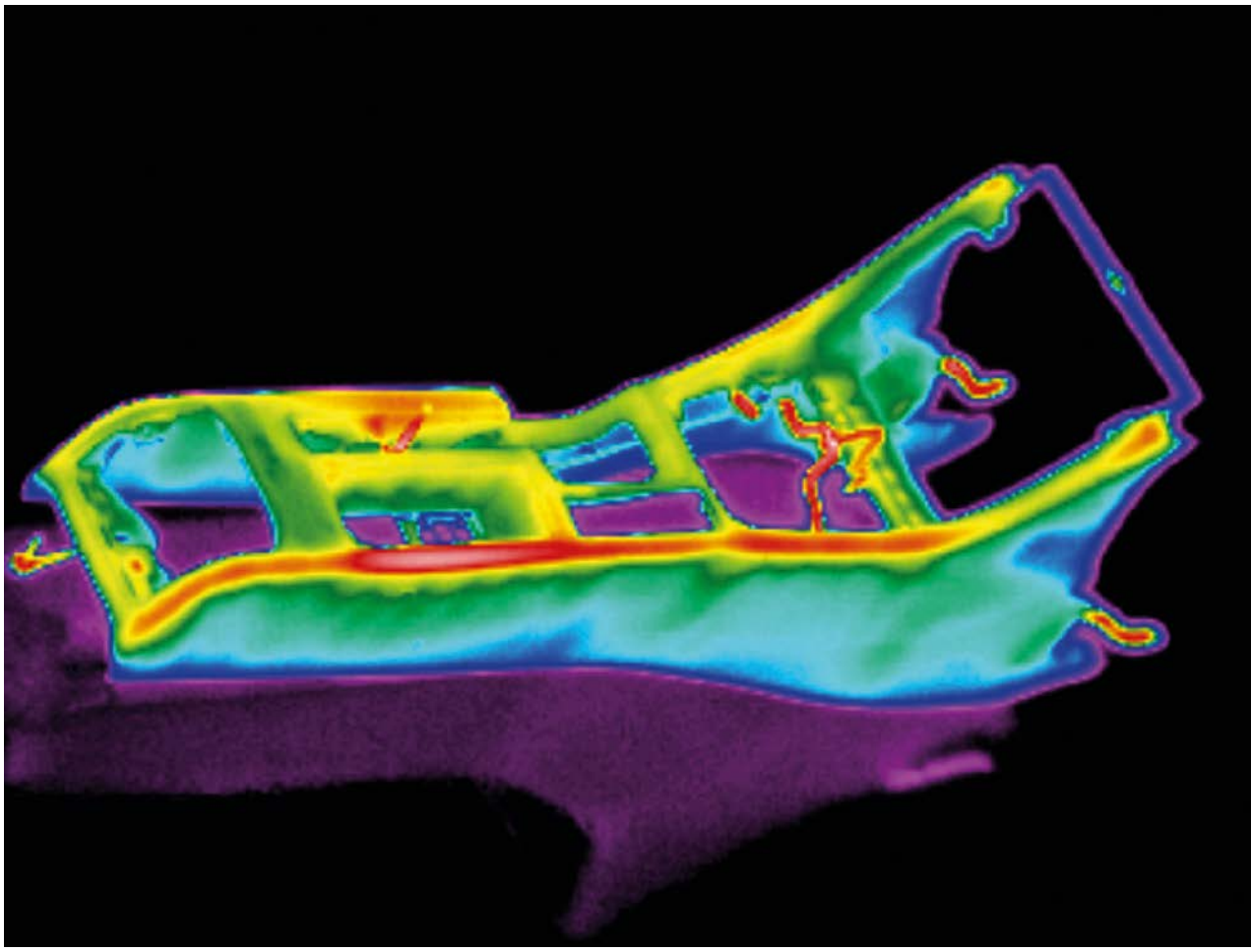


Dactylograms

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

In injection molding, the largest part of errors can be traced back to the tempering of the injection mold. Inline detection directly at the source can prevent errors, enhance quality, and consequently save money.

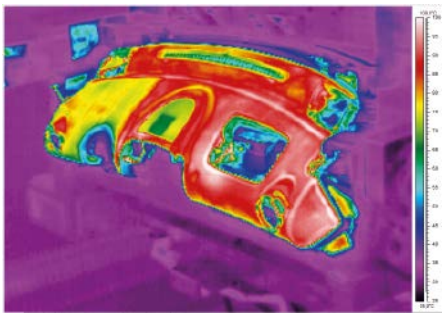
The most common thermal problems and their causes:

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

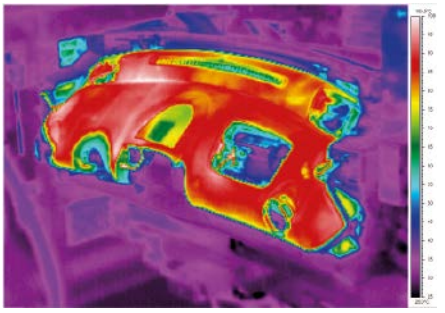
Uncontrolled and unstable processes are the most common financial drains in the injection molding process. The source of 60 to 70 % of all errors relating to moldings, which are responsible for inadequate quality and unacceptably long cycle times, is undoubtedly the tempering of the injection mold. The combination of infrared cameras and online quality control is a promising troubleshooter.

Inline Detection

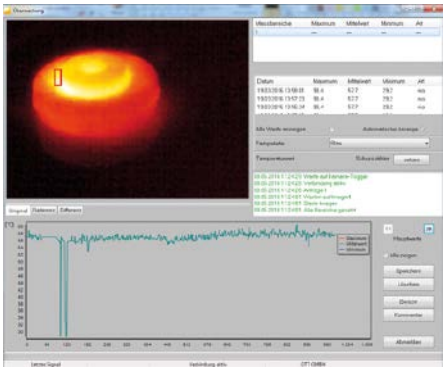
The use of compact infrared cameras by manufacturer Optris combined with the IR-ThermoControl online quality control system that was specifically developed for plastics processing by GTT Willi Steinko and Plexpert, thermal errors in the injection molding process can be detected inline, directly at the source. The data can be transferred to IR-ThermoControl using the PI Connect software. The software is the central element



Before: clearly identifiable thermal weak points



After: thermally optimized component



The system´s analysis mask with IR-ThermoControl temperature graphic

The Optris IR cameras are a major component of the detection system.

that allows the fitter, process technician and quality leader to produce quality components in a quick, safe, and target-oriented way, and with the shortest possible cycle times. In order to take targeted measures, it is important to know where the causes of problems can be located.

Quick and Easy

This is exactly the important information the IR-ThermoControl system provides, and it even shows sporadically occurring effects and trends like, for example, a subtle temperature increase during serial production. The system can quickly and easily be installed on any given injection molding machine and it allows for increased flexibility and availability.

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. This technology is used in 2K injection molding as well as in combined foam/compact injection molding.

> *„Production managers always need to keep an eye on quality and cost – a fact that detection systems support by enabling efficient and economic process monitoring and control.“*

Process Optimization in Automotive

In an 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 which the zone depicted on the left oft he image displays a lower surface temperature than the one on the right (see image image top left of this page). 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 second image from top left on this page).

A Look to the Thermal Future

The IR-ThermoControl “Plug and Work” system distinctly reveals thermal deficiencies. For example, excessively high temperature differences on injection molded components and tools are displayed in a clear manner. Production managers always need to keep an eye on quality and cost – a fact that this detection system supports by enabling the efficient and economic process monitoring and control. Manually touching the surface of a component or tool by hand to locate hot, warm, or cold zones is finally a thing of the past.

Authors

Willi Steinko, GTT Willi Steinko GmbH

Thomas Mann, Plexpert

Contact

Optris GmbH, Berlin, Germany
Tel.: +49 30 500 19 70
www.optris.de