

## IR CURING SHOPTALK

### Infrared Equipment Division of IHEA

*This column is provided to you by members of the Infrared Equipment Division (IRED) of the Industrial Heating Equipment Association (IHEA). The group includes infrared (IR) curing equipment suppliers from throughout North America. We publish the column three times a year to give you the latest information about IR curing techniques and equipment. Contact information is at the end of the column. Most IR manufacturers offer testing for free or for a fee. Any IRED member can assist you in finding solutions to curing problems and best practices for finishing of coatings. This issue's column was submitted by IRED member Mike Chapman, Vulcan Catalytic Systems, Portsmouth, R.I.*

# Powder curing lines upgraded with catalytic infrared pre-gel ovens

Two leading Canadian manufacturers in their respective fields depend on consistent and quality powder coated products for their businesses to succeed. Their products are very different, yet both used radiant gas burners to gel their powder coating before parts entered their curing ovens. Both companies used this system for more than 15 years, yet both were dissatisfied with the overall results. There had to be a better way.

Each company found a solution by upgrading to a different form of infrared (IR) process heating that uses gas catalytic IR heaters in a versatile and efficient pre-gel oven. Here are their stories.

### First step: Time for a change

It was time for a change, and both companies sought expert advice for a solution. One company manufactures light fixture luminaries, and the other company manufactures welded aluminum balcony railings. Both companies saw the focus on quality as the driving force for change and sought to upgrade their curing ovens.

**Quality, flexibility, and efficiency.** Steven Anderson, director of operations at Toronto-based Visioneering Corp., was well-versed in process heating and IR technologies from his industrial experience. The powder coating finishes for his company's light fixtures must have a high degree of consistency in color, gloss, and reflectivity. Stringent industry standards must be met for thousands of parts per day.

"The existing curing ovens were the manufacturing bottleneck, and there was no way we could turn the heat up any higher to run the line faster as this would create quality issues," Anderson said. "Over-curing would certainly create problems."

The company had a much older style of radiant gas burners at the beginning of the oven. "We knew the technology had some benefits, but it wasn't designed to encompass all the sizes and shapes that we have in our products," he said. "We needed to surround the parts with infrared from angular directions so that we could effectively cure the parts from top to bottom."

Frank Greco, president of Greco Aluminum Railings, Windsor, Ontario, said that the company has been using radiant gas burners for 15 years but was now seeking a 2605 AAMA<sup>1</sup> certification. The appearance of the company's product has always been very good, but this new high level of certification will give his customers more satisfaction.

Of course, both companies were also looking for a more efficient process.

### Second step: Testing at oven supplier to evaluate the process

Each company contacted Vulcan Catalytic Systems, an IR oven equipment manufacturer with experience in the installation of complete powder coating lines. Greco sent parts to Vulcan for testing, and Anderson brought their own powder and parts. These parts were coated

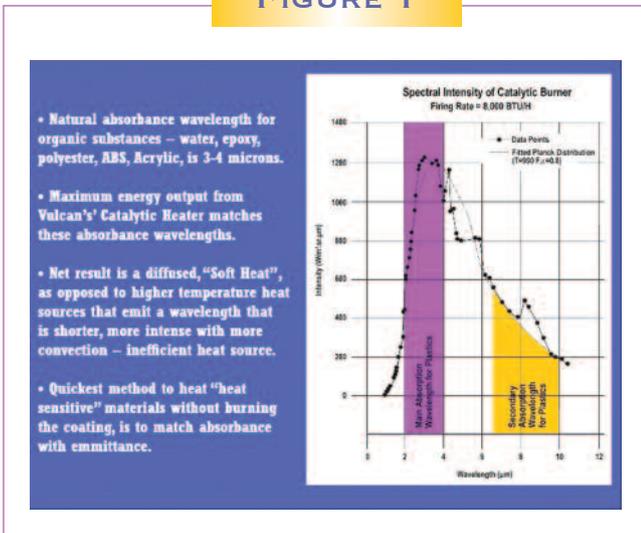
in Vulcan’s continuous gas catalytic IR oven and proved to each company the value of the technology. Parts were fitted with thermocouples and various temperature profiles were analyzed.

Anderson said he was convinced within 2 to 3 hours of testing that the technology would improve the efficiency of his company’s process. Greco said he was also convinced: “We looked to the test results to see how quickly the parts came up to temperature. The results were very good and we appreciated the guidance they [Vulcan] gave us. We checked with three potential vendors when searching for this upgrade, and it was Vulcan that helped the most in defining what we needed.”

**Third step: Designing an oven system based on production needs**

To design the curing systems, the IR manufacturer discussed application needs with each company. The oven manufacturer needed to know part size and weight, the process line speed, and the part loading and unloading process. The overall heat load was determined by the number and weight of the parts to be coated per hour along with the rate at which they are to be cured. The substrate to be coated is also critical to calculate the heat required because the capacity to absorb heat varies greatly for different materials (Figure 1). For example, aluminum requires 36 percent more heat than steel to increase the same amount in temperature per pound (steel 0.165 Btu/lb°F and aluminum 0.225 Btu/lb°F).

**FIGURE 1**



**TABLE 1**

Visioneering’s typical zone profile of infrared oven heater output

	Section 1	Section 2	Section 3	Section 4
Top	50%	45%	45%	45%
Bottom	75%	75%	75%	65%

The target temperature and dwell time is a function of the powder curing schedule.

A part window analysis determined the oven layout. In this analysis, the IR heaters are positioned around the part window to ensure complete coverage of the largest part. The oven is then designed around the placement of the heaters by using the reflective properties of medium-to long-wave IR to effectively gel the part throughout from top to bottom.

The Greco powder pre-gel oven is 15 feet long and has four zones of independently controlled gas catalytic IR heaters. The Visioneering pre-gel oven is 24 feet long and has eight zones of control. Table 1 shows the typical zone profile Visioneering uses for different sections of the oven with IR heater output.

Both pre-gel ovens are the same size as the ovens they replaced. Once the companies decided to proceed with the gas catalytic IR ovens, the oven manufacturer completed the specifications, and the ovens were bought and shipped.

**Installation.** Both companies were very pleased with the ease of installation. The lightweight modular sections are a design feature of the oven, which allows for easy shipping and handling during installation. The



Greco Aluminum Railings’ pre-gel oven interior shows the catalytic IR heaters strategically positioned to blanket the entire part. The interior of the curing oven is also evident here.

modular sections were each easily moved into place with pallet jacks. The oven was assembled by moving the right and left sections in place for final assembly around the existing conveyor line.

Both pre-gel ovens were installed over one weekend with no down time or loss of production. "The pre-assembled gas piping was also very nice and saved us time and work during installation," Greco said.

**Company:** Visioneering Corp, Toronto, Ontario, Canada, a private company founded in 1952.

**Facility:** 210,000 square feet, new powder coating pre-gel and drying oven line installed in November 2011 to replace older finishing line that included high-radiant infrared burners.

**Web site:** [www.viscor.com]

**Products:** Canada's largest independent fluorescent lighting manufacturer.

**Parts for coating:** Approximately 10,000 different steel and aluminum parts in a variety of sizes and shapes. Smallest parts are 1 square inch and largest are up to 1,200 square inches and 4 feet tall by 14 feet long.

**Production flow:** The nature of the product demands multiple runs of very small batch sizes throughout each day.

**Conveyor speed:** 8-16 feet per minute depending on part loading.

**Colors:** Polyester powder in three standard colors with an addition of 12 variations.

**Company:** Greco Aluminum Railings of Windsor, Ontario, Canada, a private company founded in 1991.

**Facility:** 45,000 square feet, new powder coating pre-gel oven installed in February 2011 to replace older medium-wave radiant gas burners pre-gel oven.

**Web site:** [www.grecoalrailings.com]

**Products:** One of Canada's leading welded aluminum railing manufacturers.

**Parts for coating:** Material: Aluminum tubes and parts in a variety of sizes and welded combinations. Typical parts are 42 inches tall; 20,000-25,000 linear feet per month production.

**Production Flow:** The nature of the product demands multiple runs of small batch sizes throughout each day.

**Colors:** Exterior finish polyester powder coating in four standard colors with a total of 40-50 different colors used annually.

## Results: Quality and efficiency improve

Visioneering is extremely pleased with improvements in quality and attributed the improvements to the fact that the IR zones are now controllable, provide a soft and continuous energy blanket, and are angled to hit the tops, sides, and bottoms of parts to effectively cure the entire part at the same temperature. "We set the initial zone at a higher IR setting, which gets us a quick gel at the entrance that allows us to keep our coating from getting too hot as it goes through the



*The pre-gel oven is at the entrance to the curing oven (red) at Greco Aluminum Railings.*



*Visioneering parts enter the pre-gel oven.*

oven,” Anderson said. “If we had all zones set the same, we would be cooking our product, and it would actually be over-cured.”

Anderson continued by saying the new system “helps us be more precise in our control. This has been extremely beneficial for our color consistency on the same part and for the same parts being run at different times of the day.”

The results are obvious and measurable. “We now have less than 1 Delta E off the scale of what our master settings are,” he said. “This is the first time we have been able to attain this high level of consistency in 15 years. These are huge, huge quality improvements for us.”

Greco noted that his company achieved quality improvements due to the consistent temperature and IR energy blanketing the parts thanks to the top and bottom heaters mounted on angles. “The parts just look nicer with more consistent color on the same part,” he said. He also noted that the company is well on its way to achieving the 2605 AAMA certification as all results so far have been positive.

**Oven operation and operating costs.** Visioneering and Greco report significant quality improvement, resulting in higher efficiency and operating cost savings. Visioneering now has the capability to improve quality and double its line speed to up to 16 feet per minute. The company also expects its gas bill to be cut by more than 30 percent. “The energy savings are substantial as the new pre-gel oven allows us to cure our product at a much faster rate than what our previous ovens were able to do,” said Jay Teles, paint line supervisor at Visioneering.

According to Teles, “Our production bottleneck is no longer the curing process. Our new found flexibility is allowing us to tailor our oven settings for each part based on powder used, part size, and thickness where with a little testing we establish a part process recipe. We now also run the curing oven at a lower temperature, and we have greatly improved the color consistency.”

Coworker Norman Minhas, also a paint line supervisor, concurred: “The parts now gel and cure better and faster than before. Since the parts gel faster, we are able to run the curing oven at a lower temperature.”

Greco Aluminum Railings is also seeing efficiency improvements. They were able to increase line speed by 20 percent and reduce the curing oven temperatures, resulting in a monthly gas savings of 21.5 percent for the curing system. The curing oven temperatures prior

to the conversion ranged from 475°F-480°F and now are 420°F-465°F, depending on the parts being run.

Greco said that another benefit of switching to the gas catalytic IR from the radiant gas burners is the lower temperature of the surrounding work area. The previous high-temperature burners emitted a lot of wasteful radiant heat, which wasn’t all contained in the oven. The surrounding work area is now much more comfortable so the new pre-gel oven was a welcome addition by the operators.

## Summary

Infrared process heating has been around for many years, and there are many different types and ways to use it. Whereas gas radiant burners work very well for some applications, such as web drying, they’re not the best option for powder gel and curing ovens. Gas catalytic IR provides the optimum IR wavelength and controlled output to improve the quality and efficiency of a powder curing process. It provides for a controlled and rapid gel of a powder, which allows for a lower temperature cure in a shorter time period. Strategically placed heaters with the capability to modulate at various output settings maximizes control, which results in the most constant and highest quality powder coated parts. **PC**

## Endnote

1. American Architectural Manufacturers Association

*For more information or to submit a question, contact Anne Goyer, executive director of IRED, at 859/356-1575; e-mail [anne@goyermt.com](mailto:anne@goyermt.com). See also [www.ihea.org/ired.cfm](http://www.ihea.org/ired.cfm).*

*Send comments or questions to Peggy Koop, editor, at 651/287-5603; fax 651/287-5650; e-mail [pkoop@cscpub.com](mailto:pkoop@cscpub.com). Or go to [www.pcoating.com](http://www.pcoating.com) and click on Problem solving. You can submit a question for this column in a few keystrokes. For further reading, articles on this topic and related topics are available for purchase. Click on Article Index and select a category.*