

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 several 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.

Get the facts about infrared



If you're considering an infrared (IR) oven for your application, then you likely have a few questions about IR technology and how it works. To help get you started, Anne Goyer, IHEA's executive vice president, conducted a one-on-one interview with IRED member Martin (Marty) Powell, Carlisle Fluid Technologies, Scottsdale, Ariz. Marty has 38 years of experience in the finishing industry, including sales, installation, design, and layout of turnkey finishing systems, spray booths, ovens, pumps, conveyors, and auxiliary equipment associated with these systems. He has been published in several trade journals and speaks at trade shows and various association meetings on code compliance, safety, powder coating, wood finishing, and other finishing equipment.

Will IR completely cure powder? I have been told that it only cures what it sees, is that true?

Yes, IR provides complete curing. Testing should be done to prove out cure times and oven settings for your application. Many parts, even those with areas hidden from the "sight" of the IR emitter, will cure due to heat transfer throughout the product from the exterior to the interior. IR quickly brings parts up to temperature and completes the powder cure in many systems.

In addition, by providing zoning from top to bottom of an oven, IR can concentrate heat where it needs to be ap-

plied while not overcuring other areas of the product. In fact, IR is so precise that product temperature can be sensed by the oven controls and temperature can be increased or decreased as needed. Of course, these types of controls and zoning will increase the cost of the equipment, but cure times can be reduced from 15 to 20 minutes to just 1 to 5 minutes. This typically makes the added cost worth it. Plus, IR systems greatly reduce floor space over conventional ovens, which can be an additional savings for many facilities.

How do I decide between gas or electric IR for my application? Which type is most cost-effective to operate, and which works best with powder?

Only testing can determine what type of IR you should use for your specific application. The best wavelength depends on the emissivity (absorption of heat) of the coating, which will determine the type of IR you should use.

In many instances, both gas and electric IR will provide an acceptable cure. If that's the case, then your decision should be based on:

- Available energy sources
- Capital budget
 - o Cost of each type of oven
 - o Utilities that must be installed to the oven location

- Typical line stoppages during production
 - o Gaps in the line
 - o Response times
 - Electric IR responds quicker than gas
 - Line stops and restarts intermittently, so determine what response time your customer(s) can live with

Why is IR used as a booster to a convection oven?

IR boosters are used to heat up the product surface and increase the powder temperature, quickly melting the powder on the parts.

Many times, improvements to an existing system can be accomplished by installing a booster oven. It can be as simple as installing a 1- to 3-minute booster oven in front of an existing convection oven. This boost will take the surface of a given part from ambient to anywhere between 300°F to 500°F, depending on what is desired to melt and flow the powder. This boost in temperature will then allow the existing convection oven to complete the cure of the powder. Bottom line, you can increase the line speed of your system or maintain your line speed with the heavier products by adding a booster oven.

PHOTO 1



Courtesy of Fostoria Process Equipment

PHOTO 2



Courtesy of Fostoria Process Equipment

Booster ovens can have similar results with new installations, and they can be especially helpful when multiple color changes are required. When there are color changes with a convection oven in operation, powder can be blown off of the intended parts and onto parts of a different color, causing reject or rework. For convection ovens, the gap in the line has to be large enough that parts aren't affected by blow off. Using an IR oven will minimize the part gap on the conveyor line and greatly reduce any contamination problems. Plus, IR brings the part and powder up to the melt point much quicker.

Is IR good for dry off after washing and pretreating parts?

Yes, **IF** applied correctly. Water is one of the toughest materials to eliminate from the surface of a part. It will depend on the substrate material you are drying as well as the configuration of the part to the IR. Also, orientation and racking of the part(s) is critical in order to minimize the pooling of water in corners or crevasses.

IR is most effective when the larger water molecules can be blown off from the part prior to drying. Convection ovens with a high volume of air movement can also be used for water dry-off. However, for convection processes, the dry-off oven needs to have sufficient exhaust. The laws of physics won't allow the water to evaporate into air that is already saturated with moisture.

Is IR harmful to my factory workers?

IR does not emit any harmful wavelengths or radiation. As with any bright light emitter, high-powered flashlight, the sun, or the like, do not stare at an IR emitter for a prolonged time. Also, like a hot stovetop, avoid touching the hot IR emitter.

Does IR work best with light colors or dark colors?

We don't know. If there is a difference between light and dark colors, it is only a matter of seconds. It all depends on the coating's emissivity, which, put simply, is based on the amount of heat wavelength given off from an IR emitter source and how much of the energy is absorbed by the coating. Regardless of color, the better the coating absorbs, the quicker it gets hot.

You just never know how a coating will absorb, react, or cure with IR. The pigment, resin, metal flake, and combination of factors will all make a difference. That is why IR suppliers require testing, testing, and even more testing. Testing is the best thing you can do to ensure that the right wavelength is used.

Does an IR oven need an exhaust fan?

When it comes to curing coatings, the answer is yes. Powders will usually

smoke, and coatings emit odors that are unpleasant. These need to be exhausted to the atmosphere outside of the building. If you're using a booster oven, you can use the exhaust fan on the main convection oven. Any gas fired oven, including gas IR, needs exhaust fans because of the gas utilized for combustion, as outlined in NFPA 86.

Can the IR oven be portable or adjustable?

Yes, portable ovens are possible. Electric IR ovens are more easily portable because of the energy source. Gas IR ovens can be portable, but don't forget about the exhaust requirement. Adjustable IR ovens are also possible, with the width made to be adjustable to accommodate various sized part widths.

There are some caveats to these statements. For instance, if the oven is for a conveyerized system, an overhead conveyer is easier to deal with than a conveyor installed above the floor. The oven supplier will have to look at your system and quote a custom solution. For automotive applications, there are many standard portable and adjustable units that are typically used for wet paint applications. Could these units be used for powder? Possibly. More likely, you'll need a custom unit like we just discussed.

Do IR ovens require more maintenance than convection ovens?

All ovens and machinery require regular maintenance. IR ovens don't specifically need more or less maintenance, but, in some cases, they do require less. Here are a few maintenance tasks to consider for each oven type:

- Convection ovens—burners need supply filters (if required) and gas train inspection; burners must be checked for adjustment and correct firing; recirculation fans usually have belts that wear and need adjustment and replacement; ovens need to be cleaned
- Gas IR—gas supply inspection; burners checked; some have ceramic bricks that need replacement; some have reflectors that need to be cleaned

- Electric IR ovens – emitters must be checked and replaced; reflectors need to be cleaned
- Exhaust fans in any of these ovens need inspection and maintenance

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Marty Powell, Carlisle Fluid Technologies

For more information or to submit a question, contact Anne Goyer, executive director of IRED, at 859/356-1575; anne@goyermtg.com; <http://www.ihea.org/?page=IRED>.

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