

The “Thermal Fingerprint” – Injection Molding in the Focus of Industry 4.0

Uncontrolled and unstable processes are the most common financial drains in the injection molding process. 60-70% of all errors relating to moldings, which are responsible for inadequate quality and unacceptably long cycle times, can be traced back to the tempering of the injection mold.

By using the compact Optris infrared cameras and the **IR-ThermoControl** online quality control system which was specifically developed for plastics processing by GTT Willi Steinko GmbH and Plexpert GmbH, thermal errors in the injection molding process can be detected “inline” at source.



The data can be transferred to **IR-ThermoControl** using the PI Connect software. This is the central element which allows the fitter, process technician and quality leader to produce quality components in a quick, safe, and target-oriented way with the shortest possible cycle times. In order to take targeted measures, it is important to know where the causes of problems can be found.



*“In order to take targeted measures, it is important for the process owners to understand where the causes of problems can be found. The **IR-ThermoControl** system provides this important information.”*

Willi Steinko
CEO GTT Willi Steinko GmbH and textbook author

The most common thermal problems and their causes

Appearance	Thermal problem classification	Most common cause
Dimensional problems, poor mechanical performance	Excessive temperature deviations in the mold wall	Asymmetrical cooling channel layout, insufficient heat dissipation, bridging of cooling channels
Molding warpage	Excessive temperature deviations in the mold wall, partially or over the entire molding	Asymmetrical cooling channel layout, insufficient heat dissipation, bridging of cooling channels
Surface markings in the form of shiny and matt patches, feathering	Thermal moldings of inserts and ejector pins, mandrels, retainers, ribbing and apertures	Insufficient heat dissipation, inadequate isolation of hot runner systems and hot runner nozzles, untempered molding lots
Excessively long cooling times/cycle times	Poorly configured tool tempering, significant pressure losses within the tempering system, hotspots on the molding	Blocked cooling channels, inadequate technical condition of tempering and cooling equipment, aggressive condition of water, untreated or insufficiently treated water

The **IR-ThermoControl** system provides this important information and even shows sporadically occurring effects and trends like, for example, a subtle temperature increase during serial production. This system, which can easily be installed on any given injection molding machine within 5 minutes, allows for unparalleled flexibility and availability.

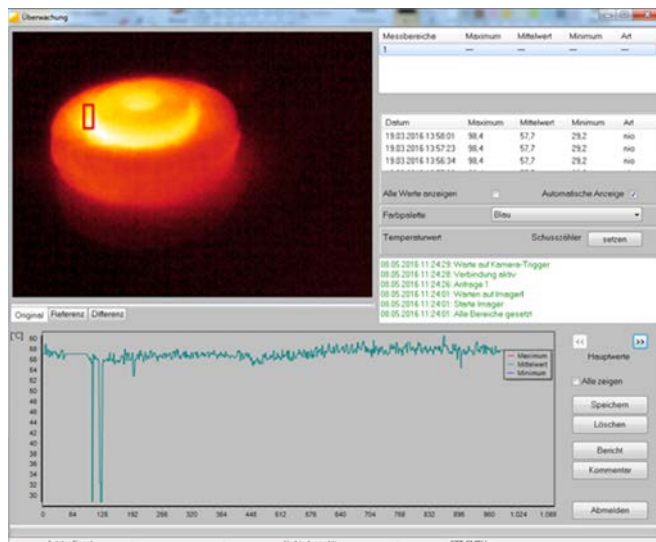


Positioning the infrared camera in the tool installing area

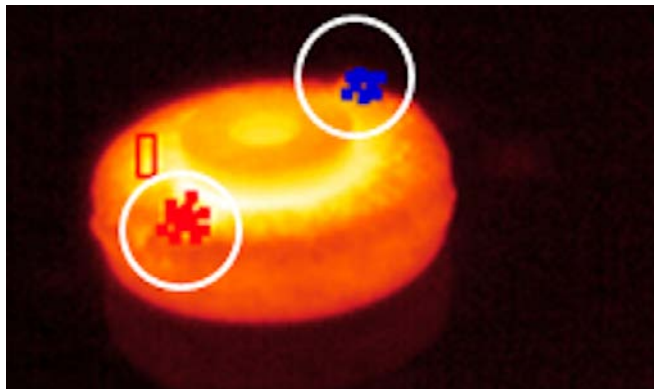
Reference image system

The process-oriented user guidance facilitates the definition of control limits and automatically provides temperature deviations via a reference image system. This means that any differences that occur can be seen instantly.

The **IR-ThermoControl** quality module creates an image of the molding in every cycle. A reference image is made of the first good part. Every subsequent recording is compared with the reference image. If there is a deviation at any given point an alarm is sounded.



Analysis mask with **IR-ThermoControl** temperature graphic



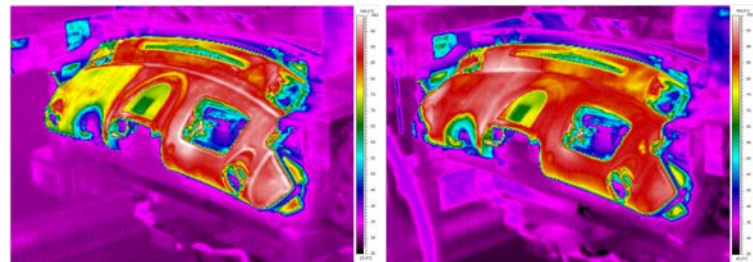
Red zones indicate an exceedance of the threshold value, blue zones indicate a shortfall

This technology is used in 2K injection molding as well as in combined foam/compact injection molding (Krallmann Pilot Werkzeug GmbH).

GTT GmbH is holistically and professionally devoted to cycle time reduction, tool optimization, and the quality improvement of injection molded components.

PLEXPART GmbH develops value-adding software and hardware for the plastics industry and conducts FEM and injection mold simulations with the focus to tempering stage.

In another example from the automotive sector, any faults that occur in the process are immediately visible. The following application shows a thermal weak point occurring during production in that the zone on the left depicted displays a lower surface temperature than that on the right (See left image). Consequently, the length of the manufactured component was almost 2.5 mm shorter than specified. This dimensional deviation was caused by the fact that the required dwell pressure could not be reached. As a result, the tool tempering was adjusted in this zone and, in this way, was optimized (See right image).



Before: clearly identifiable thermal weak points

After: thermally optimized component

A look into the thermal future:

No other technical instrument reveals thermal deficiencies as distinctly as the **IR-ThermoControl** "Plug and Work" system. For example, excessively high temperature differences on injection molded components and tools are displayed in a clear manner.

If you are responsible for production and need to be mindful of quality and price, continuous use of **IR-ThermoControl** enables you to monitor and control your processes efficiently and economically. Touching the surface of the component or tool by hand to locate hot, warm, or cold zones is finally a thing of the past.

This article can be found online at:
www.optris.com/temperature-measurement-injection-molding



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