

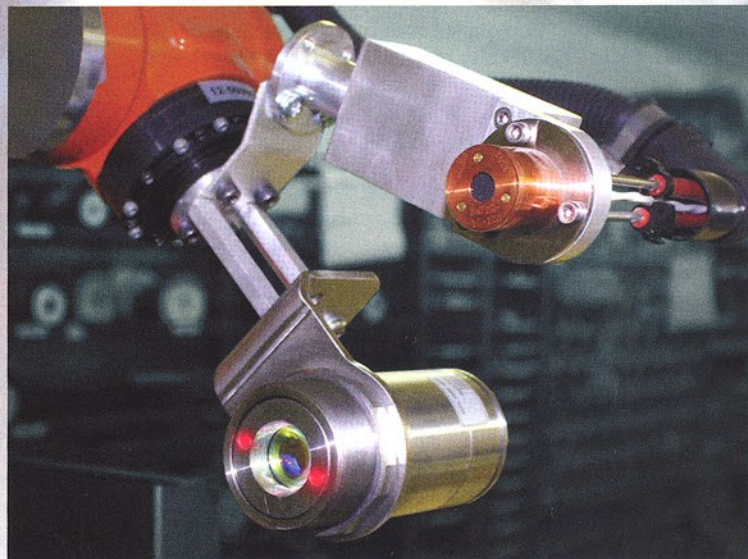
**22 FEATURE**

**PUTTING THE 'THERMO' IN THERMOFORMING**

Earlier this year, Ceramicx Ltd and Trinity College Dublin (TCD) signed a technology licensing agreement to build and market a test instrument to map the previously invisible IR heat spectrum, a development that can be utilised for increased accuracy in the design of plastic thermoforming systems.

# TECHNOLOGY SPOTLIGHT

## Bringing the 'thermo' in thermoforming



The heart of The Herschel is a Schmidt-Boelter radiant heat flux sensor. This specialised sensor uses IR transparent glass, specialised material and temperature sensor systems to measure the IR heat impinging upon a target that is less than one millimetre in size.



The sample plastic sheet is typically placed on the grid for test work under an IR heat source.

“The practical result of this work is that thermoforming companies may design and lower their energy needs with confidence, thereby cutting the carbon footprint of all products made, – Wilson”

this instrument: A specialised grip was manufactured that fixes the heat flux sensor to the wrist of a 6-axis robot. Software programmes were then written to position the heat flux sensor anywhere and in any position in front of heaters and heater assemblies.

The small size of the sensor and the accurate positioning of the robot are said to allow excellent resolution when it comes to heat flux mapping of industrial scale equipment and facilitate the measurement of everything from the energy efficiency of heaters to the amount of energy that would reach a target in a real application.

Wilson added that empirical IR heat measurement is key to progress in thermoforming. “In the past, for example, there was no reliable way of knowing the IR heat distribution from arrays of heaters for thermoforming, since you could not ‘see’ the heat. Now, we can use the Herschel to see the IR heat and how it spreads in 3D space. This has opened up a whole new world in terms of our understanding of IR heating systems and how to properly design them for specific targets.”

He went on to explain that there are actually no limits to these targets. “All manner of polymer-based

products, from vending cups to sports shoes; composites; glass; automobile brake discs; printing; textiles; food – the Herschel can be deployed anywhere where predictive IR heat measurement and heat design is needed.”

**The uptake in the manufacturing sector**

The revived North American manufacturing sector is currently leading the uptake for many of these scenarios – not only in thermoforming platen design and build, but also in terms of heat analysis and test work for OEM and blue chip brand manufacturers.

“We have quickly found that some of the savviest OEMs – in [sectors including] automotive, packaging, sports goods – are very interested indeed in getting IR heat testing into their processes and in looking at the heat performance of

various kinds of thermoformed polymer sheet,” continued Wilson. “Depending on the application and need, some thermoforming polymer sheets are a better fit-for-purpose than others. Others still may offer more cost-effective use when matched with the right heat sources.

The Herschel is able to empirically test and rate the alternatives one against each other – providing thermoforming manufacturers with a scientific rationale for decision making.”

Wilson concluded by adding that the applied science of IR heating is still in a relative infancy. “IR-based heating is very often misunderstood and often misapplied in manufacturing. Comparing temperature with radiation, for example, is a very common mistake. The new Herschel can help remedy many of these situations, can reduce cost and can also dispel many IR heating myths.”

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The Herschel software programmes have been written to generate 3D images having facilitated the positioning of the heat flux sensor anywhere and in any position in front of heaters and heater assemblies.

Immediately after signing the agreement, the instrument was branded ‘The Herschel’, a scientific tool for characterising the infrared heat flux spatial distribution in three-dimensional spaces. To date, it is said to be

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the only machine of its kind in the world to offer this service. Earlier this year, the technology was debuted by Ceramicx’s US distributor, Weco, at the triennial NPE trade show for plastics processors in Orlando, Florida, primarily due to the benefits it offers plastics thermoforming machinery manufacturers.

Large US-based inline thermoforming customers and OEM manufacturers have been shown how the

Herschel creates 3D maps of the infrared heat radiation. US thermoforming machinery builders, such as Modern Machine, were shown how the Herschel can dispense with the ‘black art’ of thermal estimation and instead introduce pinpoint accuracy in machine design, based upon the true and actual heat needs of any plastics thermoforming system.

The Herschel utilises a robotic arm, linear stages, control and acquisition software and infrared heat flux sensors, as well as other instruments, to map the IR heat flux distribution in a system. Sensors, robotics, thermocouples, data acquisition and mathematical

analysis software all work together in providing figures that give the thermoformer – along with the designer of any industrial system – the ability to optimise the energy demands within it.

These figures can reportedly be tweaked further, taking into account the precise nature of the effect of IR heat radiation on a variety of target bodies – including all varieties of polymer sheet. All of these have different properties and performance characteristics when subjected to different kinds of IR heat radiation; short, medium and long wavelength.

“The new Herschel system takes the thermo out of thermoforming and puts it under the microscope,” explained Ceramicx Founder and Director, Frank Wilson. “It analyses the heat work component in any system, so that all outputs and manufacturing decisions may be appropriately measured, predicted and supported. The practical result of this work is that thermoforming companies may design and lower their energy needs with confidence, thereby cutting the carbon footprint of all products made.”

In addition, Wilson says Ceramicx is able to use the Herschel to design and create “ever more bespoke” IR heating systems for the needs of different thermoforming companies. It is also reportedly able to use the Herschel to measure and compare the performance of competitor heating systems.

**At the heart of the system**

The heart of The Herschel is a Schmidt-Boelter radiant heat flux sensor. This specialised sensor uses IR transparent glass, specialised material and temperature sensor systems to measure the IR heat impinging upon a target that is less than one millimetre in size.

According to Wilson, combining this sensing technology with state-of-the-art robotics is the true innovation for

