EPRI | ELECTRIC POWER RESEARCH INSTITUTE

INFRARED CURING AND DRYING

Many industrial processes require controlled heat for drying products and curing coatings. This drying or curing process is accomplished in large industrial ovens that traditionally have used convection heat fueled by natural gas. Electric infrared radiation (IR) ovens offer an efficient and cost-effective alternative to convection ovens.

DID YOU KNOW?

Infrared technology has attractive payback and increased productivity for a wide range of applications, owing to its reduced final energy consumption when compared to conventional heating as well as its non-energy benefits such as low floor space requirement and low maintenance to name a few.

HOW IT WORKS

Whereas convection ovens first heat the air in order to transmit heat to a product through forced convection, IR transmits heat through electromagnetic waves. Electric IR emitters can provide fine control of IR wavelength in order to match specific requirements of an application. For example, IR frequency can be tuned to heat only the substrate while passing unabsorbed through a coating.

An IR oven can be used as a standalone technology. It also can be used to supplement heating in a natural gas convection oven. This is called a hybrid IR application or a boost oven.

APPLICATIONS

IR can be used in a wide range of processes to dry or cure products, including but not limited to:

- Paint on car bodies and home appliances
- Paint and powder coatings on light fixtures
- Paints and varnishes on hardboard, particleboard, and chipboard
- Coatings on steel and aluminum coils and sheets
- Epoxy powder coatings on oil filters and irrigation pipes
- Polyvinyl chloride waterproofing on automobile rocker panels
- Pre-drying of ink and powder coating on paper
- Dyes and coatings on textiles, apparel, and fabric
- Glass and glass products manufacturing
- Machinery and computer products manufacturing

BENEFITS

Faster curing and drying. IR systems achieve full output in seconds and provide higher heat transfer rates and faster response times ranging from less than a second to five minutes, depending on wavelength. This compares to 20-40 minutes for conventional methods.

Energy efficient. With IR, there is no waiting for the oven to warm up and no need to keep it running, so less energy is consumed. IR is 90% more efficient in some applications. IR's energy usage profile can result in lower load factor for some facilities.

Improved productivity. Faster production results in curing and drying more products in less time. Some ovens can be zoned, providing maximum flexibility and better process control.

Less floorspace. IR ovens are compact and save space, with an up to 92% smaller footprint than convection ovens.

Low maintenance. Little is required beyond periodic cleaning of the reflectors and replacement of emitters.

Cleaner production. Reduced airflow during process minimizes dust and dirt contamination.

Cleaner environment. Electric IR produces zero on-site emissions due to the absence of fuel combustion; however localized emissions from process chemicals, such as paint or coatings, may still occur.

Enhanced worker safety. Reduced ambient air heating through the elimination of open flames, reduced on-site emissions and dust contribute to a safer work environment.

Higher-quality products. IR improves product appearance by ensuring more even coloring and coating. High-gloss coatings may appear even glossier. Well-controlled heating ensures that the product is not overheated. Pigment cross-contamination can be reduced due to the need for lesser airflow.

LIMITATIONS

Line-of-sight technology. Curing and drying is only effective where the IR radiation can reach the surface. For products with complex hidden surfaces, solutions to work around line-of-sight issues include use of a hybrid system with a convection oven and allowing adequate soak-time.

Product guarantee barriers. In the past, some manufacturers were not willing to change their coating process unless the change was approved by their coating vendor, and some vendors warranted their product only if it cured for an established period of time and temperature through a recipe that essentially requires curing with natural gas convection. More recently, many paint manufacturers are formulating paint for IR curing.

Cost. Capital cost may be higher for IR ovens than for convection ovens, and installation costs vary depending on infrastructure needs, material handling requirements, and safety equipment. A general rule of thumb is that electric IR emitters cost $100–$200 per kilowatt, depending on equipment rating.

3002008459

May 2020

Electric Power Research Institute
3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com