HOW IR INDUCTION FURNACES WORK

ADVANCED TECHNOLOGY FOR RESEARCH & INDUSTRY

KNOWLEDGE BASE FACT SHEET

- SCOPE: How infrared induction furnaces operate, using the ATV Solder Reflow Oven as an example.

Infrared induction furnaces for solder reflow typically come in the construct of a cold walled vacuum chamber, consisting of a bank of IR lamps and heating plate. The purpose of this system is to provide elevated temperatures for processes such as soldering, brazing, annealing and getter activation in the electronics industry.

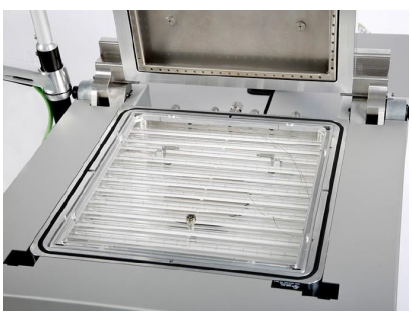
Vacuum solder reflow ovens are an example of an infrared induction furnace. Reflowing solder during vacuum helps to remove voids from the bond line of a solder junction. This is achieved by pulling out gases or liquids, whilst the solder is above its reflow temperature and under vacuum of around 0.003mbar abs.

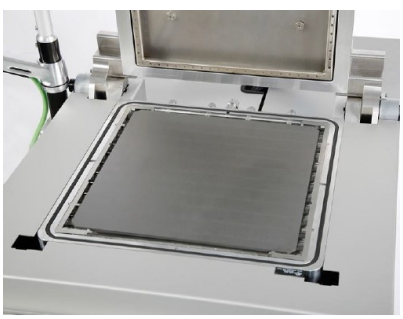
The vacuum chambers are water cooled to maintain a safe environment and to maintain the integrity of the vacuum seals.

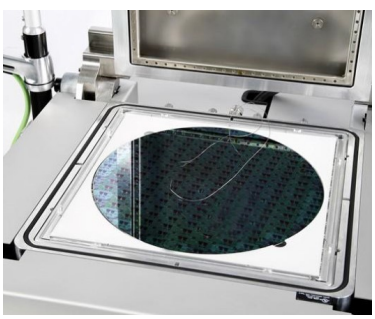
Inside the chamber are multiple IR lamps that are used to directly heat the plate, which the parts being processed will sit on. This plate can be constructed from carbon-coated aluminium for temperatures up to 450°C, or graphite for temperatures up to 700°C. The main benefit of direct IR heating is the fast ramp up and stability of the heating applied, while also being a more efficient means of providing heat and cooling to a solder junction. Feedback is provided to the system by multiple thermocouple monitoring, and process variation can come in the form of controlled gases to form different environments inside the chamber.

Below is an example of a process for formic acid solder reflow, which is a fluxless (clean) solder reflow process that uses heated formic acid vapour to remove contaminants from solder surfaces, thereby improving the hydrophilic properties.

- The process starts with pulling a vacuum multiple times, before backfilling with nitrogen in an attempt to create an inert oxygen free atmosphere.
- The hotplate is then directly heated by the IR lamps to follow the heating profile specified.
- Formic acid (HCOOH) vapour is introduced at an elevated temperature of 150°C prior to the molten temperature of the solder, and this is the cleaning phase of the process.
- The temperature profile reaches the maximum temperature specified in the profile (240°C) and dwells, allowing the solder to enter its liquid state.
- A vacuum is used again to help pull any voids from the solder junction.
- The final stage is to cool the chamber, heating plate and part back to a cooler temperature which is safe to handle. Cooling is achieved by directing pressurised nitrogen onto the underside of the heating plate and inside of the chamber. The ramp-down cooling rate can be controlled by the flow of pressurised N2 entering the chamber.







These images show the IR lamps (left), heating plate fitted (middle) and the parts being processed (right)

Example of a formic acid reflow profile.