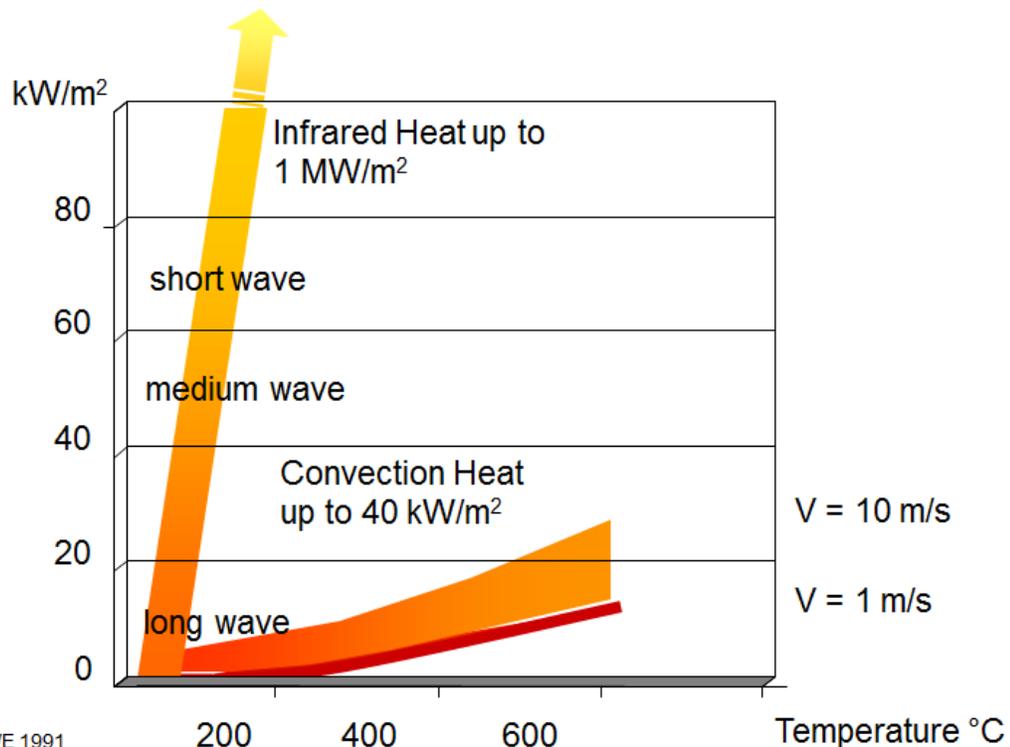


## Infrared emitters dry water-based coatings efficiently

After industrial coating processes lacquer has to be dried with the help of heat. Often this is done by hot air or infrared systems. Compared to other technologies Infrared heat needs less space and provides energy exactly where it is needed. Infrared drying has the best results with material which has a simple geometric shape. But if the oven is designed appropriate to the requirements lacquer can also be dried on parts which have a complicated shape. In many cases convection ovens and Infrared heat are combined in a drying station. Examples show how real drying processes of coated parts work with different infrared emitters of Heraeus Noblelight

Convection ovens transfer heat using the medium of air. The higher the air humidity and the speed of the airflow, the faster the drying of the material. In practise there is a limit for oven temperature and the speed of the inflow because of overheating during a line stoppage. As a result the heat transfer capacities of convection curing ovens are relatively low. This means that large ovens are needed, which require a great deal of space.

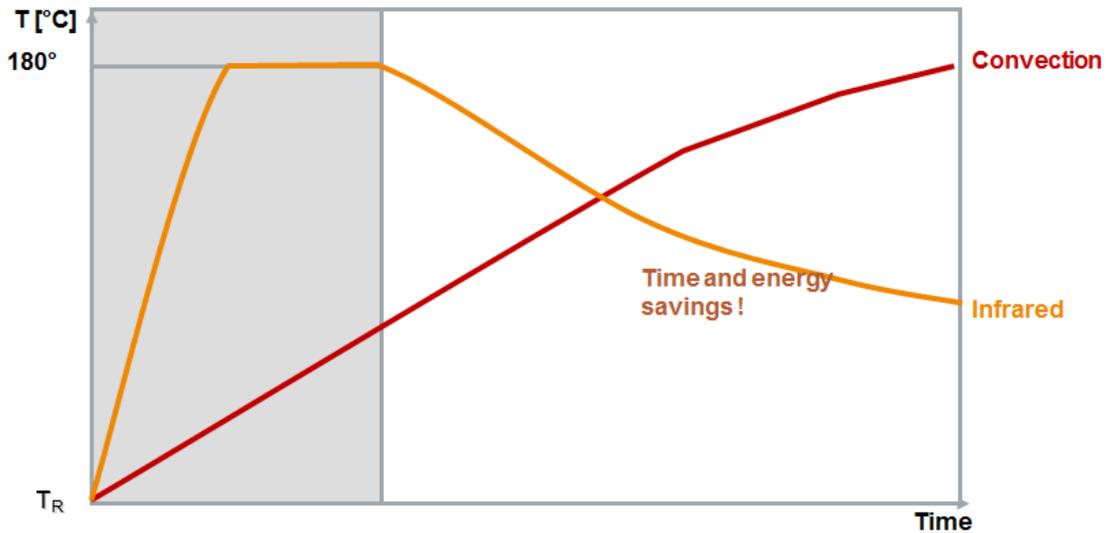
Infrared systems transfer heat without a contact medium. They emit electromagnetic waves with similar properties to light, which are only transformed into heat when they meet the material. Infrared radiation has a significant higher heat transfer capacity than convection.



Source: RWE 1991

Another benefit of infrared is their short response time. Short wave quartz glass heaters or medium wave carbon heaters respond within a few seconds. Therefore infrared ovens can be switched on and off and adjusted to suit new products very quickly.

## Typical temperatur process IR / Convection



Most of the lacquers absorb infrared radiation very well because of their chemical characteristics/composition. Radiation gets partially into the coating layer and arranges a fast evaporation of the solvent. To diminish the emission of organic solvent into the atmosphere it is possible to use water based coatings. Water needs more energy to evaporate than organic solvents, that is the reason why in practise there is a higher need for action for existing facilities. Where there is not enough space available to enable the existing curing oven to be extended, an infrared booster can be the ideal solution. This is an infrared heating unit installed before or in the entrance to the oven which ensures that the powder melts quickly. The Booster makes a fast raising of the temperature and enables the adherence of the needed dwell time. Any temperature differences in complex components are balanced out during the subsequent convection heating process. When infrared heaters that can be switched on and off quickly are installed, they can be shut off when the conveyor stops or during breaks in the production process in order to save energy. The wavelength of infrared radiation has a significant effect on drying. Water evaporates particularly quickly when irradiated with medium wave infrared. This is because the medium wave radiation is absorbed very efficiently by water and then directly converted into heat, instead of NIR infrared emitters in the near infrared region.

Extensive tests have shown that carbon emitters dry water-based lacquers significantly more efficient than short wave infrared emitters. A carbon infrared emitter requires up to 30% less energy than a conventional short wave emitter to carry out the same drying process.

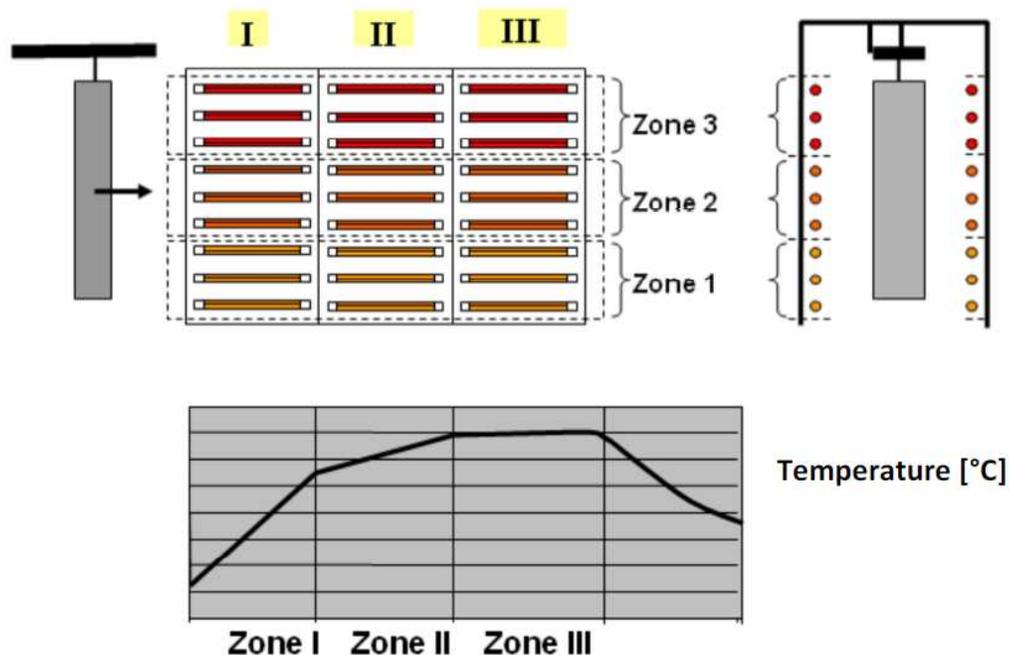
## 2. Influencing factors of IR heating

The extent to which the energy emitted by infrared heaters heats the object and the temperature reached by the lacquer depend on:

- angle of impact of the radiation
- distance between heaters and object
- spectral distribution
- pigmentation of the lacquer
- lamination strength of the lacquer
- heat conductivity of the material
- wall thickness of the object

Two-dimensional parts with a uniform wall thickness, such as powder-coated aluminium or steel panels, are the simplest to heat using infrared radiation. Highly three dimensional products are difficult to heat with infrared heaters because specific areas may be in shadow where the infrared rays do not reach them. Metals, and in particular aluminium and steel, have high levels of heat conductivity.

This allows even complex three-dimensional parts to be heated with infrared heaters, as the temperature differences balance out after a short period. In addition, infrared heaters can be arranged in different positions in the oven with regard to their angle of impact and distance from the parts and can also be used across different zones. For example, in the case of very tall components, the heaters higher up in the oven can be operated on relatively low power settings because the natural convection process will help to ensure that the upper parts of the components are heated.

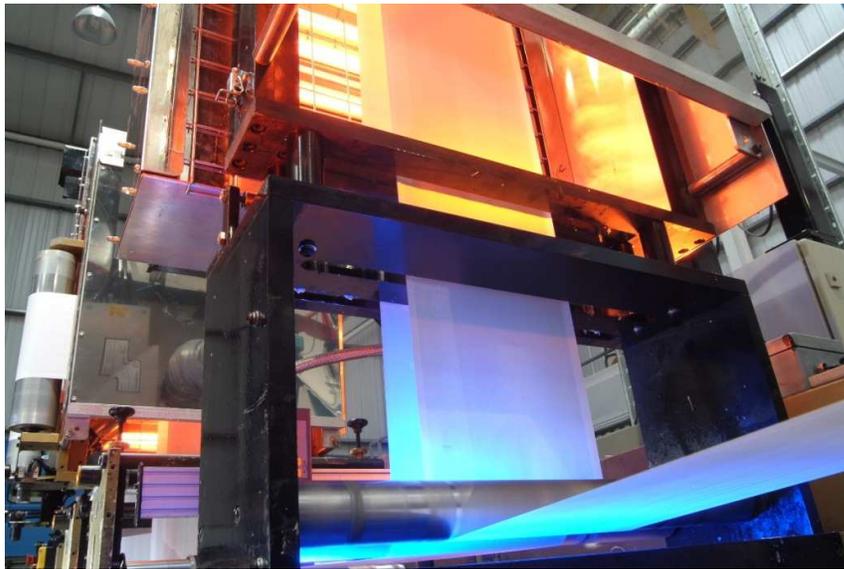


Less power is needed to maintain the temperature of the oven than to heat a component. Therefore, in the waiting area of an infrared oven fewer heaters or heaters with a lower specific output are used.

### 3. Infrared heating in practice

#### Drying non-slip coatings on paper

A carbon infrared system from Heraeus Noblelight is helping Orvec International to achieve the quality of non-slip coating required on disposable tray mats to meet the stringent demands of major passenger airlines



When the Kingston-upon-Hull company recently decided to introduce a new range of non-slip tray mats to meet the specifications of a major airline, a new manufacturing line was set up and the manufacturing technology was adapted to allow an extremely high quality non-slip coating to be applied.

Since installation, the infrared system has proved to be highly energy-efficient and its high power density, coupled with the suitability of medium wave infrared for water removal, has ensured that the applied coating is dried effectively to give a high quality finish. The fast response of carbon infrared has also proved important in this application, as the heating can be switched off very rapidly if needs be, so preventing any damage to the web in the event of production line breakdown. Following successful operation of the system over a number of months, Orvec decided to see if line speeds of the drying section could be increased even more, to meet rising customer demand for the non-slip trays. Accordingly, a 7kW carbon infrared was retrofitted and this has allowed a further 30% improvement

### **Faster drying of wood stain on panels**

Saunderson's Furniture Ltd, has installed an infrared dryer to assist in the colour staining and lacquering of wooden panels used in the manufacture of its wide range of high quality furniture. The Kilbirnie factory produces finished items such as hi-fi cabinets, directly from bare timber. This timber, in panel form, must be colour-stained and UV lacquered before assembly.

Since the introduction of the Environmental Protection Act, there has been a trend in the woodworking



industry away from solvent-based coatings and towards water-based coatings.

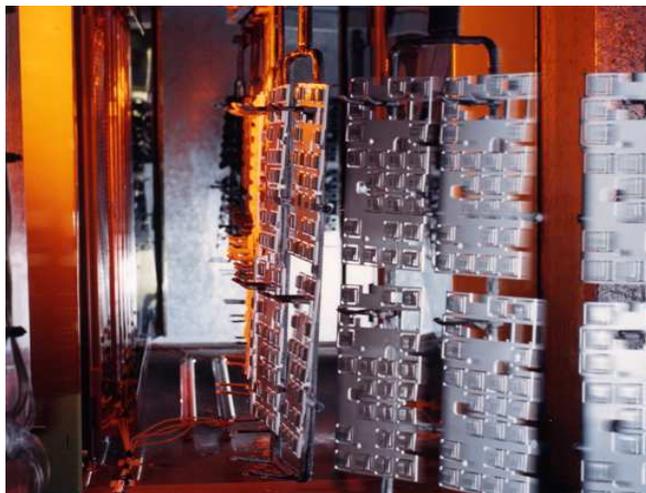
Initial problems were caused at the point where the UV lacquer was applied over the colour staining. With solvent-based paints, the solvent would "flash off". However, with water-based paints the stain coat is still wet when it reaches the lacquer stage, with the result that the lacquer does not key properly and the correct finish is not achieved.

They finally decided on two medium wave infrared heaters which have proved to be extremely energy-efficient. They warm up to the required temperature in less than two minutes, so they can be switched off at lunchtime and during long breaks, unlike gas ovens which must be run at temperature throughout the working day. Due to this successful results Saunderson installed additional modules for further processes in their production line

### **Infrared reduces reject rate of plastic parts**

Kestrel produces a wide range of products for major companies in the UK and Europe in the electronics, automotive, computer, white goods and DIY fields. Microwave oven keypads for a major electrical equipment manufacturer are moulded at Kestrel and then need to be printed and coated with a clear protective lacquer. Previously the parts had been heated 20 minutes by using a convection oven.

During this prolonged drying time dust could settle on the painted surface with detriment to the final finish. An infrared oven from Heraeus Noblelight is providing drying and curing of paint and lacquer on injection moulded keypads in less than 20% of the time it would take with a convection oven. The oven is just 1.5m long and 1m high and fits quite easily within the space available. It



features two 3kW infrared cassettes with medium wave emitters.

In operation, it is used to provide drying and curing for two types of keypad. With some pads it is necessary to apply a coating of a water-based paint after moulding. This coating is dried in the oven before the mouldings are printed and then sprayed with a two-pack, resin-based clear lacquer. Since the installation of the oven, it has been found that the reject rates have reduced dramatically, as the pads are dried and cured in just 3.5 minutes, compared with the twenty minutes in the convection oven. As a result, there is less opportunity for settling dust to damage the final finish. Furthermore, the infrared system has proved significantly more energy-efficient than the convection oven, as it needs to be switched on only when it is operating.

### **Infrared heat allows drying of lacquers on gas bottles in a small amount of space.**

The company Eurocylinder Systems AG produces high pressure gas bottles. The range of products also includes bottles which need to be coated with high quality coloured lacquers because of special customer needs. To implement these demands the company installed an own production line in an already existing hall. That makes it possible to adjust their products to different bottle sizes and diameters and to lacquer them with special colours. The bottles have to be coated three times, that is why the coating and drying process is especially important. The company was looking for a space saving solution and found an infrared drying system which met their expectations. The infrared system is two meters long and dries basis lacquer, coatings and printings



in only a few seconds. The IR drying station is featured with medium wave emitters. Due to a suitable emitter position, the IR drying station can be adjusted to different bottle thicknesses. As a result of the compact system the coating station could be retrofitted in the production line by saving space. Furthermore the emitters react almost instantaneously, that makes it possible to shut them off even during operating stops that saves energy and costs.