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Opening photo: All Phoenix TM thermocouples are manufactured to the highest quality standards and conform to the ANSI MC96.1 special limits specification.



INNOVATIONS: PRESENT&FUTURE

‘Thru-Process’ Temperature Profiling in Industrial Ovens

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Accurate oven temperature profiles are essential to guarantee high-quality coated products and their reproducible production. With the PhoenixTM ‘thru-process’ measuring systems of the TS04 series, the product temperature profile data in coating processes can be easily and effectively monitored (**Fig. 1**). The system consists of a data logger, a heat protection barrier and the ThermalView Finishing Software. The following describes the operation and structure of the system.

What is temperature recording?

All industrial ovens are equipped with sensors that report the recorded environmental temperatures back to the oven controller. Often several of these sensors are present, at least one in each oven zone. But how can you tell what really happens on and in the product? One possibility is to pass long trailing thermocouples through the oven. This is not only cumbersome and time consuming, but also has the consequence that the oven can't be fully loaded,

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Figure 1: With the Phoenix™ 'thru-process' measuring systems of the TS04 series, the product temperature profile data in coating processes can be easily and effectively monitored.

and so the production is disturbed. On top of that, the partially loaded oven behaves differently than under production conditions, and the long thermocouples are prone to electrical and magnetic influences. This makes the evaluation and assessment of the collected data even more difficult. In turn, IR temperature sensors only display surface temperatures at specific points, need line of sight of the product, and cannot give any indication of what happens inside the product.

The TS04 finishing system has been developed as a complete solution for monitoring product temperature profiles, especially in coating processes. The flexible system is easy to use and records the temperature data of the product during the oven run. The system is located directly at the product, e.g. in the automotive industry, a car body can be prepared so that it can be introduced at any time in the painting line. In preparation, the body is equipped with

thermocouples at all relevant points (the different options are discussed in more detail below). The profile data obtained is stored inside the data logger. This is protected by the thermal barrier from the temperatures prevailing in the oven. After the end of the process, the data logger is removed and read out. The ThermalView Finishing Software converts the raw data into meaningful process data. This information can be used to make quick and informed decisions about how



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Figure 2: The new model PTM1-200-LT data logger with a maximum operating temperature of 80 °C is available in either 6, 10, or 20-channel versions.

to solve thermal cure problems. The measurement results are available as a complete temperature profile at a glance. This can be used, for example, for process or product optimization, customer audits, reduction of operating costs, saving of resources and much more. In addition, with the optional 2-way wireless telemetry communication upgrade, there is the ability to receive the collected data in real time. This eliminates the waiting time and the oven manager can intervene directly in the ongoing process and effects are analyzed immediately.

Software

The ThermalView-Finishing Software was developed especially for the coating industry and is an easy-to-use complete package. The entire oven process is illustrated by detailed graphical data. For example, the burner and fan positions can be entered so that problem areas can be quickly identified. The cure window can be stored and, as the exact temperature data is displayed as a curve for all mounted thermocouples, it can be recognized at a glance whether all measuring points are within the specifications. Also profile comparisons are possible. Changes to the oven settings, or at the product can be

compared and analyzed with archive profiles. A full report can be created either in print or PDF format for easy communication of profile results. These are just a few of the many features that can be used to analyze the process in detail.

Datalogger

The new model PTM1-200-LT data logger with a maximum operating temperature of 80 °C is available in either 6, 10, or 20-channel versions (**Fig. 2**). They work in a temperature range from -100 °C to + 500 °C. The accuracy is +/- 0.3 °C, and resolution of 0.1 °C. The datalogger

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memory size is 3.8 million data points. In addition to the optional radio telemetry, there is also the option of data transmission via Bluetooth. This means that the test set-up can now be started and checked easily by a smartphone or tablet directly at the oven, during production. The calibration certificate and the calibration data are stored in the logger and can be transferred to the ThermalView software by just a click of a button. You have all the necessary information at a glance for quality audits at any time. A proof of specification is directly visible and comprehensible.

Thermal Barrier

The TS04 thermal barriers with heat sink are made of high heat-resistant stainless steel, robust closures and 100% silicone-free insulation material. The microporous insulation and the built-in phase change heat sink provide enormous heat protection in a compact size. Designed for typical cure temperatures of 140 °C - 220° C and cure times of approx. 30 minutes, the thermal barrier TS04-60 measures 60 mm in height, 180 mm in width and 420 mm in length. The barrier provides thermal protection at 200 °C of 0.8 hours.

Thermocouples

For temperatures up to 300 °C, probes are available for various mounting methods. This makes sensors with magnets ideal for ferrous workpieces. For other materials, sensors are available with clamps or with open tip, for gluing on (**ref. Opening photo**). All sensor cables are equipped with double PTFE insulation and additional steel mesh, and are available in various cable lengths. For special applications, other mounting options or materials, such as high temperature glass fiber cable insulation, can be used.

Conclusion

Temperature logging in industrial ovens has been applied for many years. The benefit of such procedure is process control and resulting product coating quality. In addition improved oven efficiency and optimized operating costs are possible. All this is directly related to the correct setting of the ovens. The aim of every oven measurement is to bring the energy and the quality of the products into balance so that both are optimized. This is precisely what the Phoenix™ 'thru-process' temperature monitoring systems provide. ○

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