Infrared heat welds plastics efficiently and repeatable

Infrared emitters from Heraeus Noblelight simplify plastic processing

- **Infrared emitters provide heat on surface or rims where it is needed**
- **Infrared heat helps to join plastic parts efficiently**
- **Enables process automation**

Pipes, tubes, barrels and even pressure-resistant filter housings are many of the plastic products which need to be assembled from individual components after injection moulding. Infra-red heating helps to weld the plastic components together without the need for adhesives or other fastening devices. Many of these production steps are significantly facilitated and speeded up by using infra-red emitters. Both time and energy are saved when quartz glass emitters are matched exactly to the product and process.

Contact free welding

The british company Harvey Softeners Ltd produce cylindrical pressure tanks with a glass-filled polypropylene cylinder body. The cylindrical housing is produced in two mouldings, which are joined together afterwards. The glass fibres make the tanks tough, the complete assembly is able to withstand internal operating pressures of around 10 bar. Typical hot plate welding methods would be unsuitable in this application, as the melt temperatures involved (210℃ to 250℃) would expose the short glass fibre s in the polypropylene, which would then abrade the PTFE coating of the hot plates, causing accelerated wear and hence frequent and costly replacement.
Being a non-contact method, it does not promote plastic adhesion to the heating surface, which can necessitate frequent tool cleaning.
At Harvey Softeners an IR module is positioned between the butt ends of the opposing cylinders and the power is switched on. The melt temperature is achieved in around 40 seconds, the platten is withdrawn, the power is switched off, and the butt ends are brought together under pressure to effect the weld. Under bursting tests at pressures of around 28 bar, it has been found the cylinder body has been destroyed well before the welded joint.
The Welding Institute, in Cambridge tested intensively how infrared heat can be used for welding plastic pipes. To weld the material infrared emitters are arranged in movable plattens that they can be positioned between two pipes. Fast response emitters like short waves make it possible to switch the emitter on only when the module is positioned directly between the two ends of the pipes. It has been found out that most of the plastics which were tested can be melted in a few seconds and joined simply by pressing the two pieces together.

It is also capable of handling large surface area products, as it is a simple operation to add more emitters to a heating bank. In addition infrared heaters can be custom-built to match the geometry of the product to be welded.

Short wave emitters are suited well for welding plastic parts. This emitters transfer huge amounts of energy in a very short time. That is why short wave emitters help to diminish the station times or can produce more parts within the same time.

Different plastic types are qualified in a different manner

Customers are mainly interested if their product can be welded better with infrared emitters than with other technologies. Every plastic part is different. But Heraeus can resort to results from tests which are made in our application centers, what makes it easier for evaluation:

- Characteristics of plastic have the biggest influence on the results. Thermoplastics like polyethylene, polypropylene or polyamide can be heated a second time/a couple of times. Thermosetting plastics like phenolformaldeyd, polyester- or melamine resins cannot be heated again. The surface of the plastic would not melt anymore.

- Some plastics contain additives or filling material like glass fibres. The glass fibres strengthen polyamide containers and make them stable against pressure. Heating this type of plastics would expose the short glass fibres in the polypropylene, which would then abrade the PTFE coating of the hot plates, causing accelerated wear and hence frequent and costly replacement. Infrared emitters can´t be damaged by glass fibres because heat is transferred without contact to the material.

- Tests showed that plastics or rubber made with silicon additives cannot be weld anymore. One example is the material for the contact surface of tires. In contrast of pure contact surfaces made of pure rubber can be welded well.

- Black plastics absorb infrared radiation better than white plastics or transparent material that is why dark plastics can be heated faster. Tests show that two halves of polyamide depending on their colours, are welded together within different times. Using the same temperature plastics made of black material need only 12 seconds to be heated while it takes 40 seconds to heat white plastics.

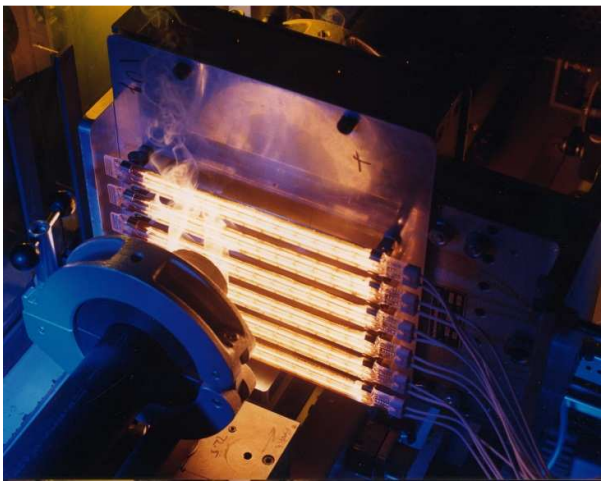
Infrared helps automatic plastic welding

Another example shows how an infrared welding system using special-purpose infrared emitters from Heraeus Noblelight has helped Hepworth Drainage to improve the quality of an inspection chamber assembly production process. This product consists of a base unit offering multiple connections to clay or plastic drainage systems. This was formerly done using a hot melt adhesive. Modern environmental protection requirements and, not least, the requirement for cost-saving, led the British company to investigate potentially more efficient solutions.

A complex automated process with a robot which brings the various component tubes into an infrared welding cell and welds them together, now takes only 22 seconds. As a result, the production cycle times for plastic inspection chambers at Hepworth have been significantly reduced and the quality of the components significantly increased. Moreover, the new heating process is environmentally-friendly as, in contrast to the previous hot melt adhesive system, there is very little fume production. These process improvements have also been made possible because quartz glass emitters can be shaped to match the product three-dimensionally. Consequently, the heat is generated only where it is required. In addition, infrared emitters need to be switched on whenever the heat is actually needed, so that energy is saved.

Heraeus offers a wide range of emitters, which transfer high power and can be switched quickly. We also produce Carbon Infrared emitters with a spectrum which is suitable with the absorption spectrum of plastics. All emitters can be adjusted to shape, size and spectrum of the individual process. Reproducing even complicated heating processes makes an automatic plastic welding possible.

Cylindrical water containers are made of two halves that are welded together afterwards. Tests have shown that the connection is impermeable to liquid and can withstand high pressure.



Infrared emitters are arranged in movable plattens that they can be positioned between two pipes. During a few seconds the pipe ends can be weld together.