing department. In 2013 he moved into sales, looking after the Norwegian market as well as having responsibility for Sandvik products.

Larsson's career with Sandvik began 41 years ago, working in the warehouse at Sandvik in Kista. He was employed outside of Sandvik between 1990 and 1996, when he returned to work in sales again, both internal and external. Over the last 20 years, he has been responsible for the Nordics, finally as regional sales director, based in Stockholm.

"I've thoroughly enjoyed all these years I've spent at Sandvik," Larsson said. "I've worked with some great, talented and knowledgeable people in an exciting and dynamic company and industry and it has been a privilege to have been responsible for sales in the Nordic region. We work very closely with our customers and enjoy strong relationships which have been built up over many years and have contributed to their success as well as that of Sandvik. I am pleased to be handing over the reins to Erik, who I know will do a fantastic job and I wish him all the very best in his new role."

"Björn and I have been working together since September this year (2019) to ensure a smooth transition and I would like to assure customers that our products and set up are exactly the same and it is very much business as usual," Bäck said. "I am looking forward to continuing our successful relationships and building upon the excellent work established by Björn and the team. On behalf of everyone at Sandvik, I wish Björn the best of luck for the future and a long and happy retirement."

Countries in the Nordic region covered by the Stockholm office include Sweden, Denmark, Finland, and Norway, as well as Latvia and Iceland.

MORE INFO materials.sandvik

Lindberg/MPH ships two atmosphere pit furnaces

Lindberg/MPH has shipped two electrically heated atmosphere pit furnaces to the automotive industry. The nitrogen atmosphere pit furnaces will be used for heat treating automotive parts.

The two pit furnaces use high-velocity forced convection heating systems inside an atmosphere tight retort chamber and have a maximum operating temperature of 1,250°F. The work chamber is approximately 50" in diameter and 60" deep. The overall dimensions are 101" wide by 90" long by 148" high with a working height of 110". The maximum load gross weight is 10,000 pounds.

The atmosphere tight furnace retorts are interior chambers that contain the nitrogen atmosphere and workload within a cylindrical shell that has a solid bottom and sealing trough at the top. The systems also feature forced cooling systems to accelerate the furnace cooling cycle while the load is under nitrogen atmosphere.

"Pit furnaces provide customers with

the ability to process large product loads. These furnaces also feature forced cooling to reduce cycle times and further increase production rates," said Kelley Shreve, applications engineer.

Features of these Lindberg/MPH nitrogen atmosphere pit furnaces include:

› Eurotherm programmable temperature controller.

› Motorized butterfly valves and air blowers in the forced cooling system.

› Nitrogen pressure reducing regulator and two manually adjusted flowmeters.

› Electrically operated boom lift cover lid.

› Alloy propeller furnace fan with high efficiency 3-HP motor.

› Helical coiled Ni-chrome heating elements.

› Thermal efficient ceramic fiber insulating modules.

MORE INFO www.lindbergmph.com

Lindberg/MPH has shipped two electrically heated atmosphere pit furnaces to the automotive industry. (Courtesy: Lindberg/MPH)

L&L Special Furnace Inc.'s GS1714 bench-mounted box furnace. (Courtesy: L&L Special Furnace)

L&L Special Furnace ships electrical bench top box

L&L Special Furnace Co, Inc., has shipped five model GS1714 furnaces to a worldwide leading manufacturer of chemicals and chemical coating products in the Midwestern United States. These products are primarily used in the medical field as a coating. They must be cured at 800°F and the furnaces can also be used for sintering of chemical powders up to 2,200°F.

The model GS1714 has an effective work zone of 10" high by 15" across by 13" deep. The furnace is designed to be placed on a bench top or with an optional furnace stand. It has a program control with six individual programs with up to six segments each. Each furnace is equipped with KISS datalogging software, which allows its temperature profile to be recorded on a PLC. This software can allow for 25 furnaces to be included and grouped in the data logging software. The furnaces can also be equipped with overtemperature protection.

Also available is the larger GS2026 with all of the same options as the GS 1714 but with a working zone of 18" wide by 12" high by 24" deep.

The model GS1714 is in stock now at L&L and available for immediate delivery.

MORE INFO www.llfurnace.com

Seco/Vacuum launches products to update processes

Seco/Vacuum Technologies (Seco/Warwick Group) in a single year launched two products that will have significant long-term impact for in-house heat-treatment departments and commercial heat treaters alike.

Both products update legacy processes in widespread use in industries such as automotive, aerospace, and other high volume, high value markets, and their contribution to these industries will be immeasurable.

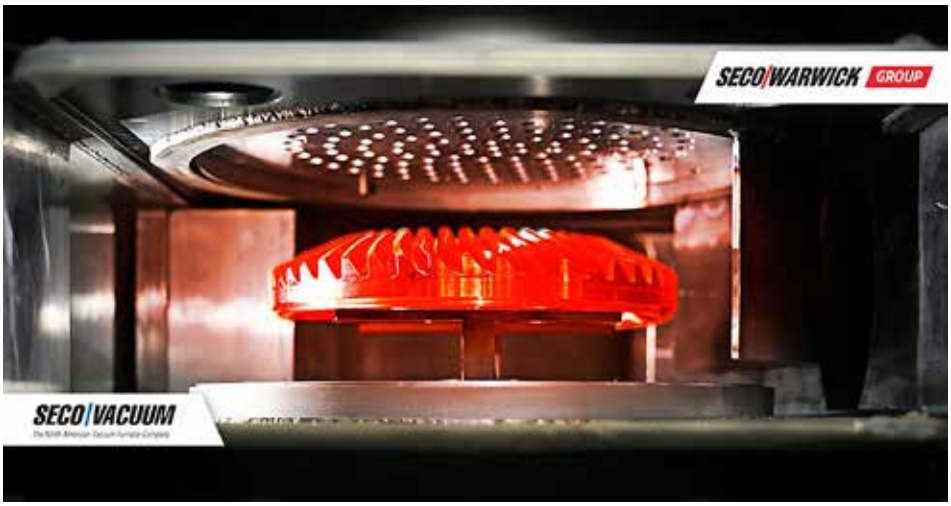
Super IQ® is a revolutionary gas carburizing furnace that will replace the traditional integral quench furnace in common use for nearly 40 years. It delivers cleaner parts with no flames and no endogas, it can accelerate production capacities and offer greater process flexibility with higher temperatures, and it can be easily adopted into current IQ process lines using existing loaders.

UCM® 4D Quench® is a unique single-piece flow vacuum furnace and quench system that will eliminate the hot and dangerous manual process conditions that are in common use today. Perfect for transmission product manufacturing, such as large gears, the 4D Quench system moves each part, automatically, one at a time, from a vacuum heating chamber to a quench chamber, cooling with no distortion using nitrogen jets directed at the spinning part (the 4th dimension), resulting in perfectly uniform parts with no manual handling.

As a baseline, these two new technologies will improve reliability, repeatability, and quality, while at the same time, reduce operator risk and manufacturing liability.

Piotr Zawistowski, managing director of Seco/Vacuum Technologies, said, "Seco/Warwick Group is on a trajectory to help companies do more than simply survive and compete using ordinary tools. We are making available a new set of advanced tools in these furnaces that will allow our customers to break new boundaries in efficiency, safety and productivity. And this is just the beginning.

"We are proud of our accomplishments throughout 2019 to be able to bring these products to market and we look forward to introducing them to companies through-



The Seco/Warwick 4D Quench system uses a proprietary arrangement of cooling nozzles that surround the part and ensures a uniform flow of cooling gas from all sides; top, bottom, and side – "3D" cooling. To complete the process, a table spins the part (the 4th Dimension), further enhancing quench uniformity. (Courtesy: Seco/Warwick

out North American who will use them to advance their own fortunes and futures in the years to come," Zawistowski said.

During 2019, Seco/Vacuum Technologies also introduced Secovisory, the company's heat-treat advisory council, comprised of a team of vacuum furnace consultants who apply their professional counsel, process knowledge, and supervision to help their customers navigate difficult thermal processing decisions. "Secovisory's mission is to be available to listen, solve and support your specific heat treat challenges," Zawistowski said.

MORE INFO www.secowarwick.com

PCI certification emphasizes powder coating done right

The Powder Coating Institute (PCI) provides information, education, and training to advance the use of powder coating as a high quality, durable finish for industrial and consumer products. A major component of this effort is the PCI Certification program.

Powder coating is an exceptionally high-quality product finish. The performance of powder coating depends on the quality of the substrate, preparation, powder material selected, application process, and curing method. To realize the best possible performance, the correct procedures must be followed within each process. These procedures are developed based on the end-user's desired aesthetics and the end-use performance requirements of the finish.

The PCI Certification program focuses specifically on powder coating operations and is designed to acknowledge coaters who understand the correct procedures and processes needed to achieve required product performance. PCI certification is an extensive audit program, conducted by a PCI-authorized inspector, who evaluates an applicant's powder coating processes and procedures, equipment, maintenance practices and quality control to ensure they have the capability of producing a high-quality powder coated product and meet the high-performance standards necessary to achieve PCI certification.

PCI Represents the North American powder coating industry. The PCI certification program offers two certification types: PCI 3000 certification applies to custom coaters, and PCI 4000 certification is for original equipment manufacturers that apply powder coatings in-house.

PCI certification benefits both certified coaters and manufacturers that outsource their powder coating needs. Among the many benefits for certified coaters are having a qualified, third-party evaluation and assessment of their powder coating capabilities, a tool to serve as a basis to create a continuous improvement process for enhancing powder coating operations, differentiation from other coaters, access to the PCI certified logo to promote their certified status, and the image elevation associated with the high standards of certification. Manufacturers who use a PCI certified coater benefit from the added assurance that the selected coater takes powder coating needs seriously and has demonstrated they have the competency and processes in place to deliver a quality powder coated product.

"Process measurement and repeatability are key to giving customers confidence that a certified finishing operation has the processes in place to do the job well," said PCI Interim Executive Director Sheila LaMothe. "By successfully completing the certification process, coaters demonstrate that they understand that powder coating is a high-performance painting process that must be maintained and controlled to optimize the performance of the finish. This is a crucial component of powder coating done right."

Annual audit procedures are required in order to maintain PCI certified status. The certification cycle consists of an intensive on-site audit, followed by two years of maintenance audits which require documentation that ensures processes and procedures evaluated during the on-site audit have been sustained to the level required for PCI certification. In year four, the intensive on-site audit is repeated.

MORE INFO www.powdercoating.org/certification

Tenney Environmental ships walk-in chamber

Tenney Environmental, a division of Thermal Product Solutions, announced the shipment of one Tenney Environmental walk-in chamber to the chemical products industry. This chamber will be used to perform temperature and humidity testing of heat pump and air handling systems containing hydrofluorocarbon refrigerants.

This Tenney walk-in chamber maintains a relative humidity range of 20-85 percent in the temperature range of 20°C to 85°C limited by a 5°C dew point. The interior of the chamber has dimensions of 14' W x 14' D x 9' H. The operating temperature range

Tenney Environmental's walk-in chamber is designed with an Intrinsically Safe Interior. (Courtesy: Tenney)

is -10°C to 60°C.

This chamber is designed with an Intrinsically Safe Interior (-INS) design. When an intrinsically safe interior is employed, pressure relief equipment is also installed to safely relieve a deflagration or explosion emanating from the chamber, should it occur. A large explosion relief panel is installed in the rear chamber wall with fracture clips around the outside perimeter. Safety chains are also mounted around the outside perimeter to limit panel travel outward should a deflagration or explosion occur.

"Tenney has been building chambers for this customer for nearly two decades. When the customer first approached us with their testing application, we reviewed the worst-case volatile chemical that would be tested inside the chamber workspace and designed the chamber to provide ultimate safety. Our proven design gives our customer confidence and peace of mind when performing tests in our chambers," said Jeff Comitz, applications engineering manager.

Special safety features include:

› Non-sparking circulation blower design.

› Low-watt density sheathed heaters with heater surface temperature monitoring and control.

› Intrinsic safety barriers for temperature sensor wire connections.

› Intrinsically safe humidity transmitter approved for use in hazardous locations.

› Interior incandescent lighting (explosion proof) rated for use in hazardous locations.

› Explosion relief.

› Emergency stop pushbuttons (An E-Stop is mounted on both the outside and inside.)

› An MSA Chillgard 5000 refrigerant leak monitor is provided to monitor the chamber workspace for refrigerant gas leaks originating from the customer's test product. This unit will shut down chamber operation when a leak down to 1 ppm is detected.

› Pneumatic intake and exhaust damper ports are installed, which will be opened whenever an MSA Cillguard fault or alarm condition is detected.

MORE INFO www.thermalproductsolutions.com

Wisconsin Oven ships conveyor oven to treat auto parts

Wisconsin Oven shipped a natural gas (direct) fired continuous duty conveyor oven to an American manufacturer. This conveyor oven will be used for stress relieving steel snap rings used in automotive parts.

The oven has a maximum operating temperature of 650°F and a work zone of 2'2" W x 10'0" L x 1'0" H. Temperature uniformity of ±20°F at a set point of 550°F per the customer requirements was verified with a profile test to meet AIAG specification CQI-9.

This stress relieving oven, when preheated, has sufficient capability to heat 350 pounds of steel parts per hour from 70°F to 550°F. Heated air will be delivered in a horizontal airflow configuration through a fully adjustable boxed duct (louvered openings are factory preset), located along the length and across the height of the work chamber.

"Wisconsin Oven has a long history of providing exceptional temperature uniformity. Our oven designs optimize airflow distribution and our experienced technicians are able to meet the most stringent industry specifications," said Jeff Judd, sales engineer.

Features on this stress relieving conveyer oven include:

› Programmable controller with fast acting auto-tune.

› Temperature survey using three travelling thermocouples.

› Flame detector and flame relay with alarm horn and red light.

› MTR-3 balanced weave wire mesh belt; 304 stainless steel construction.

› Variable frequency drive for conveyor speed control.

› Load and unload extensions.

MORE INFO www.wisoven.com

Wisconsin Oven's recently shipped natural gas (direct) fired continuous duty conveyor oven has a maximum operating temperature of 650°F and a work zone of 2'2" W x 10'0" L x 1'0" H. (Courtesy: Wisconsin Oven)

INDUSTRIAL HEATING EQUIPMENT ASSOCIATION

Learn from the best in 2020 and beyond

IHEA's Infrared Division provides technical training at powder coating seminars.

IRED Education in Atlanta: The Industrial Heating Equipment Association (IHEA) partners with the Chemical Coaters Association International (CCAI), Products Finishing magazine, and Southern Company to provide a comprehensive training course that encompasses classroom instruction, hands-on demonstrations and personal interaction with expert presenters. The Powder Coating and Curing Processes Seminar is scheduled for March 30–April 1, 2020, at the Georgia Power Customer Resource Center (CRC) in Atlanta, Georgia.

The one-and-a-half-day agenda will cover a variety of topics presented by members of companies who are dedicated to the education and growth of the industry. IHEA's IRED members will present a section on infrared curing, which reviews the basics of infrared technology, several useful applications both electric and gas, and case studies to prove the benefits for those who use it. Attendees will also benefit from seeing how to cure parts during the lab demos.

› Curing: Infrared Basics — Scott Bishop, Alabama Power.

› Curing: Electric Applications — John Podach, Fostoria Process Equip., a division of TPI Corp.

› Curing: Gas Catalytic/Complex Applications — Eric Bellon, Heraeus Noblelight America.

The seminar combines the perfect mix of technical information, classroom involvement, hands-on practice, and social interaction for attendees to receive the best overall training value. You won't find a more cost-effective powder coating and curing training seminar anywhere else. Learn from industry experts in this state-of-the art facility.

Registration fee includes: Classroom & Lab Sessions; Breakfasts, Breaks, and Lunch; a Networking Reception; CCAI's *Powder Coating Training Manual* ($65 value); and the newly revised *Infrared Process Heating Handbook for Industrial Applications – 3rd Edition* ($40 value).

To register: www.ccaiweb.com/event/PCCMarch20

PROCESS HEATING EDUCATION ONLINE

IHEA's Fundamentals of Industrial Process Heating Online Learning Course continues to provide an excellent overview of the essential areas used throughout the industrial process heating field. Students benefit from the flexible web-based distance-learning format. It's an

Seminar attendees get up close and personal with infrared technology.

affordable alternative to campus-based classes and allows students to go at their own pace. The program offers a vital tool to industrial process heating operators and users of all types of industrial heating equipment. Students learn safe, efficient operation of industrial heating equipment, how to reduce energy consumption, and ways to improve a company's bottom-line.

Registration is now open for the six-week course that begins April 13, 2020. Students will learn the basics of heat transfer, fuels and combustion, energy use, furnace design, refractories, automatic control, and atmospheres as applied to industrial process heating. A complete listing of topics covered can be found at www.ihea.org/event/FundamentalsSpring20.

IHEA's online courses are a terrific value for IHEA members and non-members alike considering no travel expenses are involved, and there is no time out of the office. Take advantage of the online tools provided and benefit from the ability to learn almost anywhere.

Registration for the Fundamentals of Industrial Process Heating course is open now through April 6 at www.ihea.org/event/OnlineSpring20. Cost for IHEA members is $750 or one member voucher, and non-members is $925. The course includes electronic course handbook, course instruction, quizzes and projects, class forums, and the opportunity to contact the instructor throughout the course. Students will also receive PDHs for successfully completing the course. Printed materials are available for an additional fee.

CALLOUT INFO

Benefits of online training:

- Students can take the course at home or work.
- Flexible web-based distance-learning format.
- Affordable alternative to campus-based classes.
- Allows students to go at their own pace.
- Instructor-led, interactive and safe.

PROCESS HEATING RESOURCES TO EDUCATE EVERYONE

In support of IHEA's strategic plan to "provide the knowledge base for the process heating industry worldwide," IHEA offers a selection of publications, videos, archived webinars, and industry links that are accessible from the website, www.ihea.org under Publications and Education tabs.

Among the assortment of books available, the association partnered with publisher Vulkan Verlag to supply valuable reference guides.

"In order to expand our knowledge base, IHEA has brought in these titles to assist those in various sectors of the industrial heat processing industry to access the most recent information and stay current with new technologies," said Education Committee Chairman Brian Kelly of Honeywell.

In addition to the printed materials, IHEA's Learning Academy houses a collection of videos available for IHEA members. Some are for rent, others are free for viewing. The videos are designed to give you information and provide an understanding of many industrial process heating technologies.

IHEA also provides valuable links to archived IHEA Insider Newsletters, an up-to-date industry news feed, and past columns that were featured in trade publications. There is a plethora of relevant knowledge for anyone involved in the industrial process heating industry through the website, www.ihea.org.

IHEA members can take advantage of all IHEA education offerings and resources at a discounted rate. Is your company an IHEA member? For additional information on the Industrial Heating Equipment Association and becoming a member, visit www.ihea.org.

Find the Industrial Heating Equipment Association (IHEA) on social media for current news, events and networking: Facebook, Twitter and Linkedin.

IHEA 2020 CALENDAR OF EVENTS

MARCH 12–16

IHEA 2020 Annual Meeting

IHEA's 91st Annual Meeting will be held on Royal Caribbean's *Brilliance of the Seas,* sailing from Tampa, Florida. In addition to IHEA's committee meetings, business presentations and networking opportunities, the itinerary includes a day to enjoy Cozumel, Mexico.

For details on IHEA events, go to www.ihea.org/events

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JUSTIN SIMS
MECHANICAL ENGINEER /// DANTE SOLUTIONS

Using computer modeling to design low pressure carburizing schedules for strong carbide forming steel alloys.

Simulation tools to effectively calculate process

One common goal for a wide range of industries has been to increase power density in shaft and gear components. The steel producing industry responded with high strength steels containing elements such as chromium, vanadium, and molybdenum. While these elements impart a great deal of strength, they also bring the propensity to form carbides during carburizing processes. While gas carburizing has been the main source of carburizing for decades, these types of steels are difficult to gas carburize due to the high amounts of carbides that can form during the process. The formation of these alloy carbides then retards carbon diffusion by reducing the effective carbon gradient.[1] Figure 1 shows excessive carbide formation and networking in Ferrium S53, an extremely difficult to carburize alloy.

As the amounts of certain alloying elements are increased, the size of the austenite phase field shrinks. This means that less carbon is able to dissolve into the austenite matrix. The carbon that does not dissolve into solution forms carbides. Figure 2 shows a portion of the Fe-C equilibrium phase diagram. Figure 3 shows an isopleth from the Fe-Cr-C ternary phase diagram for 5 percent Cr. At carburizing temperatures, it is possible to dissolve upwards of 1.5 percent carbon in austenite in a Fe-C system. However, for the Fe-Cr-C system with 5 percent chromium, the amount of carbon is reduced to approximately 0.75 percent. For steels with yet higher chromium content, such as Pyrowear 675 with 13 percent chromium, the austenite field is reduced even further, and the formation of carbides at carburizing temperatures is rapid. Understanding when carbides form and how large they grow is extremely important when designing a carburization schedule.

Low pressure carburizing is the perfect solution to the fast forming carbide problem because of the ability to control the atmosphere chemistry quickly; i.e., boost and diffuse steps. During the boost step, where a carbon rich gas is introduced into the vessel, carbon accumulates on the part surface, with some diffusing and some forming carbides. When the carbon carrier gas is removed during the diffuse step, the carbides dissolve and provide an additional carbon source for diffusion into the part. In determining carburizing schedules, carbide formation must be considered for accurate case depth formation. Equations that have been developed over the years, such as the ones shown below, prove ineffective in describing the effect of strong carbide forming elements on the diffusion of carbon. A model must go past simple diffusion and account for the carbide formation and dissolution. These equations are only valid within particular chemistry ranges, as discussed in references [3] for Equation 2, [4] Equation 3, and [5] Equation 4.

$$\text{Case depth} = f * \sqrt{t} \qquad \textbf{Equation 1}$$

$$D(T,C)=0.47*\exp[-1.6*C]*\exp[-(37{,}000-6{,}600*C)/R/T] \qquad \textbf{Equation 2}$$

$$D(T,C)=(0.04+0.08*C)*\exp[-31{,}350/R/T] \qquad \textbf{Equation 3}$$

Figure 1: Grain boundary carbides formed in Ferrium S53 steel during carburization.

$$D(T,M,C)=(0.146-0.036*C*(1-1.075*Cr)+ k1*M)*\exp[-(144.3-15.0*C+0.37*C2+ k2*M)/RkJ/T] \qquad \textbf{Equation 4}$$

where:
T is temperature, °K.
C is weight percentage of carbon.
k1 and k2 are multiplying factors for specific elements.
M is weight percentage of Mn, Si, Ni, Cr, Mo, or Al.
R is the universal gas constant, 1.986 cal/mol/°K.
RkJ is the gas constant expressed as kJ/mol/°K.

Simulation tools, such as DANTE, provide the means to effectively design the boost/diffuse schedules used for the low pressure carburizing process of steels with high carbide forming elements. Simulation can be used to design the duration of the boost steps by predicting the size of the carbides and/or the amount of carbon in carbide form

IRON-CARBON PHASE DIAGRAM

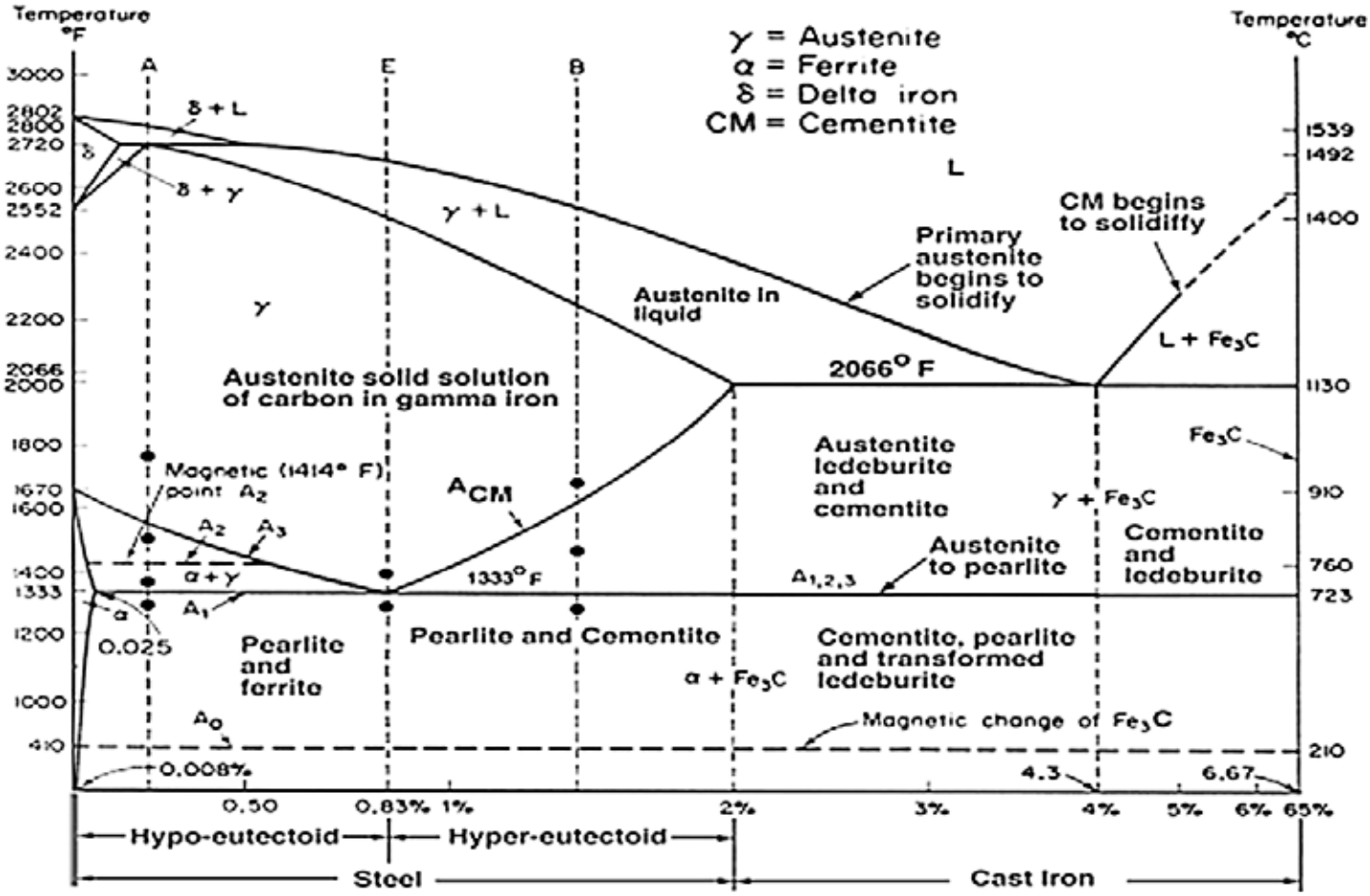


Figure 2: Portion of Fe-C equilibrium phase diagram. [2]

during the boost step. The length of the diffuse step can then be determined by calculating how quickly the carbides dissolve. The two plots show the difference between properly defined boost steps, Figure 4, and a schedule in which the boost steps are too long, Figure 5. Both schedules have the same total time. In Figures 4 and 5, Free Carbon is the carbon that is dissolved in the austenite matrix, Carbon in Carbide is the amount of carbon in carbide form, and Total Carbon is the sum of these two values.

It is evident that the carbides from the poorly designed boost steps are becoming thermodynamically stable and will most likely not dissolve fully at the carburizing temperature, whereas the good schedule sees carbides forming during the boost step and then nearly dissolving during the diffuse steps. Steps could continue to be added in this manner until the required case depth and carbon profile are achieved.

To gather the required data for modeling carbide formation and dissolution behavior, experiments must be conducted. The experiments should be performed in vessels that will be used for production, as the injection and removal of gas will vary depending on the equipment. The transient behavior of the carbon flux on the part surface must be described by the model. Generally, cylindrical coupons are used, with various boost and diffuse times. The idea is to capture carbide behavior at different times of the process, as well as the carbon diffusivity through the austenite matrix. The carbon profile of the coupon is then determined by carefully machining thin layers off the cylinder, collecting the chips from each layer, and performing a LECO analysis. Alternatively, carbon levels can be measured by mass spectrometer. The measurements report the total

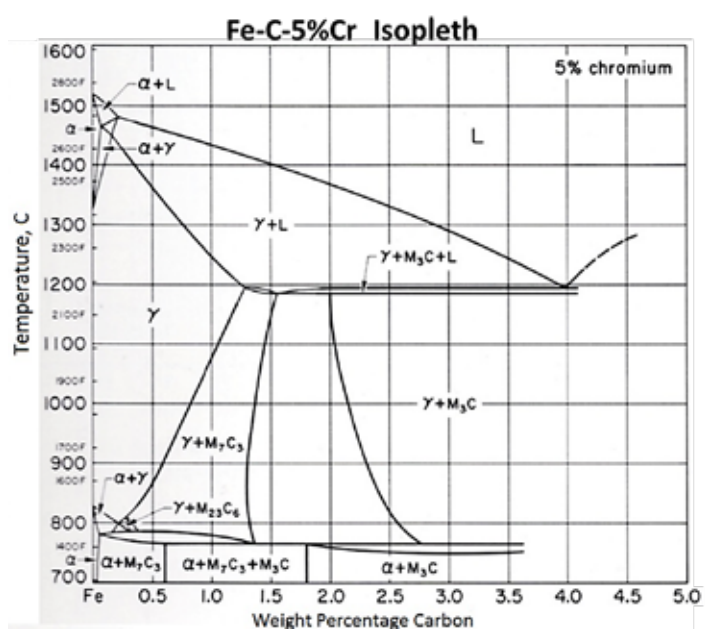
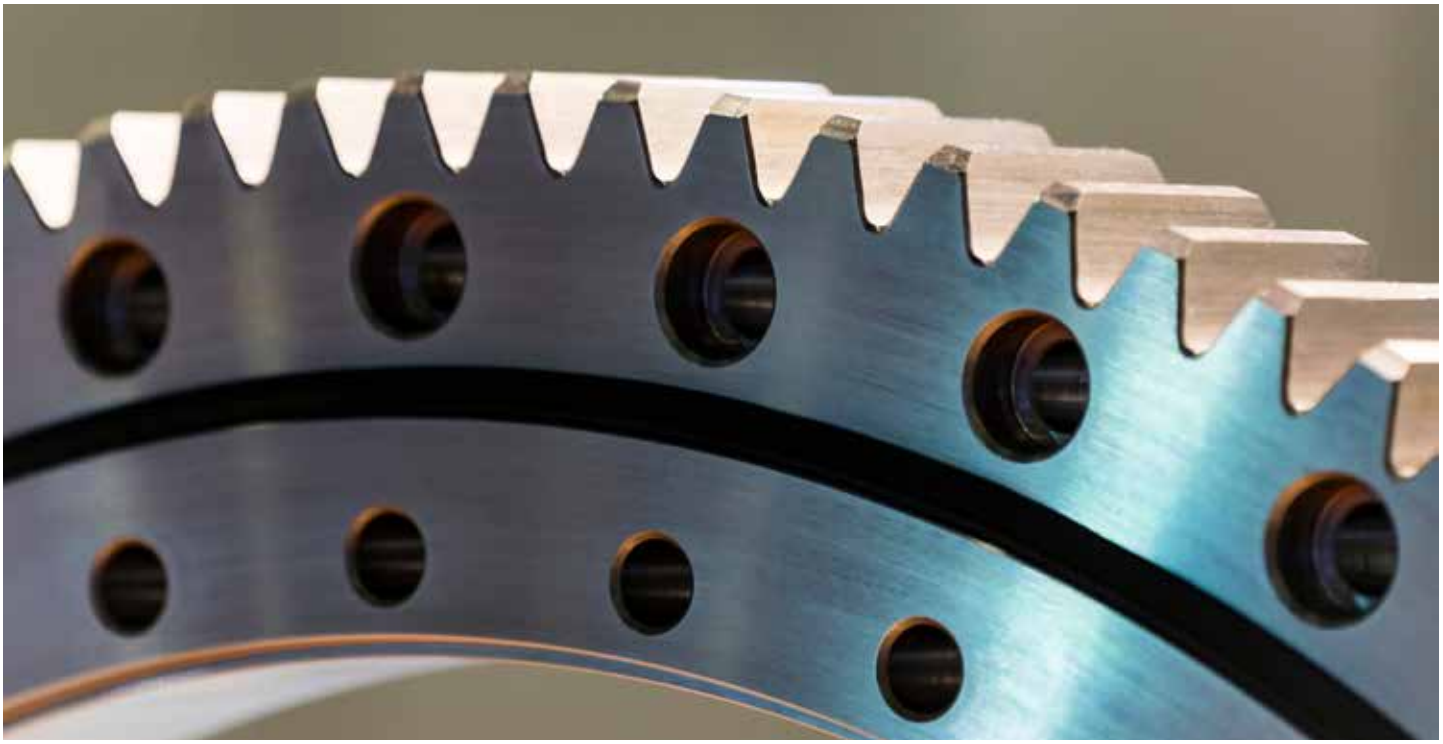


Figure 3: Isopleth from Fe-Cr-C ternary phase diagram for 5 percent Cr. [2]

carbon, a combination of carbon in the matrix and carbon in carbide form, so that a fitting algorithm must be employed to tease out the carbide kinetics. Metallographically prepared mounted samples are also examined optically, with SEM also being used occasionally, to



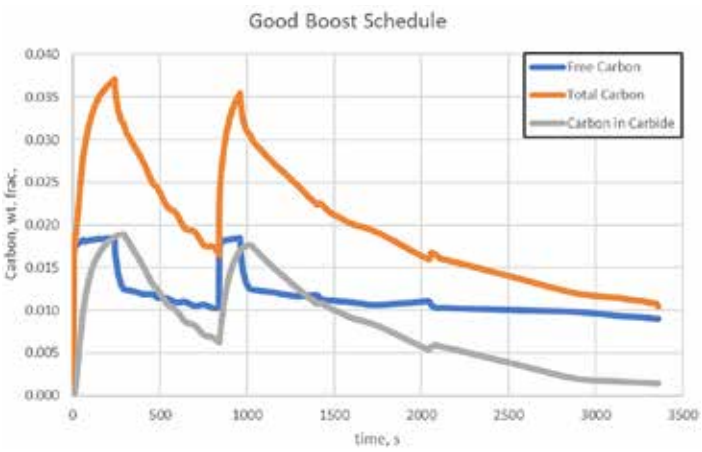


Figure 4: Properly defined boost/diffuse steps in which the carbides are mostly dissolved by the end of each diffuse step.

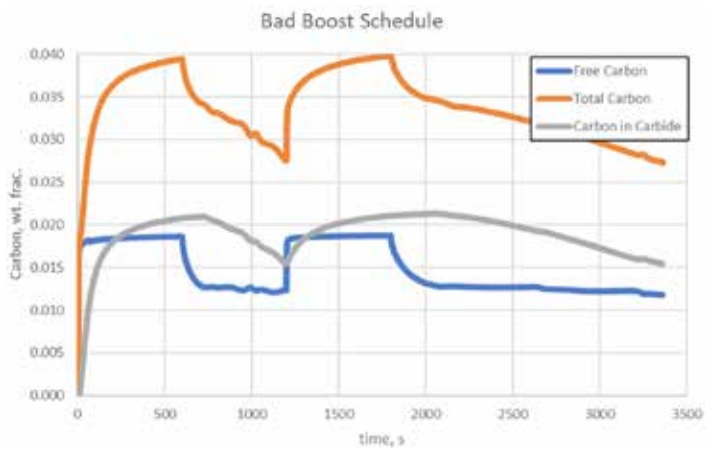


Figure 5: Poorly defined boost/diffuse steps in which the carbides are not dissolved by the end of each diffuse step.

view the carbides. Microhardness measurements are also made on the samples to compare to the carbon measurements and determine a hardness versus carbon relationship.

While high strength steels have the ability to allow for higher power densities in gears and shafts, they also bring the added complexity of rapid carbide formation during carburizing processes. Modeling these processes provides a means to reduce the possibility of unwanted stable carbide formation. However, simple mass diffusion models are no longer sufficient in describing the carbide formation and dissolution behavior. A model which accounts for such behavior must be employed. The DANTE software contains such a model and can be used to design LPC schedules for high alloy steels with relative ease. By modeling the LPC process, the part designer or heat treater is able to avoid the possible detriments of excessive surface and grain boundary carbides or surface contamination by soot or tar.

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ABOUT THE AUTHOR

Justin Sims is a mechanical engineer with DANTE Solutions, where he is an analyst of steel heat-treat processes and an expert modeler of quench hardening processes using DANTE software. Project work includes development and execution of carburization and quench hardening simulations of steel components and analysis of heat-treat racks and fixtures. He has a mechanical engineering degree from Cleveland State University.

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This article outlines the ability to examine and predict the effect of different quenchants on the resultant hardness for simplified geometries.

Determining Grossman H-value from cooling curve data

In the last article, I described how the Jominy end quench test could be used to predict hardness for a series of different round bars, based on the Lamont [1] charts. To calculate the hardness, you needed the Grossman H-value [2]. In this article, the Grossman H-value will be described, and the method of calculating the H-value from cooling curves will be discussed. Limitations of the use of the Grossman H-value will also be provided.

Historically, the Grossman H-value was determined experimentally by quenching a series of round bars. After quenching, the bars are sectioned, polished, and etched. The 50 percent martensite region is determined. This is readily achieved because the transition in etching between dark and light etching corresponds to 50 percent martensite. Table 1 shows the historical values of H-value used.

Classically, the Grossman H-value has been defined as:

$$H = \frac{h}{2k}$$

Where h is the heat transfer coefficient at the surface of the part (usually defined at 705°C), k is the thermal conductivity of the steel. Since the thermal conductivity of steels does not change appreciably over temperature, or from one alloy grade to another, the Grossman H-value is approximately proportional to the heat transfer coefficient.

Although this method has been used in the industry for many years, it is not without problems. The biggest issue with the application of the Grossman H-value is the difficulty in quantifying agitation rates. The terms describing the agitation are not quantifiable and can result in errors. There is really no understanding of what is meant by "mild" or "violent" agitation. Since most oils are tested without agitation, this results in a narrow range of possible oil values. Also, when the original testing was done, the oils used in the original paper were straight oils, devoid of speed improvers. Modern oils achieve much higher quench rates (nearly double) than those tested in the original paper. Further, the different methods of quenching, such as spray quenching, have no equivalent to the Grossman H-value. This method is only focused on the ability of the quenchant to harden steel and gives no indication regarding distortion. However, use of the Grossman H-value provides a method of determining the hardness of a steel alloy based on the quenchant used.

AGITATION OF FLUID OR PIECE	Brine		Water		Oil	
	in.$^{-1}$	mm^{-1}	in.$^{-1}$	mm^{-1}	in.$^{-1}$	mm^{-1}
No Circulation	2.00	0.079	0.90	0.035	0.25	0.010
			1.00	0.039	0.30	0.012
Mild circulation or agitation	2.20	0.086	1.00	0.039	0.30	0.012
			1.10	0.043	0.35	0.014
Moderate circulation			1.20	0.047	0.35	0.014
			1.30	0.051	0.40	0.016
			1.40	0.055		
Good Agitation			1.50	0.059	0.40	0.016
			1.60	0.063	0.50	0.020
Strong Agitation			2.00	0.079	0.80	0.031
Violent Agitation	5.00	0.200	4.00	0.157	1.10	0.043

Table 1: Severity of quench (H) for various quenching media and agitation [3].

CALCULATION OF H-VALUE

Previously, there has not been a way of determining the severity of quench (H) from cooling curve data. Recently, a correlation of the Grossman H-value to cooling curve data was presented [4]. In this method, the average heat transfer coefficient at 705°C was correlated to the Grossman H-value. This method is based on the methodology of Kobasko [5][6]. In this method, the dimensionless Biot number is used:

$$Bi = \frac{hL}{k}$$

Where h is the heat transfer coefficient, k is the thermal conductivity, and L is the characteristic length. In this instance, the measuring device is the ISO 9950 [7] or ASTM D6200 [8]. In each case, this is a 12.5 mm diameter probe composed on Inconel 600. For an infinite cylinder (L > 7D), the characteristic length, L = 0.346r (*r is the radius of the probe or 12.5 mm for the ISO 9950 probe*). The equation above can be rewritten as:

PRODUCT	Cooling Rate at 705° (°C/s)
Houghto-Quench 100	22.3
Houghto-Quench G	59.2
Houghto-Quench K	69.2
Water @ Ambient	144.8

Table 2: Cooling rates at 705°C for a slow, medium, and fast quench oil, compared to water. Oils were tested at 60°C, while water was tested at ambient temperature.

$$Bi_v = \frac{hL}{k} = \frac{h}{k} K \frac{S}{V} = 0.346 \frac{hr}{k}$$

The thermal conductivity of Inconel 600 can be determined from the literature, so that the only remaining variable to determine is the heat transfer coefficient. We also must determine the cooling rate at 705°C. The cooling rate at 705°C is determined from the cooling curve from your supplier, using an ASTM D6200 Inconel 600 probe. Four examples will be used (Figure 1). The cooling rates at 705°C are shown in Table 2.

The intensity of the thermal gradient in the probe is determined:

$$m_\alpha = \frac{\alpha}{K_n}$$

Where m_α is the intensity of thermal gradient in the probe; α is the thermal diffusivity of Inconel 600 (or 5.6 x 10^{-6} m^2/s); and K is the Kondratjev form factor K. For a cylinder, K is

$$K = \frac{R^2}{5.783}$$

Where R is the diameter of the probe. For the ISO 9950 probe, K = 6.75 x 10^{-6} m^2.

Next, the intensity of the thermal gradient in the fluid is calculated:

$$m = \frac{CR_{705°C}}{T - T_\infty}$$

Where T is the temperature the heat transfer coefficient is desired (in this case 705°C); T_∞ is the quenchant temperature an infinite distance from the probe (the bulk average temperature of the fluid — in our case 60°C); and CR_{705} is the cooling rate at 705°C from the cooling curve.

The Kondratjev number, K_n, is the ratio of the intensity gradients:

$$K_n = \frac{m}{m_\alpha}$$

The Kondratjev number, K_n, is also a function of the generalized Biot number, Bi_v:

$$K_n = \frac{m}{m_\alpha} = \varphi Bi_v = \frac{Bi_v}{(Bi_v^2 + 1.437 Bi_v + 1)^{0.5}}$$

This relationship is shown in Figure 2.

From the ratio of intensity gradients, the Kondratjev number, K_n, is calculated. Using Figure 2, the generalized Biot number is determined. From there, the heat transfer coefficient at 705°C is determined:

$$h = \frac{Bi_v kr}{2K}$$

The value of the heat transfer coefficient, h, is substituted in the equation below.

$$H = \frac{h}{2k}$$

Example: Assume that the cooling rate at the center of a standard ASTM D6200 Inconel probe (12.5 mm diameter by 60 mm long) when quenched into Houghto-Quench K is 69.2°C/s. The bath temperature is 60°C. The thermal diffusivity of Inconel 600 is equal to 5.6 x 10-6 m2/s. The thermal conductivity of Inconel 600 is equal to 25.4 W/mK. Calculate the heat transfer coefficient h, and the Grossman H value.

First calculate m:

$$m = \frac{69.2\ °C/s}{705 - 60°C} = 0.11 s^{-1}$$

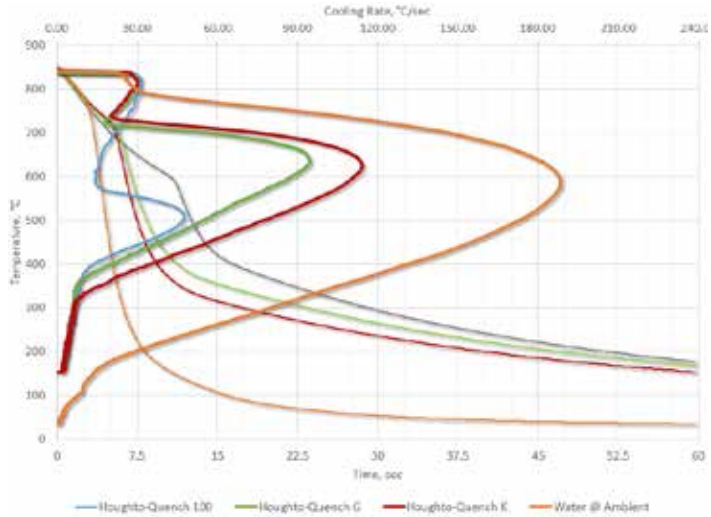

Figure 1: Typical cooling curves of a fast, medium, and slow quench oil compared to water. Oils were tested at 60°C, while water was tested at ambient temperature.

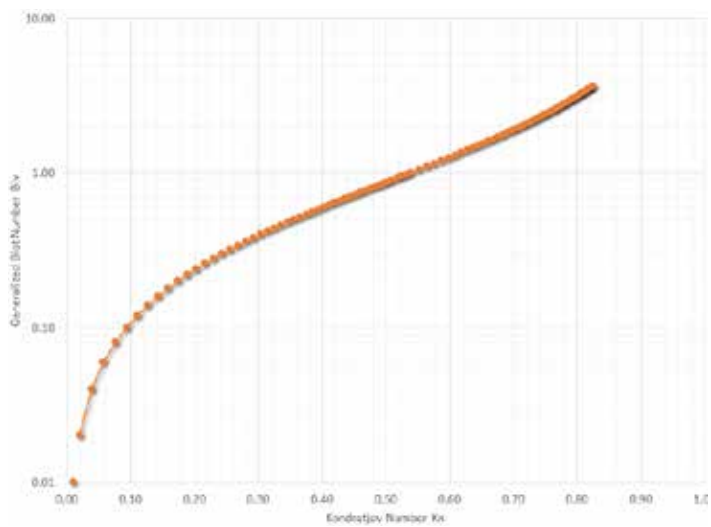

Figure 2: Correlation between the Kondratjev number and the generalized Biot number.

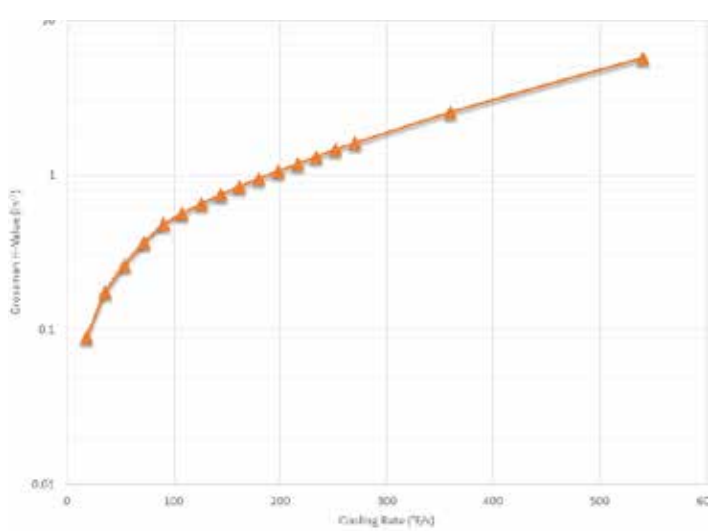

Figure 3: Correlation of the cooling rate at 705°C and the Grossman H-Value.

Next calculate m_α:

$$m_\alpha = \frac{\alpha}{K} = \frac{5.63\ x\ 10^{-6}\ m^2/s}{6.76\ x\ 10^{-6}\ m^2} = 0.83s^{-1}$$

Calculate K_n:

$$K_n = \frac{m}{m_\alpha} = \frac{0.11\ s^{-1}}{0.83s^{-1}} = 0.129$$

In Figure 2, determine the generalized Biot number, Bi_v from K_n. From the graph, Bi_v = 0.143.

Determine the heat transfer coefficient, h:

$$h = \frac{Bi_v kr}{2K} = \frac{(0.143)(25.4)(6.25\ x\ 10^{-3})}{2(6.75\ x\ 10^{-6})} = 1681\ \frac{W}{m^2K}$$

The Grossman H-value can now be determined:

$$H = \frac{h}{2k} = \frac{1681}{2(25.4)} = 33.1m^{-1} = 0.84in^{-1}$$

To make things easier, I have calculated the effect of cooling rate at 705°C on H-value for a wide range of cooling rates. This is shown in Figure 3. From this graph, the determination of the H-value from the cooling curve has been reduced significantly. An advantage of this method is that the H-value can be determined from the cooling curve. If cooling curves are determined with different agitation rates, the H-value can be directly determined.

CONCLUSIONS

In this short article, a description of the method to determine the Grossman H-value from cooling curves has been illustrated. This offers the reader the ability to examine and predict the effect of different quenchants on the resultant hardness for simplified geometries.

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ABOUT THE AUTHOR

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JASON SCHULZE
METALLURGICAL ENGINEER /// CONRAD KACSIK

The review process should be strong enough to ensure conformance, as this will be key to eliminating variables when problems arise.

Quality review: Heat-treat related certifications

As heat treaters, we must admit that, at the end of the day, what we feel we are paying for is a certification that reflects a conforming product or work performed (service). This by no means down-plays the importance of the physical work performed to get there. Just that, to ensure the work was performed and that the results are conforming, we examine the certification(s) associated with that work. The practice of reviewing certifications related to heat treat is essential to verify conformance during internal and third-party audits.

FLOW DOWN OF REQUIREMENTS

While we may depend on suppliers to be the experts, we are obligated to flow down the requirements we choose to set forth. In other words, it would do a heat-treat supplier no good to state on a purchase order, "perform a temperature uniformity survey in accordance with AMS2750" to a pyrometry service provider. As heat treaters, we must take ownership of any product or service we choose to outsource, making the flow down of detailed specific requirements essential. In this case, it would be better to reference an internal procedure which describes the variables associated with pyrometry service in accordance with AMS2750 to the pyrometry service provider.

It is, of course, important to understand our own requirements as they are flowed down to use (i.e. print, PO, specifications, etc.). This may include industry specifications, prime (customer) specifications, as well as your own requirements. These should have already been detailed in an internal procedure, so in that case, we will save that topic for another day. Let's assume heat treaters have interpreted their associated requirements and have documented them in an internal procedure.

The flow down of requirements for any service or product will typically take two forms; referencing an internal procedure or documenting the specific requirements within the purchase order itself. Throughout my consulting I notice that the method used will depend greatly on the system used within purchasing. Some purchasing programs have standard remarks which outline basic purchase requirements and will, at times, include specific requirements for the product or service listed. These specific requirements are derived from internal procedures and specifications. While this can work well when controlled, it can tend to present issues when requirements have changed. For example, if a purchase order to a masking supplier has the specific chemistry requirements within the standard remarks of the PO and the chemistry requirements change within the internal procedure, someone must request that the standard remarks within the purchase order be modified as well. If the necessary changes are not made, the purchase order may flow down obsolete requirements and the results may not be conforming to the new requirements.

Flowing down of specific requirements on a purchase by stating an internal procedure can mitigate that potential issue. Revision control of the relevant internal procedure should also be flowed down on the purchase order as this can assist in the correct requirements being flowed down. This would require the purchaser to send a copy of the procedure or a copy of the relevant section of the procedure referenced. Of course, many heat-treat suppliers have a purchasing system that may include engineering, quality, and manufacturing approval, which, in turn, will help mitigate potential issues. If you find you do not have a purchasing system in place that includes approval steps, it may be something to explore and implement.

VERIFYING CERTIFICATION REQUIREMENTS

The verification process is typically the last step before the certification is kept on file and, perhaps at some point, presented to an internal or external auditor. In the context of conformance, the importance of certification review cannot be over-stated.

The verification process should be performed by an employee who is familiar with the requirements as they are flowed down. At times, I see that a receiving clerk is signing off certifications as "reviewed." In this case, I would be obligated to identify training the receiving clerk received in order to justify this. Another way to handle this would be to have the receiving clerk merely receive the paperwork (verify quantity, etc.) and have someone from quality/engineering verify the certification associated with the product or service is conforming. The key to this is that the person verifying compliance of certifications has a documented training record that indicates they are familiar with the process/service/product provided and its associated requirements.

To ensure the specific requirements have been met and are documented on the certifications, some suppliers choose to implement checklists. Checklists may be designed for a specific test performed or product received. For example, a pyrometry checklist used to verify certification conformance to AMS2750 may be like what is shown in Figure 1. Each test described in AMS2750 has its own section assigned with variables for each test.

Documentation of the review process varies depending on the systems implemented. Some suppliers may use a stamp with a date, others may use a stamp and hand write the date. More electronic-based systems will use anything from an electronic signature to a PDF stamp.

Once the evidence of review has been documented, again, depending on the quality system implemented, the paperwork may be saved electronically, or a hard copy filed away for a predetermined amount of time. Regardless, the documents should be able to be retrieved when requested by a purchaser or auditor.

SUMMARY

Documentation of conformance should be clear on certifications

Conrad
KACSIK_____ QUALITY INSTRUCTION
Instrument Systems, Inc. Revision Date 11/19/2014

Kacsik Pyrometry Review Form

1. The results of testing and calibration shall be documented with the following requirements at a minimum;
   1.1. **Calibration of Recording, Monitoring & Controlling Instruments**

☐ Applicable
☐ Not Applicable

#	Characteristic Requirement	CF	NC	N/A	Comments
1	Instrument number or furnace number				
2	Make of Instrument Calibrated				
3	Model of Instrument Calibrated				
4	Standard used during Calibration				
5	Method Of Calibration used				
6	Required Accuracy				
7	As Found Data at each Calibration point				
8	As Left data at each calibration point				
9	Offset As Found				
10	Offset As left				
11	Sensitivity (Pass/Fail)				
12	Statement of Acceptance/Rejection				
13	Any Limitations or Restrictions				
14	Date The Calibration Was Performed				
15	Due date of the next calibration				
16	Technician who performed the calibration				
17	Conrad-Kacsik name/logo				
18	Signature of Conrad-Kacsik Calibration Technician				
19	Calibration points are the min, max and the middle 1/3rd of the operating range.				

1.2. **System Accuracy Test Report**
☐ Applicable
☐ Not Applicable

#	Characteristic Requirement	CF	NC	N/A	Comments
1	Identification of the Sensor being tested				
2	Identification of the test sensor				
3	Identification of the test instrument				
4	Date Test was Performed				
5	Time of day test was performed				
6	Set point of the furnace during test				
7	Observed test instrument reading				
8	Test sensor correction factors				
9	Test instrument correction factors				
10	Corrected test instrument reading				
11	Calculated system accuracy difference				
12	Indication of test "Pass" or "Fail"				
13	Identification of Conrad-Kacsik Technician who performed the calibration				
14	Conrad-Kacsik name and/or logo				
15	Signature of Conrad-Kacsik technician who performed the calibration				

1.3. **Temperature Uniformity Survey Report**
☐ Applicable
☐ Not Applicable

#	Characteristic Requirement	CF	NC	N/A	Comments
1	Furnace identification name or number.				
2	Survey Temperatures				
3	TUS Sensor and location identification including a detailed diagram, description				
4	Time and temperature data from all recorded sensors required for the furnace instrumentation type for all zones tested.				
5	Correction factors for TUS sensors at each survey temp.				
6	As found offset				
7	As left offset.				
8	Corrected or Uncorrected readings of all TUS sensors at each survey temperature.				
9	Readings shall be identified as corrected or uncorrected.				
10	Conrad-Kacsik Company name				
11	Signature of Technician who performed the calibration.				
12	Survey Start Date				
13	Survey Start Time				
14	Survey test instrument identification number				
15	Identification of test "Pass" or "Fail"				
16	Documentation of TUS sensor failure				
17	Summary of corrected plus and minus TUS readings at each test temperature after stabilization.				
18	Identification of standard used during TUS				
19	Expiration of calibration of the standard used during the TUS.				
20	Correction factors related to each individual channel of the standard used during the TUS.				
21	Time and Temperature data on report match the raw data from the standard used.				
22	The hottest and coldest test thermocouples identified represent the actuals found in the sensor data.				
23	The TUS results conform to the customer supplied pyrometry requirements.				
24	The signature on the TUS report matches that of the actual technician who performed the service.				

The signature below is the authority which reviewed the applicable certifications against customer requirements stated on the applicable PO.

Kacsik WO#:_____ Date Reviewed: _____

Furnace ID:_____ TUS Temp:_____°F

X_____
Reviewed By (please print):

X_____
Reviewed By (please sign):

Figure 1: A pyrometry checklist used to verify certification conformance to AMS2750.

supplied. The review process should be robust enough to ensure conformance, as this will be key to eliminating variables when problems arise. Moreover, products and equipment that have been serviced should not be used until the review process is completed.

ABOUT THE AUTHOR

Jason Schulze is the director of technical services at Conrad Kacsik Instrument Systems, Inc. As a metallurgical engineer with 20-plus years in aerospace, he assists potential and existing Nadcap suppliers in conformance as well as metallurgical consulting. He is contracted by eQualearn to teach multiple PRI courses, including pyrometry, RCCA, and Checklists Review for heat treat. Contact him at jschulze@kacsik.com.

THE FUTURE OF KILN LINING

With the increasing risks surrounding the use of refractory ceramic fiber, Morgan Advanced Materials has developed a safer alternative with increased efficiency and flexibility.

By PETER ERMTRAUD and NICOLA ROBINSON

Lining iron and steel furnaces is critical to extend the life of the furnaces and to protect the purity of the metals being heat treated. Therefore, choosing the best material to meet these needs is critical. For many years, the primary material choice for the industry has been refractory ceramic fiber (RCF), which can withstand the extreme temperatures within the furnace and has a strong resistance to pollutants.

However, RCF has environmental, health, and safety (EHS) concerns. After numerous studies, RCF was classified as a category 1b carcinogen in Europe and is considered a substance of very high concern (SVHC) under Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH).

There is mounting pressure from European legislators to find safer alternatives, "Under the Carcinogens Directive, where technically possible, substitutes to RCF should be used." RCF is currently under consideration for further regulation in Europe, which will make the use of RCF more difficult with constraints and stringent controls likely to come into force in the near future.

This is compounded by the increasing commitment of major industrial companies and trade associations to improve green standards, placing the onus on the fiber industry to find alternatives that match the performance of RCF without adverse effects.

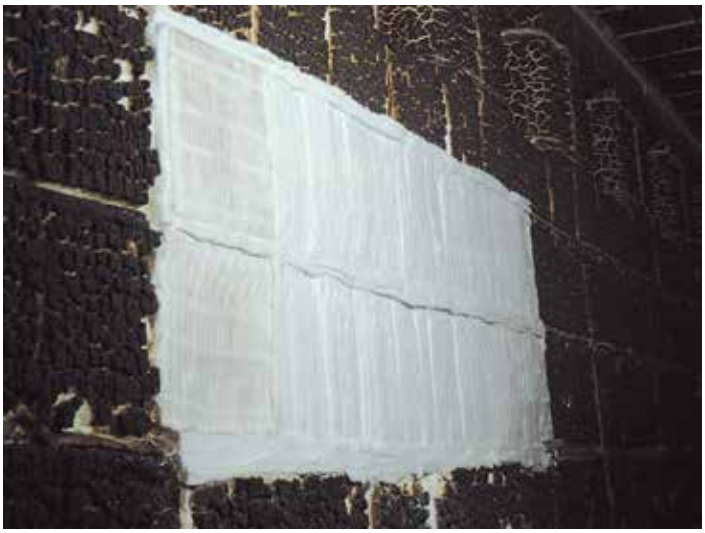
Backed by more than 10 years of research and development and more than 30 months in trials at customer furnaces, The thermal ceramics business of Morgan Advanced Materials has developed Superwool® XTRA, a material that delivers the performance of RCF without the inherent EHS risks associated with it.

REINVENTING RCF

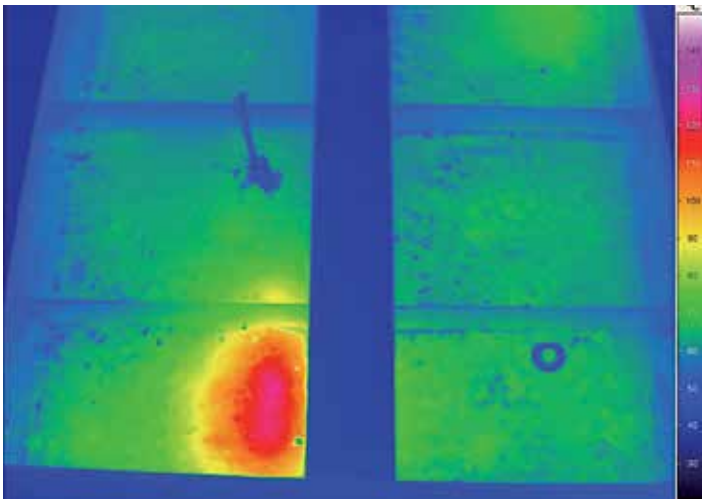
Since the 1990s, the Superwool® brand has been a mark of quality in creating low bio-persistent (LBP) fibers that minimize health risk to furnace installers, operators, and other factory employees. Morgan has achieved major advances in the performance of LBP fibers through Superwool® HT™ and Superwool® Plus™ fiber grades. The evolution of the Superwool® family of materials has been recognized with the Queen's Award for Enterprise: Innovation (2003), as insulating fiber experts have continued to innovate to meet — and anticipate — market demand.

This demand is now for a material that balances the performance of RCF with more stringent environmental safety needs. This is a significant challenge, because RCF has strong characteristics that make it ideal for use in chemical processing, iron and steel processing, and ceramics factories. For example, RCF is very resistant to attack by alkali-based pollutants, a key characteristic that needs to be considered when developing a viable alternative.

That's why, in recent years, the focus at Morgan's Fibre Centre of Excellence in Bromborough, U.K., has been to challenge the assumptions in LBP chemistry. Rather than continuing to make marginal gains in LBP performance, Morgan Advanced Materials flipped its approach and revisited the RCF itself. What the industry wants is an RCF equivalent that has low bio-persistence, so that's how development has been approached.



Finished test-field lined with Superwool® XT stack. (Courtesy: Morgan Advanced Materials)



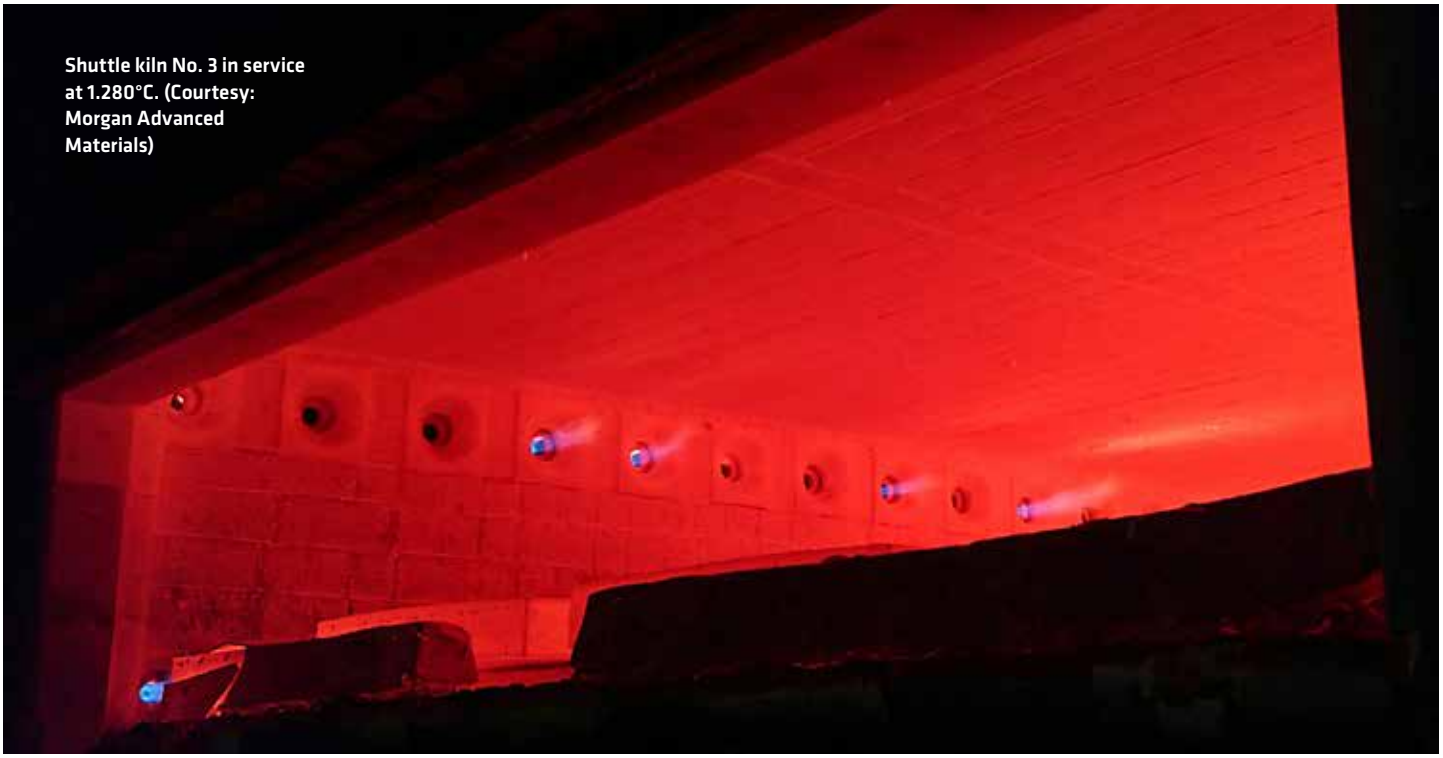
Infrared thermography of roof of shuttle kiln No. 3. (Courtesy: Morgan Advanced Materials)

Superwool XTRA is an alkali metal silicate fiber especially combined to deliver the optimum combination of RCF and LBP properties.

A DIFFERENT FIBER

Superwool® XTRA delivers the strength that industrial applications need, both in terms of its resistance to high temperatures and pollutants, but also its improved EHS credentials.

With a classification temperature of 2,642°F (1,450°C), Superwool®



Shuttle kiln No. 3 in service at 1.280°C. (Courtesy: Morgan Advanced Materials)

XTRA offers a performance equal — and in many cases superior — to RCF. The fiber is unusual in that it expands when heated up to close shrinkage gaps at high temperatures. This is reversible, so when it cools down, the shrinkage gaps return and are visible. Once heated again, it expands and once again closes the gaps.

This means there is no reason to fill the shrinkage gaps with blanket — the normal practice for RCF. With a 2-percent shrinkage, open gaps with RCF normally require an installer to fill these gaps with thin blanket. This is not only time-consuming, but more material is required, adding to the overall cost.

In terms of EHS qualities, Superwool® XTRA is exonerated from any carcinogenic classification under nota Q of directive 97/69EC.

A key benefit is that Superwool® XTRA does not form crystalline silica, a common by-product when many refractories are heated to high temperatures. Having a fiber that produces no crystalline silica is a major breakthrough for the industry, which enhances EHS compliance.

TESTED EXTENSIVELY

Superwool® XTRA has been extensively tested by Dillinger, at its mill for heavy plates in Germany. At the mill, as well as the pusher type furnaces used for slab reheating, three shuttle kilns are existing for ingot reheating and for support of the pusher type furnaces on maintenance or heavy load. This environment was chosen for testing due to the high temperatures and high levels of impurities in their atmospheres, including sodium, potassium, iron, and chromium. Over time, these impurities weaken the lining, leading to high shrinkage and surface degradation. This, in turn, increases thermal conductivity and increases heat losses and often can damage the steel infrastructure of the furnace.

A small section of wall in shuttle kiln Number 2 was selected for an initial feasibility test, because the risk of any problems resulting in long downtime issues was considered low. Tested against the existing lining material used in this application, after six months of firing, Superwool® XTRA showed 50 percent less shrinkage compared to RCF. Where the existing lining material was hard, full of cracks, and had discolored noticeably to a dark brown, the surface of Superwool® XTRA remained softer, with no surface cracks, and there was little change in color. This proves that the material is outperforming existing RCF solutions in environments with high pollutant levels.

This success led the customer to reline half of the roof of shuttle kiln Number 3 for further testing, with similarly positive results. As a result, the customer decided to switch entirely to the Superwool® XTRA grade, for the benefit of both the non-regulated status of this product and its superior chemical resistance and shrinkage performance, relative to RCF.

The refractory maintenance department has since presented Superwool® XTRA to Dillinger's EHS Department as a working alternative to RCF. The key message in its presentation is that Superwool® XTRA will reduce risk for workers, alongside reducing costs for installation, wrecking, and disposal. There are additional benefits in no-to-little maintenance for the filling of any shrinkage gaps, and no reduction in the insulating performance. As a result of this, Dillinger decided to set Superwool® XTRA as their new standard, replacing the formerly used Cerachem® Fibre.

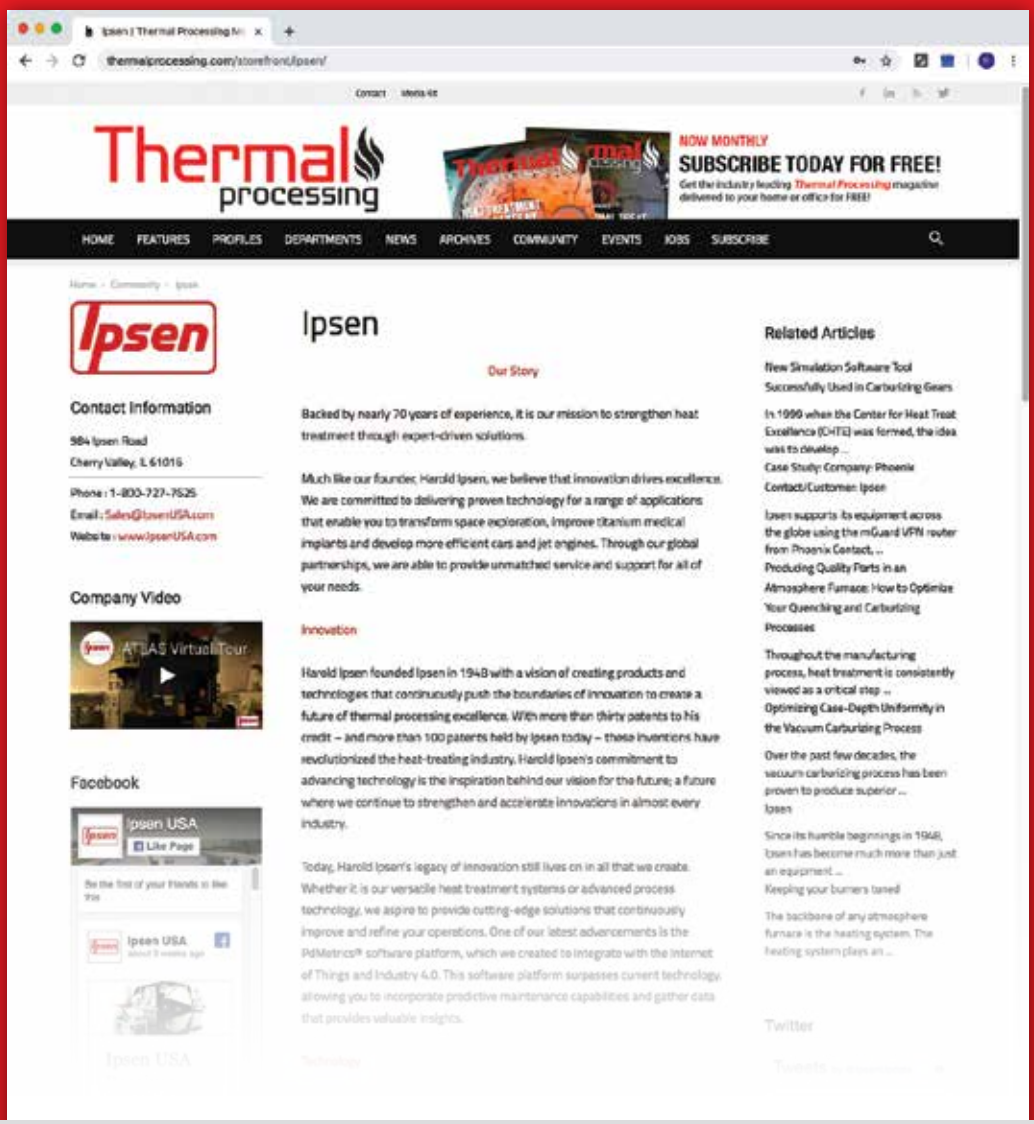
This example confirms the potential of Superwool® XTRA. EHS concerns are an increasingly important driver in terms of meeting legislative compliance — and Superwool® XTRA offers exceptional performance alongside low bio-persistence and no formation of crystalline silica.

From a commercial standpoint, the bigger benefit of this breakthrough in LBP is that it matches — and even exceeds — the established performance of RCF. Superwool® XTRA is the future for applications requiring high temperature fibrous insulation.

ABOUT THE AUTHORS

Peter Ermtraud is with Morgan Advanced Materials, Deutschland GmbH. Nicola Robinson is with Morgan Advanced Materials, Thermal Ceramics UK Ltd. Morgan Advanced Materials is a global materials engineering company that designs and manufactures a wide range of high specification products with extraordinary properties across multiple sectors and geographies. From an extensive range of advanced materials, Morgan produces components, assemblies, and systems that deliver significantly enhanced performance for its customers' products and processes. For more information, go to www.morganadvancedmaterials.com.

ARE YOU MAXIMIZING YOUR EXPOSURE?



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Thermal processing

EMBRACING INDUSTRY CHANGE

Recent advances in burner technologies commonly incorporate ceramic-based components designed to combine higher heat flux capacity, longer component life, higher efficiency, and reduced emissions. (Courtesy: INEX Inc.)

When it comes to thermal-processing methods, accepting innovative improvements is often the key to ushering in the next wave of advancements.

By MICHAEL RUMFOLA

Most companies, regardless of the industry or business, want to see improvement. Whether it is improving customer satisfaction or quality or bottom-line profit or reputation in the community, the common denominator is the same. In order to achieve this common goal, something or perhaps many things have to change. However, as soon as the realization is made that something must change in order to improve, we have a general and innate tendency to run into misoneism. Before you run for your Webster's Collegiate Dictionary or Google it, it means: "a hatred, fear, or intolerance of innovation or change."

Today, in 2020, the horseless carriage, automobile, is a prime example of embracing change. Henry Ford, Boss Kettering, and the Dodge Brothers could never have dreamed of what today's cars, trucks, and SUVs are capable of. At present day, the automobile industry is literally on the cusp of autonomous vehicles. Every car or truck produced today, regardless of manufacturer, has many orders of magnitude more computer power than was aboard the Apollo missions to the moon.

Today, a car's engine has the capability to adapt to different driving conditions and performance requirements. Braking systems automatically adjust to different road conditions. The interior climate controls adapt to desert heat or arctic cold to maintain a stable and suitable cabin environment to provide passenger comfort. Even the steering systems adapt to the vehicle speed and terrain. As with the industry that replaced the horse and buggy, there is no end in sight to changes possible with new technologies, materials, and processes. Of course, the same could be said about the aircraft industry, agriculture, food processing — the list goes on.

HEAT-TREAT CHANGES

Similarly, big changes have been evolving in the thermal-processing industry as well.

Two notable areas are insulation and controls. Gone are the days of asbestos, but advances in ceramic fiber have led to an entirely new wave of ways to keep the heat where it is desired and away from where it is not. Modern furnaces and kilns often combine traditional fire brick with panels or battens of fiber for optimum results at a minimum cost. These advanced materials for walls and roofs have benefited not only the processes but the environment outside the chamber as well.

Whole books could be written about the recent advances in process controls. Many of those advances have only been possible because the "brains" of the controller are so much more powerful. Algorithms in these systems automatically adapt to changing conditions and make adjustments accordingly, almost instantaneously. Advanced combustion systems offer precise control of temperature in an extremely uniform manner. The same is true for controlling the atmosphere inside furnaces. In both cases, adapting new sensor technologies has driven process optimization to where it is today.

Some notable changes in the evolving thermal-processing industry include insulation and controls. (Courtesy: INEX Inc.)

BE OPEN TO NEW PROCESSES

When it comes to traditional thermal processes intricately associated with producing high-quality precision products, the resistance to change is often immense. We are all familiar with several slogans that support a reluctance or resistance to change: "What works – works," "if it isn't broke – don't fix it," "don't mess with the process."

At the same time, we know that embracing change is what we must do if improvements are to be made and a leadership position in the industry is to be achieved or maintained. Improving, for example, the thermal efficiency of a process or increasing the output of a furnace or kiln often requires breaking away from the old ways of thinking and adopting new technologies, materials, and — most importantly — mindsets.

ADVANCES IN BURNER TECHNOLOGY

Recent advances in burner technologies commonly incorporate

All domestic and international burner companies now offer integral heat exchangers to provide pre-heated combustion air to improve efficiency.

ceramic-based components designed to combine higher heat flux capacity, longer component life, higher efficiency, and reduced emissions. All domestic and international burner companies now offer integral heat exchangers to provide pre-heated combustion air to improve efficiency. Some of these advanced burners require complex geometries and material substitutions in order to achieve the combination of desired improvements.

Silicon carbide components have found wide acceptance in these advanced systems specifically because of their ability to handle higher temperatures, and that capability, in turn, means that higher heat fluxes can be achieved.

Higher heat flux means that shorter cycles in batch furnaces are possible, and with continuous furnaces, faster belt speeds and increased product throughput can be achieved. In both cases, it's a simple concept: more work in a shorter period of time. Of course, this is only possible if new materials or changes, if you will, are embraced.

3D PRINTING

Many of these new components are reliant on new processes such as 3D printing, which makes it possible to produce geometries that could not be achieved with prior traditional methods. Relatively exotic heat exchanger segments of advanced burner systems are now possible and provide additional and enhanced surfaces and improved air movement or turbulence.

Silicon carbide radiant tubes with internal fins are yet another example of combining new, superior materials with new processes to achieve unprecedented improvements in efficiency and emissions reductions. These recent improvements in combustion technology have produced extremely favorable results. Some of these changes have required sophisticated employment of computational fluid dynamics (CFD).

ADVANCED SOFTWARE

The development and widespread use of powerful, high speed computers and advanced software programs have allowed these space-aged tools to become commonplace within the industrial community. Again, the significance here is that all of these improvements in materials, processes, systems, and performance were only made possible by forward thinkers embracing change.

Bottom line: Embrace change. Avoid misoneism, and reap the benefits.

ABOUT THE AUTHOR

Michael Rumfola is the president and owner of INEX Inc. He has a B.S. in physics and a B.S. in mechanical engineering. Rumfola has 25 years of experience in industrial and commercial heat-transfer industries. Born and raised, he's a lifetime resident of western New York. For more information, go to www.INEXinc.net.

YOUR INDUSTRY NEWS SOURCE

Thermal Processing magazine is a trusted source for the heat treating industry, offering both technical and educational information for gear manufacturers since 2012.

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COMPANY PROFILE ///

CAS DATALOGGERS

INDUSTRIAL MONITORING SOLUTIONS

The dataTaker DT80 is a versatile, intelligent data logger with internal battery and universal input channels. It is an ideal solution for industrial applications. (Courtesy: CAS DataLoggers)

CAS DataLoggers is a distributor of dataloggers, data-acquisition equipment, and customized data acquisition systems for virtually every industry and a wide range of applications.

By KENNETH CARTER, Thermal Processing editor

For decades, data logging has been an arduous and tedious process. And when done "old school" with pen and paper, it can also be a process where errors can be easily made.

CAS DataLoggers can not only streamline that process but make sure problems due to human error are virtually eliminated.

"Our real focus is to eliminate the need for pencil and paper in the manufacturing, plant floor, research, and development environments with respect to data logging," said Pete Martin, president of CAS Dataloggers. "We're providing options to automate that process of collecting data, if it's purely for quality, if it's for regulatory — whatever the driver is — to give you the ability to do that without paper so that it's all automated."

HEAT-TREATING APPLICATIONS

And although CAS Dataloggers works with many industries, the need to keep track of data is especially important in the heat-treat arena.

"I think there are a lot of similarities and need for what we do across all the industry segments that we service," Martin said. "But in the end, many of the customers really have some unique, specific needs when it comes to their temperature data, or we deal with any other kinds of data acquisition that's required in their process."

That process may be driven by how the measurements are made or how the data is handled and archived or how the customer wants to be made aware of those out-of-tolerance conditions, whatever they may be, according to Martin.

"We as a business, we really push to listen to what the customer says about their needs and then ask questions that — in a lot of cases — they haven't really thought about themselves," he said.

And within the heat-treat industry, temperature measurement is of paramount importance, according to Martin.

"Our general business is as a distributor of data logging, data acquisition, and paperless recorders, and temperature is the most widely measured parameter," he said. "By doing that, we can provide alerts or alarms for out-of-tolerance conditions and give you the ability to actually recover from problems that may exist whether it's the heating or the cooling part of your operation."

COLLECTING THE DATA

The devices used to collect the data have features in the hardware and software that can be configured by the user for measuring virtually any parameter, according to Martin. The devices can communicate alerts via email, text message using a network connection through the internet, or the devices can be hardwired to signal PLCs or other controlling instruments in the plant.

And that variety of how best to collect and view data is a big part of CAS DataLoggers' appeal.

"We focus on giving people tools to automate data collection that their process requires," Martin said. "With respect to heat treating, if you're talking classical metal heat treating with ovens, a lot of times those are stationary ovens. We've got intelligent instruments that can sit outside the oven with thermocouples that let the data collection happen without needing a person to sit there and pay attention to it. Whether it's having to walk by every X minutes or every hour and write data down on a clipboard, or at the end of the day, tear a piece of paper off a strip-chart recorder or a circular recorder, we eliminate the need for a person to have to perform that task."

KEEPING COMPANIES INFORMED

The need to gather data quickly and accurately will only continue to grow, and Martin stressed that part of CAS DataLoggers' mission is to make sure companies don't stagnate and get left behind.

"I've spent my professional life as an electrical engineer in the instrumentation and automation sides of the business, beginning in the aerospace world and then moving onto more classic sequential manufacturing," he said. "Data that's present on the plant floor has become an increasingly important thing for people to run their business, whether it's just for quality metrics or the regulatory piece that might surround it."

The experts at CAS DataLoggers are constantly asking customers — and prospects — questions and rely on the company's sales engineers' experience, according to Martin.

"With the years that they've been talking to different people, they've got the insight to help guide clients towards what the best solutions may be," he said. "Then we can look through the list of products and solutions that we have and give them the best recommendations and then, it's obviously ultimately their choice. But we can give them some good options to look at how the data's handled."

STELLAR TECHNICAL SUPPORT

Martin pointed out that CAS DataLoggers' technical support is an area where the company really shines.

"We really pride ourselves on the technical support that we provide, both in the pre-sale side, and also after the sale," he said. "We think that really separates us from other people who are purely just a catalog house and don't have actual experience applying these kinds of products."

Martin said that his time as an engineer and then moving into a sales role has allowed him to learn and see what happens when his company helps a customer solve problems.

"We've had loggers that have gone to the space station on the shuttle," he said.

That work also includes a lot of aerospace, underwater, and oil and gas applications, to name a few, but what Martin said really gives his company pride is hearing positive results from his customers.

"The things that I would say give us the most pride are when we hear back from a customer who has kind of been saved because of

"There's a lot going on with technology, with the internet, cloud storage, with the Internet of Things idea that's making its way to the plant floor."

The dataTaker DT85 is a higher channel count version of the DT80. (Courtesy: CAS DataLoggers)

The dataTaker DT80W is a WiFi version of the DT80. (Courtesy: CAS DataLoggers)

Grant Instruments OQ610 thermocouple data loggers are used for through process temperature logging paint/coating curing and other conveyor oven systems (with thermal barrier). (Courtesy: CAS DataLoggers)

something we've sold them," he said. "They'll call back and say, 'Hey, I was able to save the production run because your device alerted me to an issue.' Specific to heat treating, we've got a couple of customers who were using old school devices or pen and paper with long-term heat-treat processes. Over the weekend, if something happens to the oven, they'd come back in on Monday morning and have to scrap a whole run of materials. We had a customer on the far west side of Cleveland who was processing very expensive, unique alloys and lost power to an oven over the weekend."

In the past, that would have meant a loss of thousands of dollars' worth of material, according to Martin.

"Once they implemented one of our data logging solutions, they would have a record of exactly what happened to the product and the temperature as the oven cooled," he said. "With the data in hand, they could determine where to restart the process and prevent scrapping that material."

TWO DECADES OF DATA

CAS DataLoggers has been in business since 2000, according to Martin. The company was started by a manufacturer's rep company. One of the manufacturers decided to change how it went to market in the U.S. and CAS DataLoggers was formed. It later grew to include additional products and brands that focused on high-end data acquisition, data logging, and temperature monitoring.

"Myself and my partner bought the business in 2010, and here we are," he said.

As CAS DataLoggers continues, Martin expects more varied ways that data will be collected and monitored, and his company will move forward in that direction as well.

"There's a lot going on with technology, with the internet, cloud storage, with the Internet of Things idea that's making its way to the plant floor," he said. "But there are a lot of obstacles that remain in terms of data security, redundancy, and just ensuring that what you need to have happen is actually going to happen. That's a little bit risky from a business perspective."

But Martin is positive that word of mouth coupled with success stories in the marketplace will push the need for data logging into the hands of those who really need it before negative consequences can occur.

"It's only going to be too late if the impact of not having data automated and having it available to them runs them out of business," he said.

But industries are seeing the need for the services CAS DataLoggers offers more each day, according to Martin.

"With the breadth of customers we get to interact with, it really makes coming to work every day interesting," he said. "Because I can talk to a nurse with a vaccine freezer one morning, and 10 minutes later, I'm talking to somebody working for the military or in some kind of high-end aerospace application."

MORE INFO www.dataloggerinc.com

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CHRIS STEVENS /// PRESIDENT /// DALTON ELECTRIC

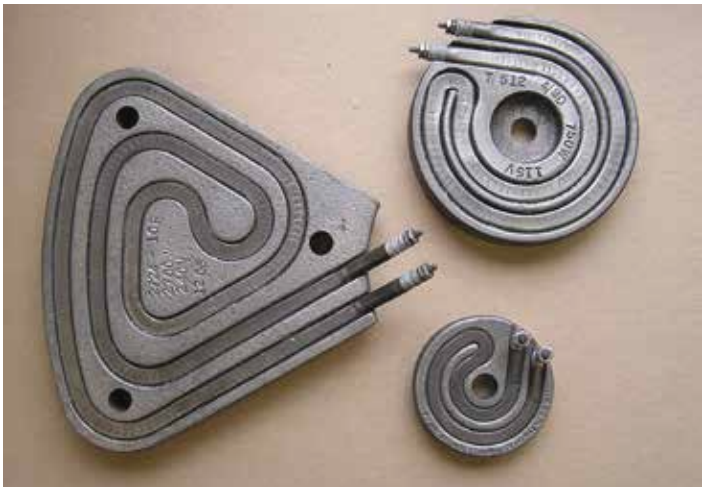
"We buy the best materials to make the best, longest lasting heaters in the industry."

What's a typical day like for you at Dalton Electric?

It starts and ends with our customers. Our value proposition to our Dalton users is reducing the total cost of heating. My daily thoughts and actions hinge on how we can most effectively communicate our message of lower cost of heating by educating heating professionals of the practical benefits — ease of removal and longer life — by switching to Dalton Electric's Diff-Therm® and Watt-Flex® technology. One minute might be spent working on a large quote with a salesperson, the next might be configuring a capital expenditure authorization to improve our efficiency, the next might be discussions with our marketing team improving our website, while the next minute might be finding our next new hire. One thing is certain about what I do — like the weather here in New England, it's always changing.

What products and services does Dalton Electric offer the heat-treat industry?

Dalton Electric has a long history in developing innovative heating technology. Some of our earliest customers were heat-treatment shops. Dalton Electric's patented Diff-Therm® platen heater design revolutionized diffusion vacuum pump operation and maintenance. Our single unit replaces three clumsy-to-install components, provides superior heating performance and longer life. We keep a readily available stock of these heaters and have the ability to custom make most diffusion pump designs still in operation.



The Diff-Therm Heater® (Courtesy: Dalton Electric Heater Company)

How are you constantly striving to improve on what you offer the industry?

Our motto, "Trust the Dalton Difference," reflects how we treat our customers, suppliers, employees, and our community. We do this with a unique personable human touch that seems to have left today's business ideology. What this means to our customers is: We pick up the phone; we greet you warmly, and we answer your questions. Our focus on just two heating technologies means we have industry knowledge about your type of system — especially in the era of company mergers and consolidation and "early retirement." Because we focus on the total cost of heating vs. the cost of the heater, we don't scrimp on low-cost materials of diminishing quality. We buy the best materials to make the best, longest lasting heaters in the industry. Lastly, we custom make our heaters to meet the demands and specifications of our users. These uncommon business principles culminate in our commitment to delivering lower total cost of heating to our esteemed customers.

Dalton has a major milestone coming up (100-year anniversary). How are you planning to mark this accomplishment?

We began planning and working on our celebration two years ago in anticipation of the centennial milestone. The first thing Dalton devotees will notice will be our website — we have begun the re-design and plan to launch on our country's birthday – July 4.

We also have several novel promotional activities and celebrations planned for our customers, employees, and suppliers over the next two years.

What's in the crystal ball for Dalton's next 100 years?

The biggest future trend is climate change or more precisely how we all must adapt to counter the effects of detrimental human activities. But in the nearer term, we see real and significant change happening at P&G, Coca-Cola, Unilever, etc. making big statements about virgin-plastic use and/or moving away from plastic all together. Electric battery powered devices will grow, and I suspect that will lead to further innovation in wind- and solar-power generation. Eventually, we will need a disruptive (next level) power generation source that does not add carbon or other pollutants to the atmosphere and fuels growth for the second half of the next decade. Dalton will remain by adapting to these new manufacturing realities and by delivering value and reason to "Trust the Dalton Difference."

MORE INFO www.daltonelectric.com