HeatWorks

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THERMOFORMERS
Reap the benifits of IR

INFRARED
Curing of carbon composites

CLEBRATING
A NEW ERA

REPORT FROM
CAMX 2017

CHINAPLAS
24.25.26.27 APRIL 2018 SHANGHAI, PR CHINA

2018 – a landmark year for Ceramicx

This coming year will be a breakout year for Infrared (IR) heating innovation at Ceramicx – no question. Not only are we seeking to improve upon our 15% average annual growth figure of the past five years but we shall be doing it from within a completely transformed infrastructure.

Any visitor to the new Ceramicx factory will find great difficulty in discerning the past footprint of our old space, which has been superseded, reconfigured, elevated (two storey in many sections) and effectively doubled in size.

Part of the Ceramicx task in the coming 18 months will be to make this new habitat fit for purpose in terms of kitting and fitting out our new spaces and production halls; creating a place for everything and having everything in its place.

It's not just a question of floors, ceilings, and hardware. So much of our infrastructure today is electronic and organizational. We now have SAP systems on board and activated. SAP is an extremely powerful tool which - the more we deploy it - will yield further and further benefits.

Our Ceramicx enterprise is now up to 65 strong. As never before, we possess technical strength in depth in order to challenge both ourselves and the variety, complexity and volume of the IR heating business that lies ahead.

The coming 2018 issues of HeatWorks magazine will lift the lid on all these developments and more. We hope that you – our readers – will continue to engage with issues of IR heat for industry. As ever, we are always delighted to hear from you. Please keep HeatWorks magazine posted with all of your issues. We hope that you enjoy this our April 2018 edition.

Frank Wilson
Managing Director, Ceramicx Ltd.

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HeatWorks

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China - unstoppable industrial might and World-Class Quality to match

By Frank Wilson, Ceramicx Founder and Managing Director

In truth, without our valued partners in China, Ceramicx would be nowhere near our stellar successes to date

Guangzhou Salami Automation Equipment Co., Ltd 广州萨莱米自动化设备有限公司

For many reasons I am looking forward with great pleasure to this year's Chinaplas exhibition in Shanghai, April 24-29.

Such is the importance of the growing Chinese market to Ceramicx that I am, once again, attending the show in person together with Ceramicx production manager Patrick Wilson. Technical and commercial preparations are underway and Ceramicx will be situated in the European zone of the show, working once more with our partners at the British Plastics Federation.

Ceramicx has good cause to anticipate serious trade in Shanghai this year and also an optimistic business outlook surrounding the Chinese plastics sector. This is a sector that is now, for example, grasping today's environmental issues by the scruff of the neck and, within a short space of time, is likely to be leading by example. Within the next five years it is more than possible that China's environmental solutions will be leading the world, alongside its industry might.

I am happy to say from first hand experience that, of all the countries in the world, China also leads the way in its scrutiny and focus on the potential and capability within Infrared (IR) heating science. It is no accident that over the past five years a number of new Ceramicx IR heating components (across the three kinds of emitter) have been created by our company expressly for the needs of the Chinese marketplace.

This kind of intense industrial engagement is actually a delight to Ceramicx: Our Chinese customers challenge our design and technical teams and our systems of world-class manufacturing to accompany them in pursuit of Infrared heating excellence. And the strategy is clearly working, as shown by the strong Ceramicx sales growth in China over the past five years.

From the beginning, Ceramicx adopted a very careful strategy prior to establishing business in China. In fact we spent many months assessing and evaluating which trade agents and trade distributors were best for our products and the best fit for our company – its aims, business model and culture. Our experience has confirmed that we made the right decisions.

In truth, without our valued partners in China, Ceramicx would be nowhere near our stellar successes to date: I cannot emphasis that fact too much: Mr Xu Shan of the Henn Group and Mr Peter Li of Guangzhou Salaimi have not put a foot wrong in guiding Ceramicx IR heating business to where it needs to be; technically, commercially and geographically. If nothing else, the Chinaplas 2018 Shanghai show, will give Ceramicx a much needed opportunity to touch base with our valued Chinese associates and set the bar even higher for us all in the months to come.

The National Exhibition and Convention Center (Shanghai) is the largest single block exhibition complex in the world and is shaped like "four-leaf clover"

There is, however, plenty else at this year's exhibition: Chinaplas is now the largest plastics and rubber fair in the Asia Pacific region and one of the top International Plastics shows in the world.

The 32nd International Exhibition on Plastics and Rubber Industries (Chinaplas 2018) rotates back to Shanghai from Guangzhou and will take place in a new and bigger venue – the National Exhibition and Convention Center, Hongqiao, Shanghai.

The last edition of Chinaplas 2017 covered 26 halls, with 3,485 exhibitors from 38 countries. The exhibition organisers reported record-breaking visitor numbers: 155,258 people visited the show in 2017, with 40,000 from overseas and overall visitor numbers increasing by over 6,000 from 2016.

The statistics show the increasing international character of the exhibition – with over a quarter of visitors now travelling the globe to China. The Ceramicx exhibition last year, for example, noted a rise in visitors not only from Europe but also from countries such as Turkey in the Near East and also from emerging markets in the Middle East.

This year's exhibition area is expected to exceed 320,000 square meters - 30% more exhibition space than that of the 2016 edition of the show in Shanghai. It is recently reported that this month's Chinaplas is now anticipating some 180,000 visitors. The new venue; expanded facilities and ambitious programme all imply a high-tech feel to the exhibition going forward.

The country's plastics and rubber industries, which are fundamental sectors, are growing significantly. New materials and processing technologies continue to emerge, and propel the expansion of upstream and downstream industries. This continuous improvement of China's industry is having a knock-on effect with regard to its marketing and exhibition activities.

The shape of the new venue, the NECC is said to be like a blooming "four-leaf clover" – which bodes well for Ceramicx in Ireland! The leaves of the clover will house different processes – extrusion, thermoforming, injection and blow moulding etc. The European pavilions - which were scattered among different halls in the past, will be gathered in Hall 2H at CHINAPLAS 2018.

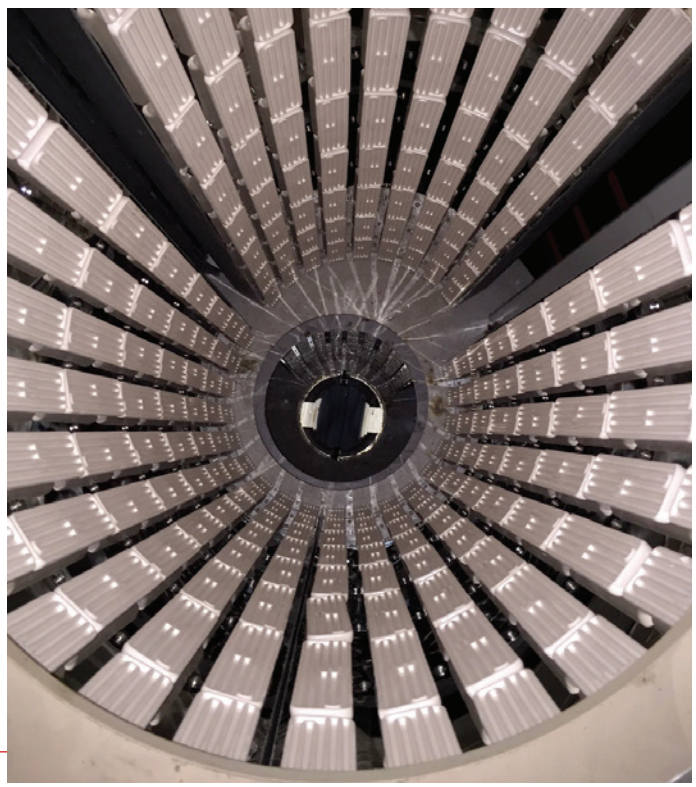
With a total construction area of 1.47 million square meters, the Chinaplas venue is the largest single block building and exhibition complex in the world. There are 400,000 square meters of indoor area, which consists of 13 large exhibition halls and three small exhibition halls. There are also conference rooms with different specifications and settings among the halls. The central area is a commercial plaza providing abundant catering services.

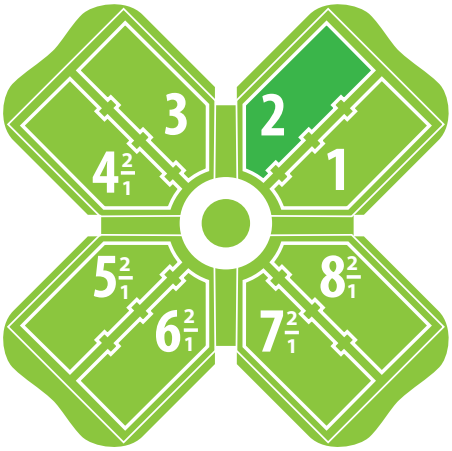
Chinaplas 2018 will also introduce a "3D Technology Zone" and a "Thermoplastic Elastomers & Rubber Zone". This former is aiming to cater for the demands of customization and small-batch production,

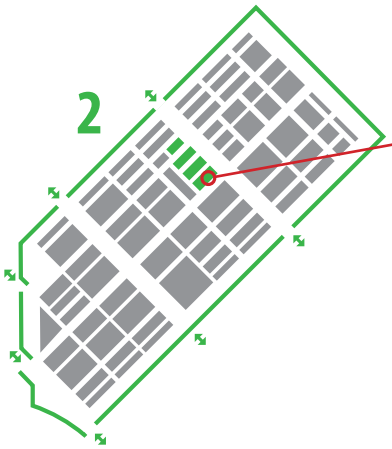
广州 李先生 *Mr Li Ping Qiang (Peter Li) General Manager of Guangzhou Salaimi, .*

北京 徐先生 *Mr Xu Shan, General Manger, HENN GROUP China, has cooperated with Ceramicx since 2005*

Ceramicx sales in China benefit from the hard work and expertise of the Guangzhou Salaimi company







Chinaplas2018

Hall 2 - Stand D96

National Exhibition and Convension Center,
Hongqiao, Shanghai, PR China

24 - 27 April 2018

with the aim of shortening development cycle time and reducing costs arising from Industry 4.0.

The shows "3D Technology Zone" will group together the vendors and providers of 3D printing (additive manufacturing) technologies. The new theme exhibition zone comes accompanied by an Industry 4.0 conference, providing a comprehensive experience for the enterprises interested in 3D printing technology and "smart manufacturing".

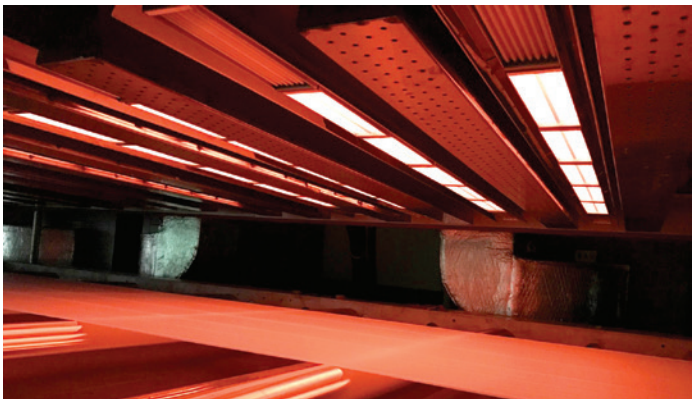
The TPE zone at Chinaplas is a response to the marketplace for energy-saving, environmentally friendly and lightweight thermoplastic elastomers. These are widely used in the automotive, electronics and electrical, medical and footwear industries and about 70 suppliers will showcase the latest development in this field.

All this and more Ceramicx is looking forward to witness on this our 6th successive year of exhibiting at Chinaplas. However - and as the song goes - 'the best is yet to come'.

Not only doe Ceramicx see further gains in China to be made in commodity thermoplastics processing techniques such as thermoforming, we also aim to introduce China to our growing expertise in heating and processing polymeric composite materials for which there is much demand, especially in the aerospace and automotive industries.

as the song goes
'the best is yet to come'.

We therefore look forward to setting out for Shanghai this year, fully engaging with the Chinese plastics community there and returning with a batch of orders, and technical and creative enquiries that will keep the pot bubbling until Chinaplas 2019 in Guangzhou.



(left) Ceramicx IR heaters find a ready application here in China for the production of three layer polyolefin-based shrink-wrap film. The process requires extremely accurate process control. China now produces over half of the world's shrink-wrap, with most production located in Guangdong province. Ceramicx commercial agent Xu Shan says that 'Ceramicx high quality IR elements FTE (economy type) and FFEH (temperature keeping and power saving type) now account for about 80% of the Chinese OEM's in this particular industry.'

The OEM (original equipment manufacturer) will typically use Ceramicx IR elements to build a large cylinder oven, the height of which can reach six metres, as in this example.

Deployment of Ceramicx 245 x 60mm IR elements succeeds in supplying a very uniform process heat for the film production.

Xu Shan adds that 'Ceramicx power saving elements can also save up to 15% of power consumption for a typical 300-400kw-rated oven. Not only does this save cost, it also boosts the OEM's green credentials.'

(above left) Process control know-how and its application is key to the effective use of Ceramicx IR heat work in Chinese industry

(above right) Ceramicx IR heat work and elements are used in many sectors in China – not just plastics. Here Ceramicx components are being used to heat cure a number of coatings

IR heat for thermoformers - Reaping evergreen benefits

For some time now, the advantages of IR-based thermoforming have been made crystal clear in all plastic thermoforming sectors; cut-sheet and inline,' says Ceramicx founder and managing director, Frank Wilson.

'Carrying on regardless with the same heat legacy issues is neither sensible nor profitable. A time for review inevitably means taking a fresh look at Infrared (IR) heat technology and an appraisal of capital spend.'

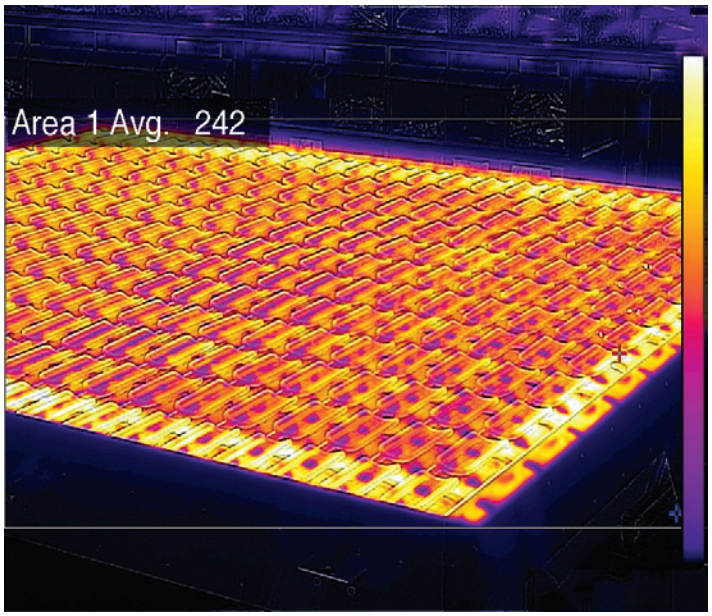
'Ceramicx is therefore delighted that many thermoformers worldwide are adopting IR-based heating + sophisticated control as a way of increasing accuracy and saving cost,' says Wilson. 'The key is to begin with great IR thermoforming platen build - then combine that with pin-point accurate electronic and process control.

The primary production benefit is that thermoformers get improved efficiency through decreased energy usage, increased production, reduced scrap and downtime.'

For a retrofit IR heating upgrade the process is relatively simple and surprisingly easy. New IR heating systems for thermoformers, designed and installed by Ceramicx, typically require an offsite period of consultation, design, build and testing and then 3-4 days onsite for integration, including a 24 hour runoff period.

Touch screen HMI interfaces with the complete control system and provides the user with a graphic based visualisation of the process.

Ceramicx believes that any thermoforming control system should provide early warning diagnostic features; the ability to alarm the operator in the event of a single heater loss, a shorted wire or a bad fuse.



Infrared image of ceramic thermoforming platen under testing (photo -Gethyn Morgan, Green Engineering)

Ceramicx also sees that most plastics thermoformers experience heating issues at some point in the life of their machine. 'The heating issues of the past ten years for thermoformers worldwide are broadly the same, says Wilson, 'and until we see a wholesale adoption of IR based heating – the core messages to all thermoformers will be the same.'

Carrying on regardless with the same heat legacy issues is neither sensible nor profitable

Those messages include the assertion that a simple infrared (IR) heating upgrade to a company's conventional heating system can increase profits for thermoformers by at least one third, according Ceramicx.

Replacing an entire thermoforming machine is too big a step for many but an IR upgrade can improve the performance of an expensive fixed capital asset and typically pays for itself within months.

Heating legacy issues can include burn-outs, electrical faults and problems with older style and non-directional heating. Tubular and magnesium filled heating solutions; black rod heating and other kinds of non-infrared sources can all make a contribution to inexact systems of thermoforming production and – above all – to a waste of energy and electricity cost.

Infrared (IR)-based replacement heating platen part of a top and bottom system with 276 ceramic heaters in 18 zones.

In a completely enclosed system or oven, this kind of heating becomes uncontrollable. Thermoforming operators are being continually forced to ramp up the power and the input electricity in order to try and maintain an even temperature.
Effective plastics thermoforming means that all energy inputs have to be properly measured and then specifically applied.

Frank Wilson says that 'I make no apology for restating the facts here: IR heating systems for thermoformers includes the following benefits:'

- A major reduction in capital equipment expense & wear and tear
- Like-for-like infrared for tubular replacements
- Elimination of 'hot box' tubular problems
- No need for changes in control or instrumentation
- Poor performing infra red to be replaced with superior platens
- Savings in directional heat
- Better resultant product quality
- Improved set up time and tool change time
- More complex parts possible
- Cooling requirements also reduced
- Matching of heating controls to polymers being processed
- Improved environment for operators

Ceramicx-designed IR thermoforming systems simply convert incoming electrical wattage into infrared output more quickly and efficiently than conventional heat sources.

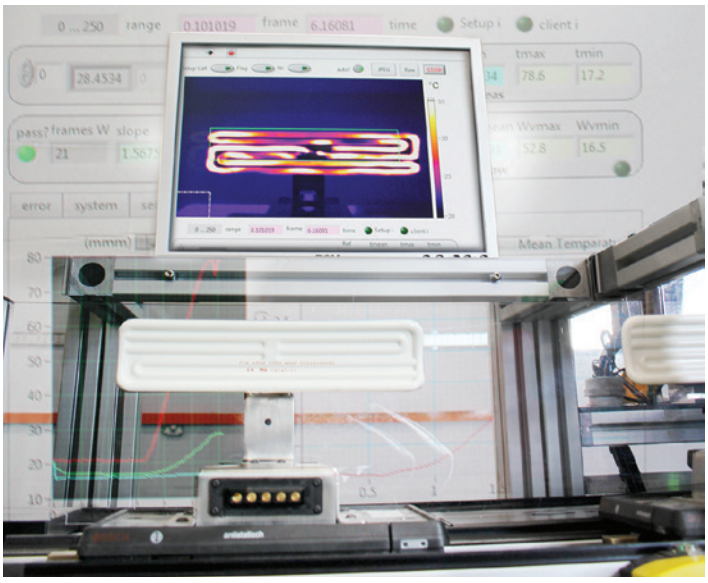
In thermoforming production a number of infrared ceramic heaters are generally mounted on reflectors, which are then arrayed upon a platen – or two – which is part of the production line.

The performance of the background reflectors - their material composition - and the performance of the platen in general – these factors are all vital in directing the infrared heating to the plastic.
Component design is everything: For example, Ceramicx points out that stainless steel is not an adequate material for use in infrared reflection work. It will absorb a high percentage of the emitted energy and will therefore over time cause burnout of the electrical wiring behind the reflector and will also start to discolour from 120ºC.

Polished aluminium on the other hand is in most cases the best reflector for ceramic infrared heating but > 500ºC it also will start to fail. The business of thermoforming thin and clear plastic sheet needs some installation of passive ceramic tiles in the base of the platen in order to reflect back the heat.

At Ceramicx the core of this platen and system build rests upon the company's world class manufacturing systems – and all of the products made by Ceramicx in house.

Ceramicx quality assurance (QA) work centres on developing systems of closely specified nominal wattage tolerances for the ceramic and quartz electrical elements. This control applies throughout the entire range of Ceramicx IR heating products. The semi automated validation system with closed-loop process-control at the company guarantees the product quality. It also assigns and records performance characteristics for each part as it is produced.



FTE ceramic element under test on our semi automated validation equipment

In summary, every thermoforming system, in some way, has its custom heat work features depending on products, materials and cycle time. The Ceramicx belief is that sooner or later most, if not all, of these – for the reasons stated above - will of necessity migrate over to IR based systems in the coming years.

Thermoforming – Ceramicx cut sheet IR heat work forges ahead

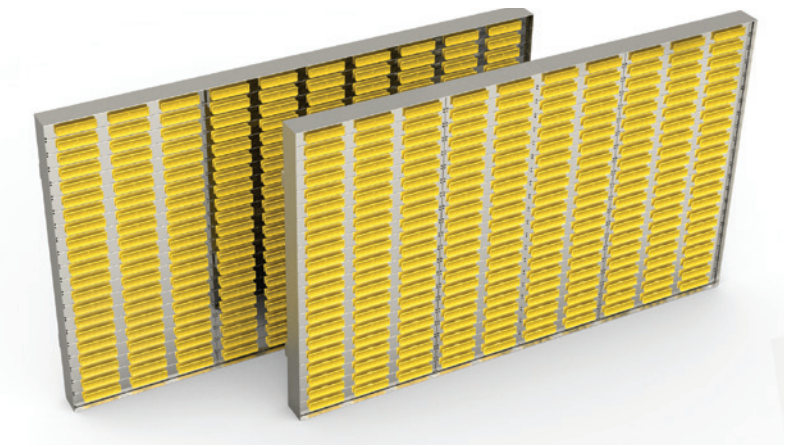
Ceramicx sales to thermoforming industries continue to build:

US Distributor Weco International for one reports great receptivity from the US thermoforming community for the message of energy cost-reduction through the use of focussed IR heat and Ceramicx products and systems.

Weco's ongoing sales include a number of large thermoforming platen customers.

One common denominator relating to these is energy usage and the size of platen. For example, in Q4, 2017, one Weco client in the US leisure sector has ordered a 4.6m x 2.7m thermoforming platen for the production of bath/spa tubs.

Such a large heating system (281kw output) involves a considerable draw on power. The new thermoforming platen was designed and built by Ceramicx in its new machinery hall. It has 10 individual control zones, 468 ceramic IR medium wave FFEH elements and operates at 480 volts.



In the same month Weco fulfilled an order for a white goods OEM client in the US requiring two platens (upper and lower) for a thermoforming system manufacturing components for fridges and freezers. Again, the platen size was large, measuring 3.2m x 2.04mm, each platen containing a total of 210 elements This particular customer required a total of 70 heat control zones, each one with its own thermocouple and each one containing x 3 ceramic IR elements. Weco Internationals President Brett Wehner says that 'in manufacturing, heavy users of utilities are likely to be extremely cost conscious of their power consumption.

Many of our US thermoforming customers are clearly in that category - both in continuous inline thermoforming for industries such as packaging and FMCG goods and also for large cut-sheet applications in automotive, aerospace and white goods. We are delighted to offer these customers energy saving thermoforming systems from Ceramicx.'

Meanwhile Europe's automotive industries continue to provide sales and innovation in the thermoforming markets; interior panels (doors and floors); parcel shelves and boot liners continue to account for much fibre reinforced production.

The automotive sector proves time and again that just as there is room for all kinds of vehicles - from standard to luxury – so there is room for all kinds of materials processing, from functional to exotic, from complex composite lay-ups to the simplest moulded components.

The contribution of all these components is needed for the make-up of the modern car. One common denominator is the drive to weight reduction: Any driver who has recently opened a boot, adjusted the parcel shelves and spare tyre covers will know at first hand that light-weighting of components continues to dominate new models. This trend opens the door to thermoforming opportunities.
Ceramicx recently won an important order to supply a Tier 1 supplier with an Infrared thermoforming system making such products for a leading automotive OEM in the UK.

The Ceramicx heat work was required to fit into the cut sheet process for the thermoforming of car interior liners - in this case the boot space. Black carpet onto black plastic sheet was robotically loaded onto a moving table then moved across into the heated zone.
The IR heat system was then applied to the top and bottom of the part for a period of time: The sheet was moved onto the mould surface where it is slowly pressed into the required shape. The component then sits in the mould for a set period of time in order to cool. It is then removed and a trimming and finishing process is performed.
A top and bottom Infrared (IR)-based heating system using 276 HTE Ceramic heater on 200w and 300W was supplied for each of the customer's two thermoforming platens. A total of 18 zones of control in the pattern was outlined by the customer. A series of HTE 300W heaters was also placed around the perimeter of both the top and lower platen to minimise edge loss of heat.

When correctly applied, IR-based heating never fails to perform with regards to consistency and repeatability. The customer was particularly impressed with the fast heat-up time for the ceramic heaters and the ease at which the IR heaters found and remained at the required temperature set-point.
This 'proof of the pudding' has meant that the customer has just placed an order for a second oven. Ceramicx is delighted that these IR heating efficiencies can be passed on so directly to the thermoforming cut-sheet industries – including applications in the modern automotive sector.

Margaret Hearty, Director of Programmes & Business Services, Intertrade Ireland with Findhan Strain, Dr. Peter Marshall and Frank Wilson from Ceramicx.

Ceramicx honoured by InterTrade Ireland

Ceramicx has won a 'Project Exemplar' award at the Intertrade Ireland Fusion awards ceremony that took place in the elegant surroundings of Carton House on the 23rd January. Findhan Strain reports for HeatWorks magazine.

The Fusion project between Ceramicx and Belfast Metropolitan College focused on the development of the composites processing Vector machine, covered previously in this magazine.

The Fusion project is a cross border collaborative project scheme that enables businesses to partner with academia in the development of novel and innovative projects. Having identified the lack of intelligent heat work solutions within the composites industry, Ceramicx partnered with Belfast Met in 2015 to address this global market need.

The 18 month project cumulated in the Vector drape forming machine that addressed specific shortcomings in the composites market and launched at the JEC show in Paris, March 2017.

Ceramicx's approach with the Vector ensures energy is used only as needed and heats the thermoset resin as opposed to tooling and surrounding space, thus ensuring a more efficient process.

The picturesque backdrop of Carton House provided an ideal venue to celebrate the progress made by four exemplar projects, out of approximately forty Fusion projects.

The event began with an introduction to the Fusion project from Margaret Hearty, Director of Programmes & Business Services at Intertrade Ireland before hearing from speakers, previous winners and other company projects.

Margaret stated the continued support for the Fusion project in years to come. The popularity of Fusion has continued to increase and is now considered to be a leading light in path finding the connection of SMEs to academia and in developing prosperous relationships between the two entities.

The presentation ceremony saw Dr Sean McNamara, founder and director of ABC Nutrition, a multi-award winning manufacturer and distributor of sports nutrition products giving an insight into his progression from Fusion graduate to business owner.

Sean discussed the importance of bringing R&D from an idea through to actual business reality and emphasised how important Fusion projects were in that process.

Delegates then heard from Graeme Crombie of Matrix Business Growth Consultants who presented a ten point plan in embedding innovation successfully within a business.

Graeme's 'meaningfully unique' definition of innovation uses these ten steps to focus on internal systems innovations and external opportunities and turn these projects into a profitable reality.

Project videos were displayed for each of the four projects prior to the presentations of the awards. The projects were

- Ceramicx & Belfast Met – Development of novel infra-red curing of composites
- StatSports & Dundalk Institute of Technology – Wide band athlete monitoring systems
- CF Pharma & University of Ulster – Digestive upset products for calves, dogs and camels
- Deluxe Group & Dun Laoghaire Institute of Technology – Simulation of interior design projects

InterTradeIreland
Discover what's possible

CAMX Florida delivers results

When the leading Ceramicx marketplace of the USA meets the dynamic technologies of reinforced materials –good things are bound to happen. HeatWorks magazine reports on a successful Ceramicx foray into the North American composite marketplace.

The occasion was CAMX, the Orlando based annual USA composite materials exhibition – postponed because of bad weather from September 2017 to 12-14 December 2017.

Frank Wilson, Ceramicx founder and director attended the exhibition, together with personnel from Weco International, distributor for Ceramicx in North America.

Weco Operations Director Tony Tenore counts off several positives from the CAMX experience.

- We had the ability to connect in person with some good customers of ours
- We all gained knowledge about "who" is a composite customer outside of the aerospace industry
- We greatly benefited from collecting information on our non-Infrared (IR) heating competitors.

Tenore adds that 'we also gained several perspectives on the features of US composite as a whole, learning, for example, what might be considered a commodity item versus something that has more critical value'.

Unsurprisingly perhaps, Weco and Ceramicx used the CAMX event to educate the composite industries about the properties of IR energy.

In no way do I seek to discredit the knowledge, ability and capabilities of the sector,' says Tenore, 'but heat is in fact mainly viewed as a commodity in the composite industry. Once we are given the ability to connect with someone and explore their manufacturing process, infrared (IR) then becomes a technological advantage versus a commodity. This is part of the challenge that we recognize and relish.'

Tenore also noted that 'controls utilized as a standard in the majority of the composites processes are considered basic when we compare them to Weco/Ceramicx capability. We definitely view this as an advantage: for the right customer advanced controls will be tied in with advanced and precise heat sources.

Another key learning point for myself,' adds Tenore, 'was the fact that the majority of composite processes are set in stone once they are proven out and put into production. This is a double edged sword - great if you are the company on the spec, but difficult if you are not there at the beginning.

On the upside, the take away was to be vigilant for new applications and to be cautious troubleshooting an older existing process.'

If any exhibitor walked out of the show and did not remember Frank and have a piece of Ceramicx literature I would be very surprised. Frank and Brett Wehner, Weco founder, appeared to have connected with every single booth at the show – giving us another great source for knowledge about the industry and how it flows. All in all, CAMX,' says Tenore, 'provided a great experience and gave us the personal knowledge that we not only belong in the industry but can excel in the industry – and far above our competition, since we provide just the right approach to the market.

Weco president Brett Wehner says that 'we were delighted with the interest and opportunities presented to us in Florida. We interacted with several existing customers utilizing our IR solutions as well as finding new names, businesses and opportunities throughout the world involved in aerospace, automotive and industrial processes. In addition, we discussed the benefits of infrared energy being utilized in new uncharted applications.

Wehner's view is that 'Infrared heating and composite processing when taken together is at a fairly sunrise stage in development. However, there is no question that the materials and the IR technology work really well together. We therefore anticipate 'ground-floor' growth and opportunity in helping improve composite heat work with Ceramicx infrared products and solutions.'

Tenore added that 'having the added expertise of Tadhg Whooley and Frank Wilson in the booth was a definite and incalculable plus. Their knowledge of heating methods and IR energy made a massive difference, especially when talking to new customers, all using different materials. Between Ceramicx and WECO there are very few heat work solutions that have not been heard of or tested in one way or another!'

Putting composite materials to the test

Ceramicx has joined forces with Comeragh Composites in order to develop a structured composites curing test programme over the coming weeks and months. Findhan Strain of Comeragh Composites reports.

Findhan Strain

Both partners have realised the potential of IR for a long time, having undertaken initial research into physical properties such as tensile strength, three point bending, impact resistance and other factors key to validating curing methods in these materials.

To date, this research has been fundamental in understanding how IR heat interacts with various fibres and thermoset matrices, most notably carbon fibre in an epoxy matrix.

However, it is now essential that engineers across the world understand that the results thus obtained can now be replicated by independent testing partners, using standard processing techniques.

other factors that are directly influenced by the heat work must be precisely controlled in order to produce a high quality, void free composite.

The new Ceramicx test programme aims to independently validate our approach to controlling this factors in carbon epoxy composites.

Figure 1 displays the relationship between time, temperature and viscosity of Cycom 5320-1; a typical Out of Autoclave (OOA) pre-preg system commonly used in the aerospace sector. The application of heat can control all of the key curves within this graph.

Figure 1

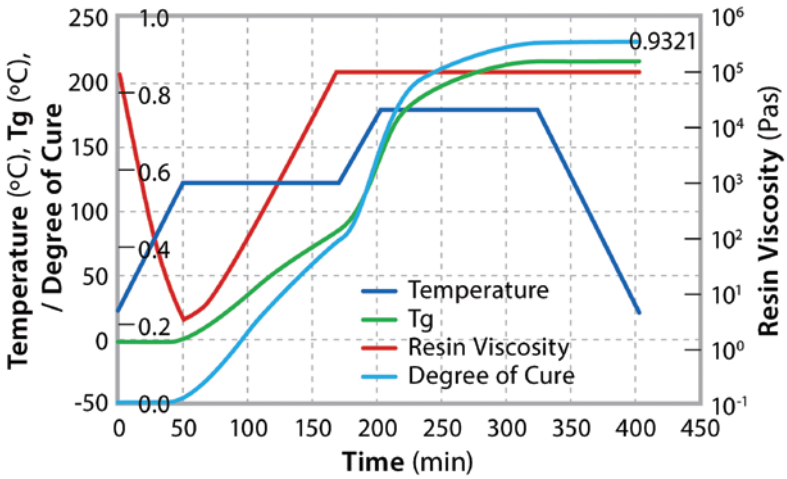


Figure 2

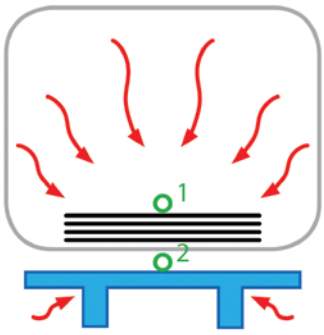


Figure 1 taken from www.cytec.com
Kinetic model output example for CYCOM 5320-1;
(RAVEN simulation software by Congervant Manufacturing TechnologiesInc.)

In effect, we have proven that the effectiveness of IR in curing composite components cannot be understated. Real processing efficiency gains can be made and measured and even enhanced material properties can be achieved. Both Ceramicx and Comeragh are therefore really looking forward to having these matters independently assessed over the coming weeks.

A key difference in composites when compared to metallic materials for example, is that we create the properties of the composite during the manufacturing process and do not rely solely upon the geometry of the material structures.

In fact, curing is the most critical part of any thermoset composites process. During curing cross links are formed between the polymer chains, thereby 'setting' the resin matrix. Even before the formation of such cross-links, the resin viscosity profile, rate of reaction and many

The blue line represents the programmed oven temperature of a typical convection oven.

In reality, however, what happens is that the temperature of the part itself will lag behind. Figure 2 shows a typical lay-out of a carbon fibre laminate being cured in a convective oven. The thermocouple (T/C) at position 1 will typically read a lower value than at position 2.

This is due to the thermal conductivity through the part, also the thermal conductivity of the tool and through overall mass of materials. Therefore, the blue curve in Figure 1 usually contains more curves as the lagging thermocouple catches up with the remaining cure cycle. This can lead to lower processing times and potentially warped parts, primarily due to uneven heating and the resulting residual stresses.

Figure 2 – T/Cs at 1 would be lower in temperature than at position 2 during heat-up

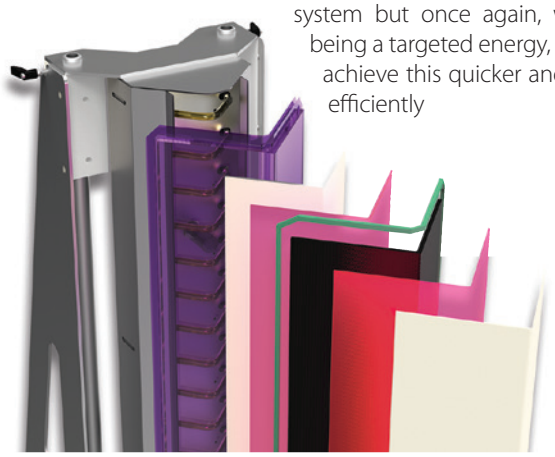
This lag also results in the addition of wasted energy to the system while the surroundings heat up and the heat eventually soaks into the part.

With IR-based heat sources this problem still persists as the thermal conductivity of the composite remains the same. However, less energy is wasted to the surrounding walls, tooling fixtures and tooling itself. And these differences are greatly reduced with a small degree of tool pre-heating - which again can be achieved more efficiently with IR based energy.

The red-line in Figure 1 is the viscosity profile of the composite resin system. This starts off as a viscous system in the pre-preg state; the application of heat to the composite then decreases the viscosity to a minimum point. This is prior to an exponential increase as the degree of cure (turquoise line) increases past the activation energy of the resin and cross-links begin to form. The application of heat to the component controls the slope of this viscosity drop and also the minimal value attained.

A fast heating rate, for example can give rise to a very low viscosity and a slow heating rate can lead to a higher minimal viscosity. Low minimal viscosity results in good flow across the part and potentially easier void removal (particularly important in an OOA pre-preg package) but the risk of excessive flow can be present and this will result in a dry laminate.

When appropriate bagging techniques that throttle resin bleed are deployed we can potentially achieve good flow, high void removal and a fast processing time. This potential exists for any heating system but once again, with IR being a targeted energy, we can achieve this quicker and more efficiently



The glass transition temperature (Tg) shown by the green line is more of a function of final cure temperature and duration as opposed to the initial application of heat. However, small efficiency savings may still be possible by understanding our process better and by shifting the point of 'Tg flat-lining' earlier in the process, achieved with the faster heating rate noted earlier.

All of these factors point to a greater need for understanding of heat-work within composites processing. The new Ceramicx composites testing programme will seek to validate our approach and prove that heating with IR energy can give notable and repeatable processing advantages.

The programme is already underway and interim results are planned for publication in the next issue of HeatWorks magazine.

Out of Autoclave Processing of Composites Conference

Ceramicx associate Findhan Strain of Comeragh Composites presented the very latest in OAA processing issues at a key event for the industry in Belfast on 15th March 2018

The Irish Composites Centre (iComp), The Knowledge Transfer Network (KTN), Composites UK and Invest Northern Ireland combined to host a cross-border conference on the 'Out-of-Autoclave (OOA) Processing of Composites' in Belfast on March 15.

The event was a sell-out in advance with the venue reaching maximum capacity, demonstrating the interest in composites locally and internationally. The breadth of knowledge and engagement in focusing on industry progress towards negating the need for autoclaves in the manufacture of highly loaded composite structures made the event a great success.

The drawbacks associated with such autoclaves have previously been well documented. These include high capital costs, high operational costs, lengthy processing times and production bottlenecks.

As readers of Heatworks magazine will know, Ceramicx has developed unique capability in the curing of advanced composite components using Infra-Red (IR) technology and I presented the very latest findings and approaches at the event

The event's keynote speaker was Peter Quigley of CCP Gransden who showcased the company's commitment to rapid processing of composites using thermoforming and injection over-moulding.

Ceramicx has played a key part in this development at the company by providing the pre-forming oven. Indeed, a similar theme presented itself throughout the event where IR was used extensively in the pre-heating or heating of thermoset and thermoplastic composites.

An interesting aspect from Dr John Summerscales at the University of Plymouth noted that autoclaves still have very useful functions within certain high value industries such as aerospace that can afford to have longer cycle times, but perhaps only for the short term future. Consequently, there are opportunities to embed infra-red heating within autoclaves also to tailor specific heating zones within an autoclave.

It was clear that the use of IR is widespread in OOA applications and the majority of presenters utilised it at some point, within a lab or in

Ceramicx associate Findhan Strain of Comeragh Compositesmaking his presentation, The Andrews Gallery, Titanic Belfast.

an industrial setting. It could also be suggested however that there are many improvements to be made in the IR heatwork presented by many delegates and my presentation aimed to address this.

After discussing briefly the rationale for using IR heating, I proceeded to cover the main topics that could be of interest to delegates: processing aspects to consider when performing any of the three primary functions attributable to composites: thermoplastic forming, thermoset pre-forming and thermoset curing. Thermoset curing is an area of great interest as the heatwork is rarely understood in detail. The Vector development project has been instrumental in identifying the specific processing parameters needed to effectively cure thermoset composites and form thermoplastic composites. In turn, this has led to a number of new projects in unique and specialised areas for Ceramicx's customers.

Heatwork in composites curing tends to be greatly overlooked when preparing a manufacturing process. Many if not most engineers automatically adhere to initial parameters set out by resin manufacturers. For example, many high value composites have profile thickness changes throughout their geometry, with additional material in highly stressed regions. This is one of the primary benefits of composites in that the thickness can be easily altered in areas of high loading. However, this presents challenges as getting heating energy into thicker parts takes place at different rates to thinner parts. This could be a profile change of 2mm to 20mm.

Couple this factor with an exothermic matrix reaction when using thermosets and the heatwork recipe can become quite complex. For a typical convective cure, the curing process is normally defined by the thickest section and this leads to longer processing times. When infra-red is deployed this is still true to some extent. However, the overall processing time can be significantly reduced by focusing greater amounts of energy in specific locations.

When processing the composite, a number of additional processing parameters must also be considered:

- Emitter type (*as covered extensively in this magazine*)
- Power density
- Distance to target
- Coating and reflector geometry
- Tooling type
- Control Mechanisms
- Processing consumables

Processing consumables are an important factor to consider when heating composites. Any material that is placed in the line of sight of the radiation can potentially alter the process. In many composite processing applications, vacuum bags, release films, peel plies and breather fabric can be placed here.

In my Belfast presentation I explained how we must consider the effect of such materials on the radiation arriving at the part and also as regards the effect on the processing materials themselves.

For example, if curing at 180ºC is targeted for the composite part, and a breather fabric is placed underneath the vacuum bag, will the vacuum bag withstand surface temperatures of say 200ºC or will it melt? Careful consideration of all processing conditions must be deliberated. This is the exact area that Ceramicx specialises in. The company has a comprehensive track record and data base of know-how regarding the performance of such materials.

Ceramicx is now focusing on developing a comprehensive test plan for characterising the heating and cure of various materials which we hope to present in future editions of this magazine.

With the previously noted benefits in processing thermosets and the rapid heating of thermoplastics, it can be concluded that IR will have a strong presence in OOA technologies.

Further developments and composite test programmes from Comeragh Composites will be regularly featured in upcoming issues of HeatWorks magazine

The Infrared curing of carbon composites

Ceramicx never tires of preaching the fundamentals of Infrared Heating – its characteristics and effects. Last November 2017 Dr Peter Marshall of Ceramicx took the opportunity to brief a UK audience of engineers and scientists attending the Advanced Manufacturing Exhibition at the NEC, Birmingham where Ceramicx had a booth. HeatWorks magazine is pleased to produce highlights of the talk here.

My name is Peter Marshall and I'm going to speak about the use of infrared to heat and cure carbon fibre. Before that – some introductions; to myself, Ceramicx and its research arm, C²I².

I have a background in materials science, nano-science, polymer processing and heat transfer. My Ph.D. focussed on nano-scale thermal transport in fluid media and used this to increase the efficiency of heat transfer processes.

Ceramicx has been a specialist in infrared heating for over 25 years and has always pushed the bounds of processing to drive productivity increases and energy cost reductions. Uniquely, Ceramicx manufactures all three types of IR emitters; enabling the company to offer a solution to most thermal processing challenges. In a nutshell, C²I² works to establish and improve the efficiency of Ceramicx's emitters and define the optimal heating technology for a given material.

We're all aware that out-of-autoclave carbon composites are gaining significant traction in our industry. OEM's are demanding better quality, faster cycle times and more energy efficient processing methods giving our industry, particularly Ceramicx's niche enclave of infrared heating, a particularly interesting time and a window of opportunity.

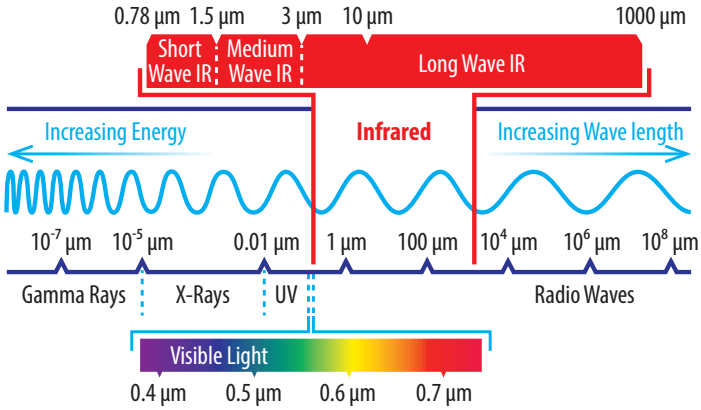
Ceramicx is a supplier of infrared heating elements, components and bespoke turnkey machinery to numerous sectors including the automotive and aerospace. Infrared and radiation heating is a complex phenomenon; it is often misunderstood and poorly applied. To address this, I will speak about three key points:

- How IR works
- How IR can be targeted
- How temperature can be controlled

IR Properties

Infrared lies just beyond the visible spectrum with wavelengths ranging from approximately 0.7µm to 1000µm. Of this band, the useful wavelengths extend from 0.7µm to 10µm. After that, the emitter body temperature is largely too low to provide a heating effect.

IR has many properties of conventional visible light: it has a magnetic field associated, can be reflected or diffracted, its energy is quantised and de Broglie's wave-particle duality holds true. Infrared is also very safe. Distinct from other forms of radiation such as nuclear, microwaves or UV, the energy of infrared photons is not substantial enough to ionise other particles and be a danger to humans.



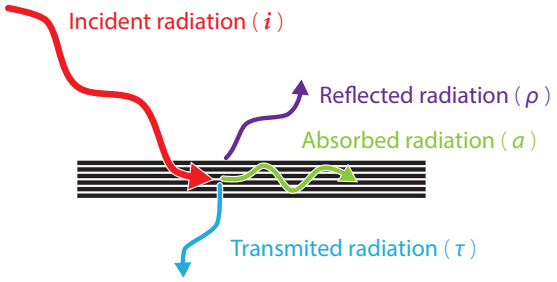
Infrared is substantially different to conduction and convection. As we all know, radiation doesn't need a medium to travel in – it's how the sun heats the earth; however the key issue that consistently gets 'lost in translation' is that IR is a form of energy, not heat. So what happens when this energy is incident on a surface? Similar to visible light, what we see is three processes occurring: reflection, transmission and absorption.

IR Heating

Taking these in order, we want to minimise reflection as it represents wasted energy which is not used in our heating process. Transmission is useful as we can see in the diagram. It allows some radiation through the material gives us a penetrating effect, very distinct from conduction and convection. We'll come back to this, but in certain circumstances, such as heating carbon fibre layups, this can be hugely advantageous and gives us the capability to minimise thermal gradients across parts during heating.

We said that IR is a form of energy which only gets converted back to heat when it is incident and is absorbed by a surface. The measurable thermal effect of the energy is dependent on many factors such as intensity; however the most influential is the absorptivity of the surface.

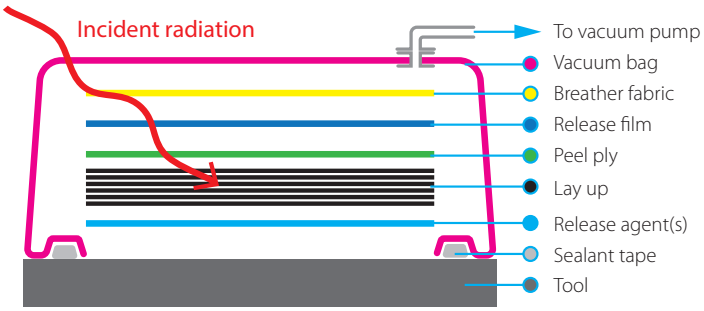
This is a material specific property which varies with wavelength and temperature. Unfortunately, traditional IR spectra use much longer wavelengths which are not thermally active (i.e. <10µm) and so we can't use these to predict thermal IR absorption. The best way to



define this is through empirical research via test instruments such as the Herschel, developed and pioneered by Ceramicx and now in daily usage at the company.

Of course, like any energy process, we cannot create or destroy energy, so the sum of the reflected, transmitted and absorbed radiation must be equal to the energy of the incident radiation.

IR Properties



Infrared can be targeted to specific materials. This diagram shows specific targeting of carbon fibre and penetration of the bagging materials using the transmission property we mentioned earlier. The bag's integrity is vital to the part's quality; therefore a heater which emits radiation at a wavelength which is transmitted by the film is paramount. This selection and tuning of the wavelength is vital to infrared's performance. What we see is that by tuning the IR wavelength to the materials, we can not only control the surface temperature more precisely, but we can minimise the thermal gradient across the part.

In this example, we see how changing the IR emitter's wavelength can influence the resultant temperatures not only of the top surface, but the underlying layers, by virtue of the properties we spoke about earlier. The goal of this experiment was to elucidate which heater had the best heating to penetration ratio. A variety of methods can be used to vary the emission spectrum of the heater, however, once this is optimised, we can look at methods to ensure that processing occurs within the processing windows specified by the material manufacturer.

Targeting & Control

Earlier, we said that IR has the same properties as light and can therefore be reflected; indeed it can be focussed to increase its intensity as well. We can therefore use these properties of Infrared to target specific portions of a part, for example, locations which are reinforced or thicker than others.

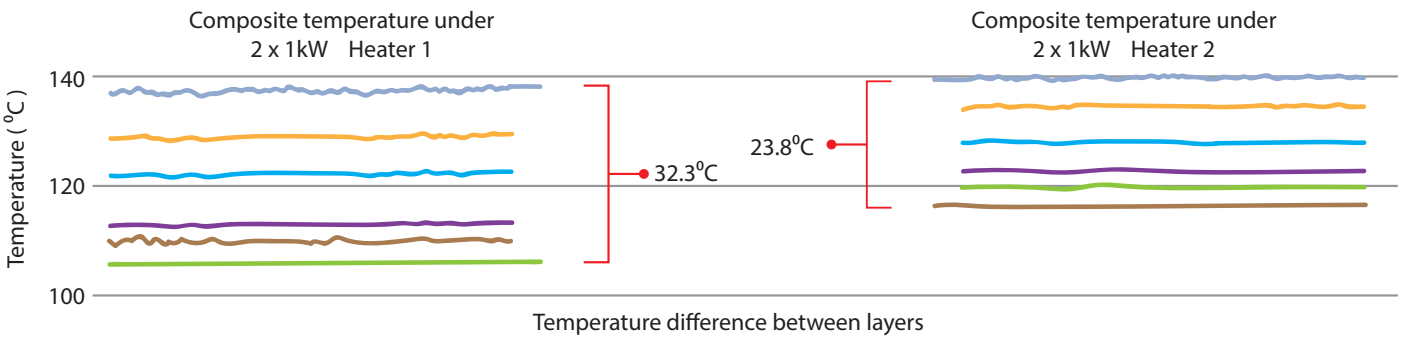
Doing this enables users to ensure even heating and optimal cycle time. Material reflectivity, like absorption, varies as a function of temperature and wavelength. To optimise the targeting of certain portions, Ceramicx uses materials specifically optimised for this purpose which can withstand and maintain high temperatures and reflectivity, respectively. Giving radiation this directional quality can dramatically change the realised heating effects by changing the area over which the energy is delivered.

The third vital point to infrared's use is its control. Material temperature is a direct product of the absorbed energy, therefore switching heaters gives fast response on material temperature. Depending on the heater employed, there can be very little thermal inertia, so we see very fast material heating response times which contrasts with large volumes of air. IR emitters can be controlled to great effect using a variety of methods, be these open-loop, thermocouples or pyrometers in conjunction with a PLC or other suitable process controller.

Open-loop control, for example, is an excellent cost-effective solution for batch systems where little or no change in material occurs. It is also extremely functional in other static systems where dynamic adjustments are not required. Processes requiring dynamic and constant heater adjustment or where materials are frequently changed will likely require closed-loop control in which either material or heater temperature is fed back to the controller which makes power adjustments. In either case, element control can be individual or in zones slaved from a single feedback device setting the percentage output of each channel to realise the desired heating effect.

Naturally there is some air heating in enclosed environments primarily due to back convection from the material to the surrounding air. This can be harnessed to aid the efficiency of the process by removing excess energy from 'hot spots' and transferring it to cold spots using classic convection. Therefore we can see the advantage of IR which allows us to harness all three modes of heat transfer rather than limit ourselves to a brace of these.

Ceramicx has built a number of carbon composite heating systems for out-of-autoclave and thermoplastic composites examples of which are shown here. Of specific interest here is the thermoplastic system which allows for carbon fibre heating up to and beyond 450°C.



Alan Dunne, Senior Development Advisor, Enterprise Ireland. Jerry O'Sullivan, Managing Director, CHOM Building Contractors. Frank Wilson, Managing Director Ceramicx Ltd. Gráinne Wilson, Director Ceramicx Ltd. Denis Naughten, T.D. Minister of Communications, Climate Action and Environment. Dr Cáthál Wilson, Ceramicx Ltd. Michael Collins T.D. (Ind) Cork South West. Danny Collins, Cork County Councillor for West Cork

The Connectivity - with the Ministry

By Frank Wilson

It was a delight for Ceramicx to meet and host Ireland's Minister for Communications, Denis Naughten, at our factory, just prior to completion, and to tour him through our construction and expansion work in progress at the company.

Earlier that day the Minister's had taken him to nearby Crookhaven, there to unveil a statue of Guglielmo Marconi, who pioneered long distance radio transmission from his house and workshop there at the turn of the century.

Marconi's achievement there reminds me that technology revolutions are now possible from anywhere in the world – perhaps even more so in green field locations that are unencumbered by the industrial legacies of the past century.

Ireland's recent GDP figures invites proof: We were able to show Minister Naughten that Ceramicx Ltd is playing a very full part in Ireland's ever-increasing manufacturing performance which – per-capita – is now among the leading industrialized countries in Europe.

I would also have to say that the Cork and West Cork areas certainly provide fertile soil for the boldness of purpose and vision that needs to accompany 21st Century manufacturing. Ceramicx, for example, is now established here for over 25 years. We now export over 95% of our world-class and hi-tech Infrared (IR) heaters and components to 65 countries worldwide. Our blue chip clients include Corning Glass, General Motors, Aston Martin, Bombardier, Corvette, Nissan, Linpac and many more besides.

Ceramicx business has grown at an average rate of 15% per year for the last 8 years. Growth of 22% was posted in 2016 and growth of 26% has been achieved in the first 6 months of 2017.

I assured the Minister that these achievements can never stand still and, from time to time, also need the support and assurance of Government in the form of forward-thinking and connected infrastructure.

For example, our new manufacturing halls, machine tool shops, robotics stations, Skype comms facilities; SAP facilities and CAD CAM facilities – all of these need the assistance of fast broadband in order for use to make the most of our Big Data based projects and our communications with worldwide markets.

Fast broadband allows Ceramicx to:

- seamlessly link our new manufacturing systems with sales and marketing throughout the world – in particular, increasing volumes in China, India USA, Middle East and Europe

- incorporate Cloud and Big Data and SAP elements into all matters of product design, manufacturing and quality assurance

- continue to lead the Infrared Heating industry in matters of Research and Development and Industry 4.0

- increase business throughout, orders, sales and jobs thereby

Communications Minister Naughten's visit to Ceramicx was therefore very timely. We were able to assure him that his portfolio is of the utmost importance to Irish manufacturing and to Ceramicx. We look forward to including an installation programme of high speed broadband into all our other upgrades and improvements.

Were he alive today I am sure that Guglielmo Marconi would approve.

Ceramicx celebrates a new Era

By Frank Wilson

December 18th ushered in a very special and landmark day at Ceramicx: We held our first Christmas party for local suppliers, neighbours and business people from the West Cork area. We hosted and toured many invited guests through our brand new facilities.

Needless to say the whole day gave us enormous pleasure. Our guests and staff too – judging by the smiles on faces and the engaged nature of the conversations.

Many activities in the past quarter of a century were responsible for bringing Ceramicx to this day; building a business; investing in world-class innovation and creating and sustaining a world-class brand.

The beginning of the year showed us that the time had come to match these business achievements with improvements and expansions to our physical surroundings. Work began in earnest in Spring 2017 and finished on time and within budget later this year.

I am not often given to superlatives but I must say that the results have far exceeded my hopes and expectations. At Ceramicx, world class production is now housed in a world class built environment, full details of which will be regularly outlined on our website and in our forthcoming issues of HeatWorks magazine.

It is entirely appropriate here to pay tribute to all the efforts of our staff, in particular to the expertise and guidance of my wife and co-director Gráinne Wilson, who played an indispensable part in the design and aesthetics of our wonderful new building and working environment.

Tribute here must also be paid to the nurturing role of our community here in West Cork and, indeed, further afield in respect of Ireland's ever-growing manufacturing base, which – per capita now leads Europe in many areas.

Ceramicx shares that 'can do' spirit that has enabled here us to export over 95% of our production to 65 countries worldwide; to exhibit through the year on four continents and to develop world-leading IR heat technology that is helping change the world's future.

None of this would be possible without our commercial achievement: Ceramicx business has grown at an average rate of 15% per year for the last 8 years. Growth of 22% was posted in 2016 and growth of 26% has been achieved in the first 6 months of 2017.

So, in the final analysis, let me reserve most of my thanks today for our clients and customers throughout the world along with our valued and loyal staff. Without your interest and innovation, none of this would be happening.

I therefore raise a glass in our new setting to you - and to our future business together.


Alan Draper

IT and Computing on the doorstep

Every successful business today needs to be computing and software savvy like never before and Ceramicx is no exception. Enter local talent Alan Draper, who is now putting his IT skill sets to good use at the company – and also studying for a BSc in software development at Cork Institute of Technology.

Alan is born and bred in local town Durrus, and attended secondary school in Bantry before attending college to study computer games development.

A spell at Ceramicx then followed; working in engineering on the sheet metal forming machines and focusing mainly on the comfort heating ranges at the company. 'A team of three of us kept the machines going all night. I worked the night shift in my initial period with the company'.

Assembly line work followed on from there. 'I learned the ins and outs of making all our engineering products, before moving onto the ceramic-based part of the plant. Here I spent time working with the kiln, and also doing some take-out of ceramic elements before then working on the casting process.

Another stint in engineering followed, and 'I took up the role of operating all of the sheet metal machines. My previous experience really helped me because I knew the products that needed to be made. I spent a lot of time on the engineering floor until such time as I learned of the Ceramicx intention to move forward with implementing an ERP system (Enterprise Resource Planning) and I decided to put my name forward to help with the project. From then on, I trained up a fellow member of staff to replace me on the floor and moved into the IT side of the business.'

I took over the production side of the implementation due to my knowledge of the products and now along with helping with marketing, the website administration and other IT jobs.

I am also now involved in researching the purchasing of new machines and in helping plan out parts of the production schedule that draw upon my increasing knowledge of our SAP system.'

The new role at Ceramicx also triggered a move to further academic study for Alan. 'I decided to return to education to further my understanding of the information technologies, so I went looking into courses, I eventually signed up for a course in computer science by night with a flexible schedule. I attend college at CIT three nights a week. With Ceramicx help and support, it is progressing very well.'


Daniel Aigl

Daniel in the lion's den

Ceramicx has doors open on a great many fronts for the right approach and the right mind set at the right time – deliberately mixing background and skillsets for maximum creative effect.

One such is Daniel Aigl, a master engineer (MEng) and seasoned pharmaceutical industry practitioner, who hails from the prestigious university town of Heidelberg, Germany. In his own words Daniel describes his Ceramicx experiences to date.

My hometown in Germany is in the middle between Heidelberg and Mannheim, two very different towns. Heidelberg being the picturesque gem and Mannheim the multicultural industrial melting pot.

The idea of our 10-month stay in Ireland is to give ourselves and our children the chance to widen our horizons. Any German parent is enabled to go on parental leave for up to three years and get an equal-pay job back on their return. Ireland was our choice of country and West Cork was simply the icing on the cake. We arrived just two days before the start of the school year.

The kids look great in their school uniforms (which we don't have in Germany) and the school atmosphere is very positive.

After a period of settling down I was already in the market for some kind of technical project work. Ceramicx and Frank Wilson came along; I explained my background and we found a project I could work on.

Company life at Ceramicx is very focused on fulfilling the customers' projects, so the lads here do not have too much time to work on internal projects. For me, it is a privilege to work on the automation of


Rob Davies

From Essex machining to West Cork tooling

The West Cork location of Ceramicx is increasingly attracting engineers and technicians from very diverse disciplines and worldwide locations.

The West Cork location of Ceramicx is increasingly attracting engineers and technicians from very diverse disciplines and worldwide locations.

Prior to Ceramicx, for example, Rob Davies worked as a press machinist/tool setter for a company that specialised in the manufacture of hinges.

Brentwood, Essex, UK was the location of the company and Rob recalls that 'this is where I learned most of my skills; working very closely with the tool making operations there; producing tight-tolerance parts from technical drawings and also adapting all manner of tools in order to increase production.'

A move to West Cork and a natural fit and working operation with Dave O'Driscoll in the Ceramicx tool shop has now produced a variety of win-win outcomes all round. Says Rob: 'the knowledge I gained from my previous employment and industry has enabled me to work closely with Dave in Ceramicx in order to increase production and to also have an input into the way some of the Ceramicx tools are adapted.'

The work of both men has lately focused on streamlining process flow in the Ceramicx tool room; reducing production steps where possible, reworking a range of tools and looking to boost volume through certain techniques.

Rob says that 'myself and Dave have already adapted tools to go from a single stroke operation to a fully automated system, whereby we have quadrupled the number parts made and done away with the need for an operator to sit at the machine pressing the foot pedal.

I like to think I have a keen eye and the ability to see things from a different perspective and to be able to change the production processes to become more efficient.'

On the slate for this year is an ambition for both men to develop all tooling 'so we can remove the secondary production processes. And further to that, our sights are now set on the removal of much manual labour involved in IR oven and platen assembly. My current aim,' says Rob, 'is to streamline manual processes and try to remove the babysitting hours that go into these operations.'

Rob's family move to West Cork was facilitated by a long period of acclimatisation via eight years of summer holidays in the area. 'The people are very welcoming, there are wonderful views almost everywhere you go and it offers the lifestyle you want for your children growing up. The education system is great and the medical services are brilliant too.'

Rob adds that 'I have found Ceramicx to be a very easy company to slot into. All the staff are very easy to work with and happy to help if you need some advice.'

the internal production. Everyone is very supportive and willingly sharing their knowledge to make life easier for me.

Indeed, working at Ceramicx is a completely new experience for me, especially when comparing it to the international company I am employed with in Germany.

Decisions here can be taken on the spot not only due to the size of the company, but also there is the DNA of simply getting things done.

Cross functional teams can spring up anytime, anywhere for this purpose; to gather new ideas or to discuss a potential solution. Discussions are held with everyone who can make a valuable contribution, whether management or shop floor.

The project I am working on is built around our SFEH ceramic heating element. The output of the production is now reaching volumes that require automation for future growth. I am therefore investigating potential production methods that would take the lid of expansion in this area.

The first step for us is to thoroughly understand all the factors in the current process. And so I am in contact with ceramic machine builders across Europe in order to look for potential partners.

If we succeed in locating one, this will then be followed by the feasibility phase, during which prototypes will be built. And if we find a machine concept to be promising, we will then start the development of a production process based upon that.

Prior to Ceramicx I have worked in the pharmaceutical/medtech industry and was always focused as an engineer on developing the process and machinery for a new product, bringing the machines into operation and ramping up the production volumes. In that sense my current opportunity at Ceramicx is a logical extension of that work.

However many other factors – work, home and schooling - will make it hard to leave when the time is up. Our job here for now is to savour all aspects of our experience and enjoy it while we can.

Ceramicx invests in SAP

Not only does Ceramicx have a brand new factory and facilities to its name, 2018 sees the bedding down of the company's SAP software and database.

We talked to Yvonne Shanahan who has been leading its introduction.

Yvonne – welcome to HeatWorks magazine. First of all – and for the unitiated - what is SAP? We see the advertising everywhere – airport lounges especially – but very little detailed information is provided.

SAP was founded in Germany in 1972 and stands for "Systems Applications Products". It is enterprise resource planning software and is used extensively throughout the world by some of the largest organisations.

Essentially SAP is software that allows a business to link together the financial information with the production side of a business, giving users access to real time information from just one source.

And how is SAP suited to Ceramicx at the present time?

The management team at Ceramicx opted to implement SAP Business One for Hana after looking at a number of other ERP software solutions. Milner Browne was engaged as the implementation and support partner. SAP is considered the "gold standard" in these matters and this therefore represents a very good fit with Ceramicx philosophy of using the very best technology available.

SAP is also a scalable solution that will grow as Ceramicx grows with it. An increased volume of data will never impede any search or report generation functions. This could indeed be an issue with other software. We also opted for a cloud-based solution. This allows continual access to our data and when staff are off site.

What functions will SAP cover at Ceramicx - i.e. purchasing, marketing, finance(accounts); utility costs etc etc

SAP comes with a standard suit of modules which can be activated as the business requires and at a rate the business can cope with. We eventually chose what would be considered quite an accelerated implantation.

Our aim was to extract as much of our data from our many databases - utilising SAP's functionality as quickly as possible.

Cermamicx modules will include:

Financial, CRM (Customer, supplier and sales opportunities (leads); Sales – Sales quote to invoice; Purchasing – Purchase request to invoice; Inventory- Stock management; Production – Bill of materials to production orders (works orders); Resources – Machine, labour and other costs; Banking; MRP and Projects modules.

And how does SAP link into some of the other current systems and media at Ceramicx?

SAP is currently integrated with all the Microsoft office applications, so we can email documents, export reports to excel and other uses. In the next phase of the implementation we plan to link SAP to the Ceramicx phone system, use handheld scanners in the warehouses, integrate with Solidworks (our CAD software) and also the Ceramicx on-line shop.

And how might Ceramicx customers start noticing a difference Yvonne?

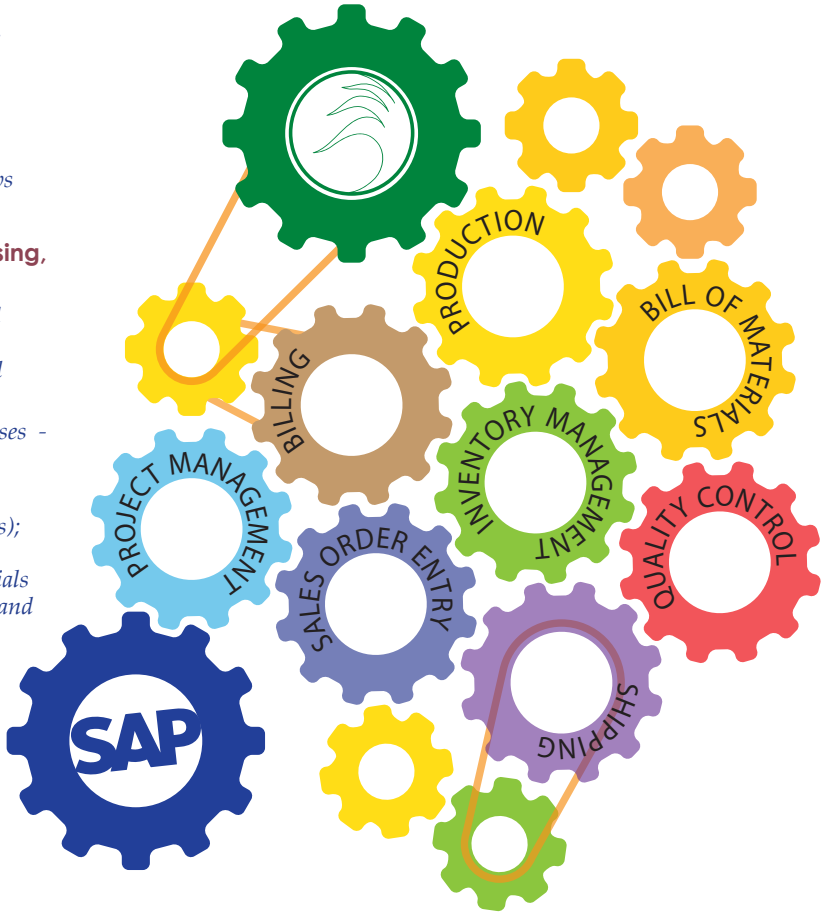
Right now and in the coming months as we allow this phase of the implementation bed down, I would hope that our customers would not notice any difference at all!

We have worked very hard to ensure that the transition from our old software to SAP has been as seamless as possible. It will be during the 2nd phase of implementation that we would be able to enhance the overall Ceramicx experience and service to our customers. For example, the Ceramicx on line shop will be first in line for this work, faster turnaround times from product design to delivery and better tracking of all our customer communications.

To sum it up in a few words?

It has been a steep learning curve for all of us here at Ceramicx - leaning totally new software, rolling out some changed and new processes as a result of the SAP implementation.

However, we can already see many benefits to the business. This is very gratifying and helps to validate the huge effort put in by everyone.



Ceramicx white paper

Free metal know-how

Ceramicx is well known for its kiln capacities; its work in clay formulations and for the variety and innovation in ceramic elements that inspired the company name.

Recent years, however, have seen the company issue a plethora of empirical know-how concerning the performance of metals under heat and stress.

'The reason these issues of metallurgy are so important in heat work,' says Frank Wilson, Ceramicx founder and managing director, is that, over the lifetime of a product, component housings and reflector play just as important a part as the elements themselves.'

Not only do these metal testing activities help Ceramicx's ongoing R&D programmes they also help Ceramicx customers to trouble shoot heat work issues and allow Ceramicx to scrutinize the performance of competitor products.

The August 2017 White Paper, for example, sets out to investigate the thermal performance of aluminised steel: Ceramicx vs. a competitor. The analysis concludes that 'at elevated temperatures, the durability of the aluminised steel material used by Ceramicx is superior to that used by a competitor. The influence of the surface polishing of the Ceramicx material cannot be discounted.

However, quite how this influences the thermal durability is known.'

Frank Wilson says that 'I never tire of noting that "to measure is to manage". At Ceramicx we are not inclined to rest on our assumptions about performance but rather put our energy into defined programmes of testing and measuring it. In this way, not only do we task ourselves with product excellence, we set the same standard for our suppliers.'

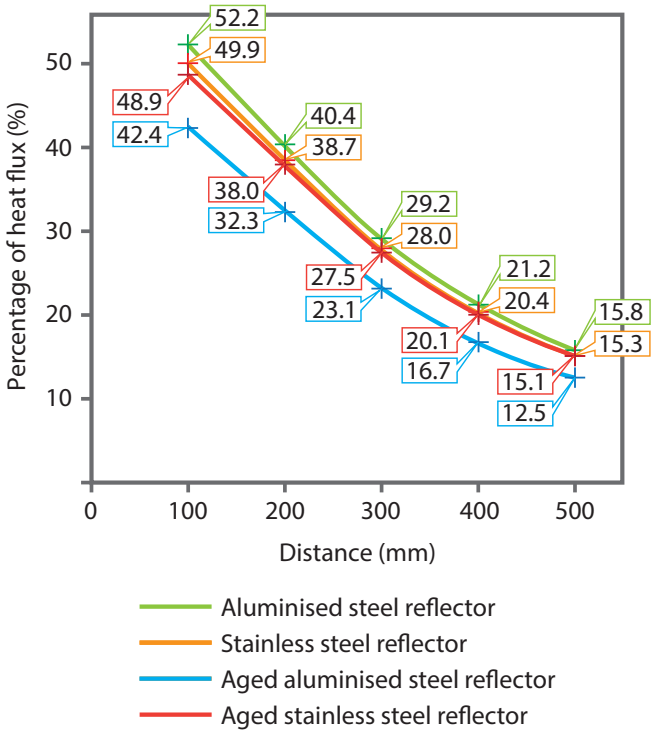
Sometimes the Ceramicx researchers will follow a thread of enquiry in order to satisfy a general principle of IR knowledge; one which will help further develop Ceramicx IR heating products.

The August 17 research, for example, was followed up in December 17 with further testing work. The Ceramicx researchers wanted to know how, and at what point, the polished surfaces made a difference to the heater performance. The August 17 work (in relation to a competitor) had shown that the use of a polished aluminised steel reflector increases the percentage of radiative heat flux emitted towards the heating target when compared with stainless steel.

The December research was able to take a different scope and examine the effect of exposing Ceramicx aluminised steel and stainless steel reflectors to high temperatures on the reflectivity of the material.

It was found that for lower temperature applications, where oxidation of the aluminium is unlikely to occur, aluminised steel is shown to be a better performing material.

Percentage of heat flux as a function of distance from element



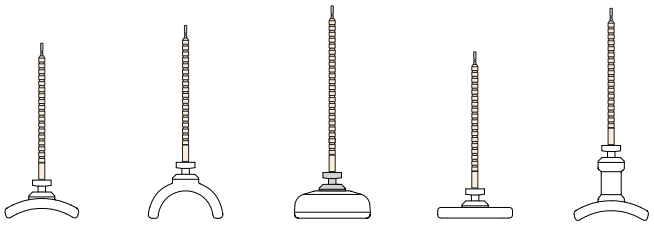
For higher temperature applications, where aluminium oxidation is likely to occur, stainless steel was found to be a better choice as the material leads to a greater proportion of radiative energy that is directed towards the target material.

'These findings are extremely important to Ceramicx,' says Wilson. 'They enable us to match our IR heating products and components to the intended application – high or low temperature. Our commercial marketplace most definitely requires "horses for courses" and, thanks to our research work, we are able to supply.'

Ceramicx White Papers are available free at www.ceramicx.

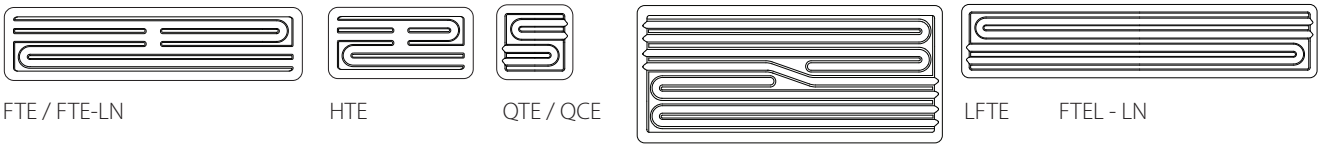
Product Guide

The full product guide can be viewed on line or downloaded from www.ceramicx.com/catalogues1/
or if you would prefer a hard copy, email a request with your details to david.hayward@ceramicx.com.



CERAMIC TROUGH ELEMENTS

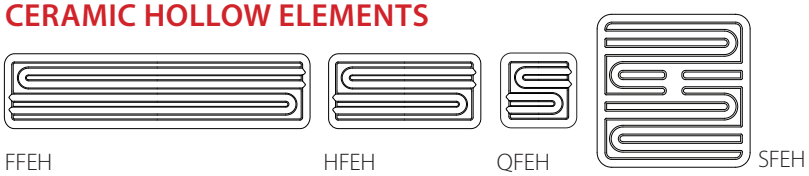
www.ceramicx.com/trough-elements/



FTE Full Trough Element	245 x 60 mm	150W 250W 300W 400W 500W 650W 750W 1000W
HTE Half Trough Element	122 x 60 mm	125W 150W 200W 250W 325W 400W 500W
QTE Quarter Trough Element	60 x 60 mm	125W 250W
QCE Quarter Curved Element	60 x 60 mm	150W 250W
LFTE Large Full Trough Element	245 x 110 mm	1000W 1500W
FTE-LN Full Trough Element -Long Neck	245 x 60 mm	250W 400W 500W 650W
FTEL-LN Full Trough Element Long - Long Neck	285 x 60 mm	1000W

CERAMIC HOLLOW ELEMENTS

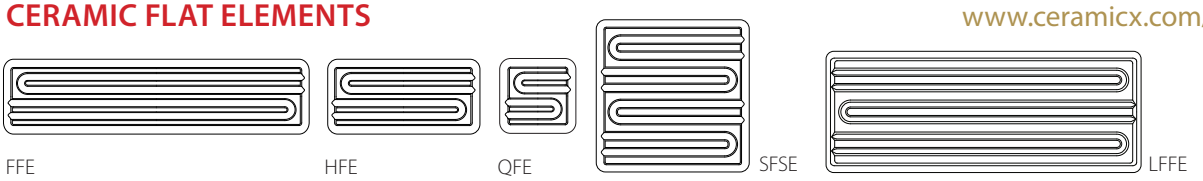
www.ceramicx.com/hollow-elements/



FFEH Full Flat Element Hollow	245 x 60 mm	250W 400W 500W 600W 800W
HFEH Half Flat Element Hollow	122 x 60 mm	125W 200W 250W 300W 400W
QFEH Quarter Flat Element Hollow	60 x 60 mm	125W 200W
SFEH Square Flat Element Hollow	122 x 122 mm	250W 400W 500W 600W 800W

CERAMIC FLAT ELEMENTS

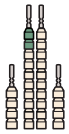
www.ceramicx.com/flat-elements/



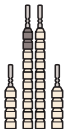
FFE Full Flat Element	245 x 60 mm	150W 250W 300W 400W 500W 650W 750W 1000W
HFE Half Flat Element	122 x 60 mm	125W 150W 200W 250W 325W 500W
QFE Quarter Flat Element	60 x 60 mm	125W 250W
SFSE Square Flat Solid Element	122 x 122 mm	150W 250W 300W 400W 500W 650W 750W
LFFE Large Full Flat Element	245 x 95 mm	150W 750W 1400W

THERMOCOUPLES

www.ceramicx.com/thermocouples/



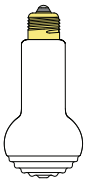
Thermocouple Type K
+ Nickel Chromium
- Nickel Aluminium

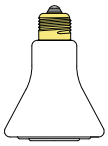


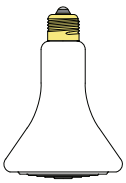
Thermocouple Type J
+ Iron
- Copper Nickel

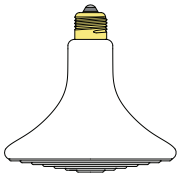
EDISON SCREW ELEMENTS

www.ceramicx.com/ceramic-bulbs/

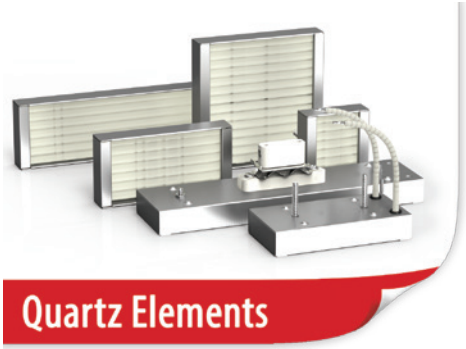

ESEB

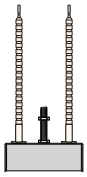

ESES

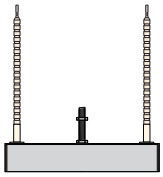

ESER


ESEXL

ESEB Edison Screw Element Ball	Ø65 x 140 mm	60W 100W
ESES Edison Screw Element Small	Ø80 x 110 mm	100W
ESER Edison Screw Element Regular	Ø95 x 140 mm	150W 250W
ESEXL Edison Screw Element Extra Large	Ø140 x 137 mm	400W



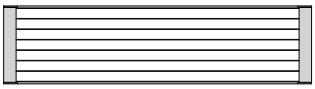

Standard

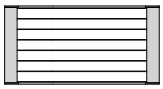

Square


Pillar

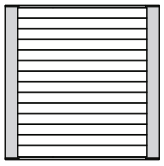
STANDARD QUARTZ ELEMENTS

www.ceramicx.com/standard-quartz-element/


FQE


HQE

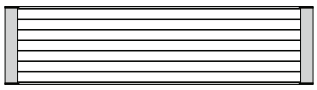

QQE

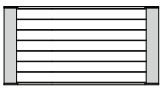

SQE

FQE Full Quartz Elements	247 x 62.5 mm	150W 250W 400W 500W 650W 750W 1,000W
HQE Half Quartz Element	124 x 62.5 mm	150W 250W 400W 500W
QQE Quarter Quartz Elements	62.5 x 62.5 mm	150W 250W
SQE Square Quartz Element	124 x 124 mm	150W 650W 1,000W

PILLARED QUARTZ ELEMENTS

www.ceramicx.com/pillared-quartz-elements/

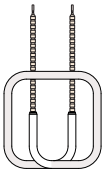

PFQE

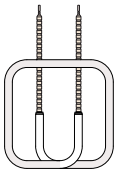

PHQE

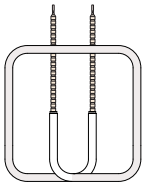
PFQE Pillared Full Quartz Elements	247 x 62.5 mm	150W 250W 400W 500W 650W 750W 1,000W
PHQE Pillared Half Quartz Element	124 x 62.5 mm	150W 250W 400W 500W

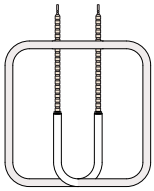
SQUARE QUARTZ TUBE ELEMENTS

www.ceramicx.com/quartz-square-tube-elements/

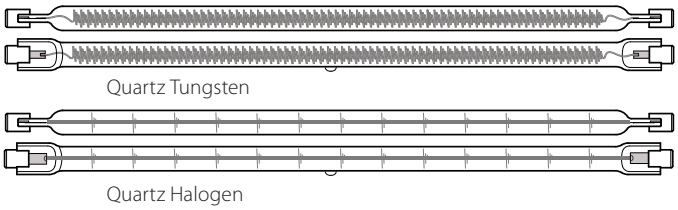

STQH 100


STQH 112


STQH 140


STQH 150

STQH100 Square Tube Quartz Heater	100 x 100 mm	150W - 400W
STQH112 Square Tube Quartz Heater	112 x 112 mm	150W - 400W
STQH140 Square Tube Quartz Heater	140 x 140 mm	150W - 650W
STQH150 Square Tube Quartz Heater	150 x 150 mm	150W - 650W



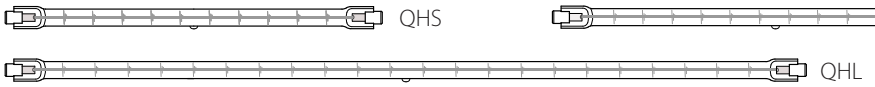
QUARTZ TUNGSTEN TUBES

www.ceramicx.com/fast-medium-wave-emitters1/

QTS Quartz Tungsten Short	Ø10 x 244 mm	750W
QTM Quartz Tungsten Medium	Ø10 x 277 mm	1000W
QTL Quartz Tungsten Long	Ø10 x 473 mm	1500W 1750W 2000W

QUARTZ HALOGEN TUBES

www.ceramicx.com/short-wave-emitters/

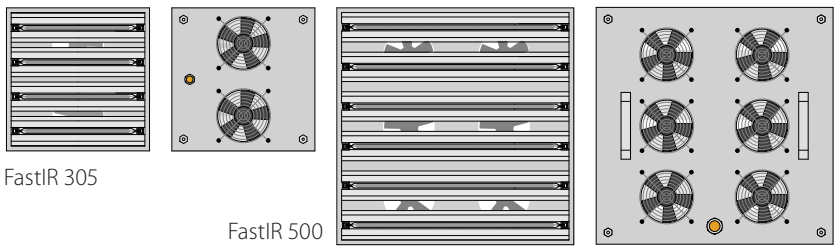


QHS Quartz Halogen Short	Ø10 x 244 mm	750W
QHM Quartz Halogen Medium	Ø10 x 277 mm	1000W
QHL Quartz Halogen Long	Ø10 x 473 mm	1500W 1750W 2000W

SPECIAL TUBE ORDERS

www.ceramicx.com/special-tube-orders/

Ceramicx can supply other types of Halogen/ Tungsten elements, of varying design, dimensions, length, coatings, terminations and electrical rating.



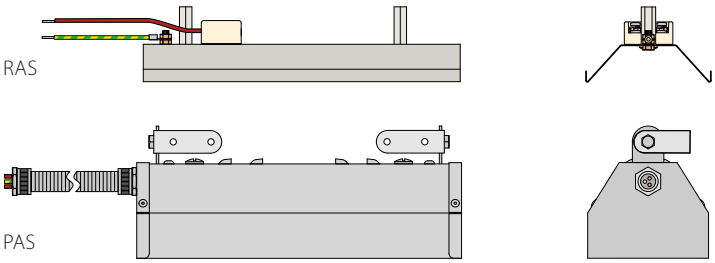
FAST IR

www.ceramicx.com/fastir-systems/

FastIR 305 305 x 305 x 150 mm **4 Tube** 4kW **5 Tube** 5kW
Suitable for 1000W Quartz Tungsten/Halogen Heaters QTM/QTH *(tubes sold separately)*

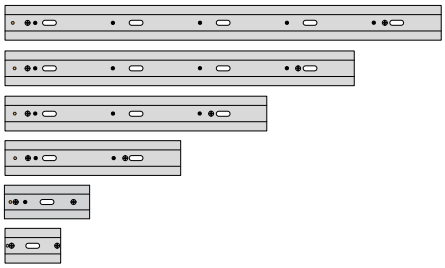
FastIR 500 500 x 500 x 150 mm **6 Tube** 12kW **7 Tube** 14kW
Suitable for 1000W Quartz Tungsten/Halogen Heaters QTL/QTL *(tubes sold separately)*

Reflectors and Projectors



REFLECTORS

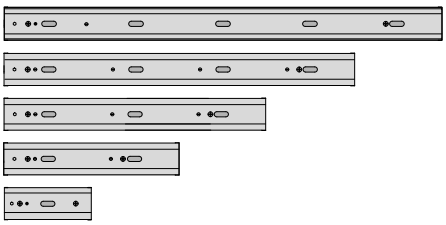
RAS 5	Reflector Aluminised Steel 5	1,254 x 100 mm
RAS 4	Reflector Aluminised Steel 4	1,004 x 100 mm
RAS 3	Reflector Aluminised Steel 3	754 x 100 mm
RAS 2	Reflector Aluminised Steel 2	504 x 100 mm
RAS 1	Reflector Aluminised Steel 1	254 x 100 mm
RAS 0.5	Reflector Aluminised Steel 0.5	160 x 100 mm



PROJECTORS

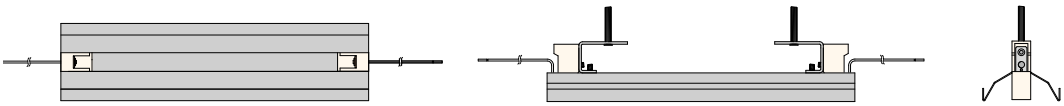
www.ceramicx.com/projectors/

PAS 5	Projector Aluminised Steel 5	1,258 x 94 mm
PAS 4	Projector Aluminised Steel 4	1,008 x 94 mm
PAS 3	Projector Aluminised Steel 3	758 x 94 mm
PAS 2	Projector Aluminised Steel 2	508 x 94 mm
PAS 1	Projector Aluminised Steel 1	258 x 94 mm

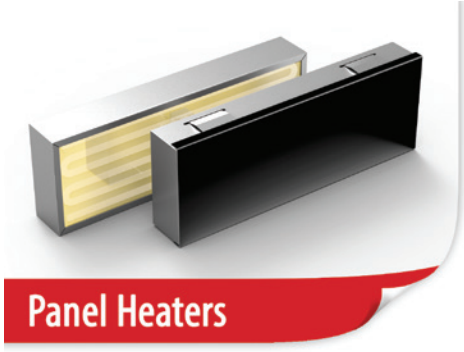


QUARTZ TUNGSTEN/HALOGEN REFLECTORS

www.ceramicx.com/reflectors/



QTSR	Quartz Tungsten/Halogen Short Reflector	250 x 62 mm	Suitable for QTS/QHS, *(Tubes supplied separately)*
QTMR	Quartz Tungsten/Halogen Medium Reflector	300 x 62 mm	Suitable for QTM/QHM, *(Tubes supplied separately)*
QTLR	Quartz Tungsten/Halogen Long Reflector	497 x 62 mm	Suitable for QTL/QHL, *(Tubes supplied separately)*



Panel Heaters

CUSTOM PANEL HEATERS.

Available with anodised aluminium or ceramic glass face.
Range of Wattages and Voltages.

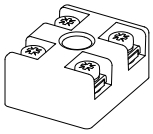
Anodised aluminium face - Good radiant efficiency, very robust, surface sheet can be easily cleaned or replaced if damaged by molten material.

Glass ceramic face - Very good radiant efficiency, high percentage transmission of radiant output in medium to short wave range, surface can be easily cleaned.

Electrical terminations Open 2P terminal block, Terminal block with cover, M6 or 1/4" threaded stud, Type K thermocouple with fixed high temperature socket and removable plug.

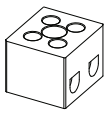
Accessories

2P Ceramic Terminal Block *



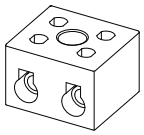
Stainless Steel
Fittings
40 x 32 x 20 mm

2P Mini Ceramic Terminal Block *



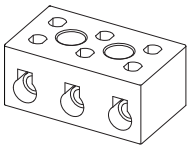
Nickel Galvanised Brass
Inserts, Zinc-plated Steel
Screws
21 x 18 x 15 mm

TB2 Ceramic Terminal Block *



(closed)
Plated Brass Inserts,
Nickel Galvanised
Screws
34 x 30 x 22 mm

TB3 Ceramic Terminal Block *



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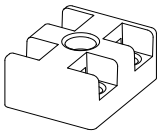
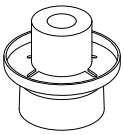
Plated Brass Inserts, Nickel
Galvanised Screws
51 x 30 x 22mm.

2P Ceramic Terminal Block *



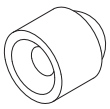
no Fittings
40 x 32 x 20 mm

Ceramic Grommet and Starlock Fastener Set



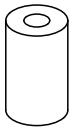
100 sets
per pack - used as an
Insulator in sheet metal
with 6mm hole
21 x 18 x 15 mm

Ceramic Beads



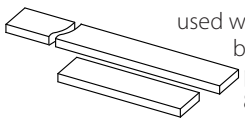
per kg
Loose or Strung
Ø5 x 6 mm
4.5 mm to shoulder

Ceramic Tubes



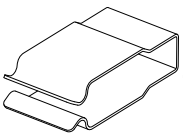
Ø5 x 11 mm

Stainless Steel Buzz Bar



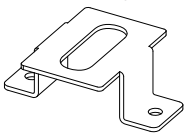
used with the ceramic terminal
block to produce a flexible
power distribution system
8 x 2 x 1000 mm

Flat Ceramic Base Holder



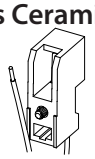
For Halogen/Tungsten
heaters fitted with flat
ceramic base

Mounting Bracket



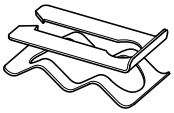
For ceramic elements
72 x 57 x 28 mm.
slot size 42 x 15 mm

R7s Ceramic Holder



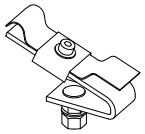
For Standard Quartz
Tungsten/Halogen
Tubes

Steel Wave and Spring set



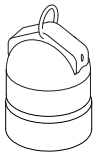
Used in the mounting
and installation of all
Ceramic elements and
the Pillared Quartz
elements

STQH Holder



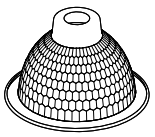
For all types of square
tube Quartz Heaters
(STQH)

E27 Edison Bulb Holder



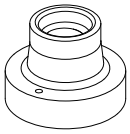
High temperature
porcelain holder used
with ceramic IR bulbs
Ø46 x 64 mm

Ceramic Bulb Reflector



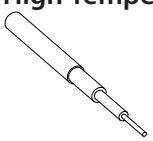
Highly polished
reflector for use
with ceramic IR bulbs
Ø220 x 110 mm

E27 Bulb Holder with Base



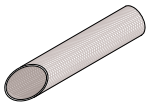
High temperature
porcelain holder used
with ceramic IR bulbs
Ø78 x 60 mm

High Temperature NPC Cable



Single Conductor Cable, Flexible Nickel Plated
Copper Core, Glass Fibre Insulation, Silicone
Coated Fibreglass Braid
0.75 mm, 1.5mm, 2.5mm, 4.0mm

Fibre glass braided sleeving



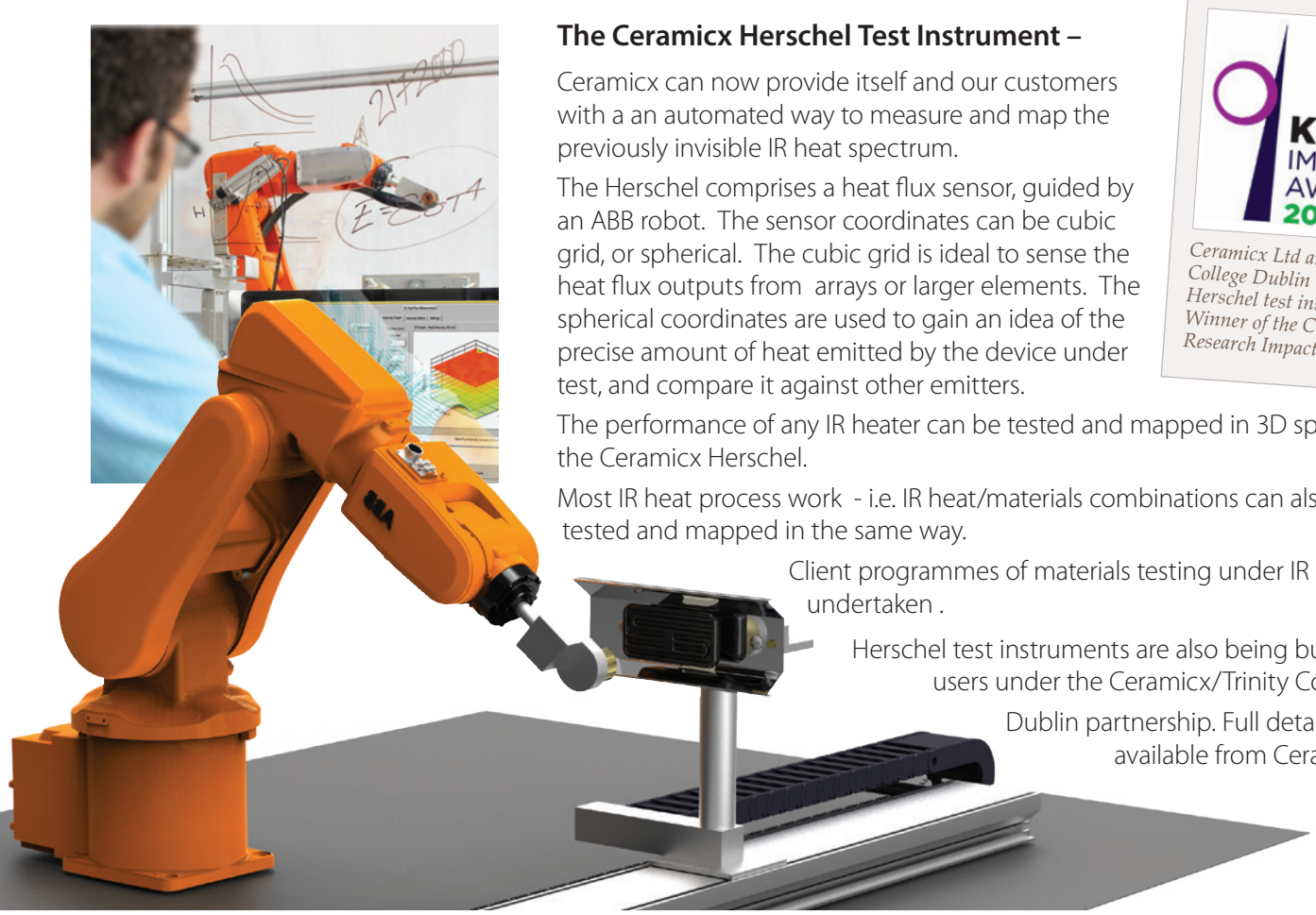
Fibre glass braided sleeving non-impregnated
continued working temperature -60ºC to + 450ºC
Nominal diameter
2mm, 4mm, 6mm

* Sold in units of 10

Research and Development

The Research and Development guide can be viewed on line, downloaded from www.ceramicx.com/catalogues1/ or if you would prefer a hard copy, email a request with your details to david.hayward@ceramicx.com.

CERAMICX RESEARCH AND DEVELOPMENT RESOURCES



The Ceramicx Herschel Test Instrument –

Ceramicx can now provide itself and our customers with a an automated way to measure and map the previously invisible IR heat spectrum.

The Herschel comprises a heat flux sensor, guided by an ABB robot. The sensor coordinates can be cubic grid, or spherical. The cubic grid is ideal to sense the heat flux outputs from arrays or larger elements. The spherical coordinates are used to gain an idea of the precise amount of heat emitted by the device under test, and compare it against other emitters.

Ceramicx Ltd and Trinity College Dublin - The Herschel test instrument. Winner of the Collaborative Research Impact Award

The performance of any IR heater can be tested and mapped in 3D space by the Ceramicx Herschel.

Most IR heat process work - i.e. IR heat/materials combinations can also be tested and mapped in the same way.

Client programmes of materials testing under IR heat are undertaken .

Herschel test instruments are also being built for users under the Ceramicx/Trinity College Dublin partnership. Full details from available from Ceramicx.

RESEARCH AND DEVELOPMENT OVENS

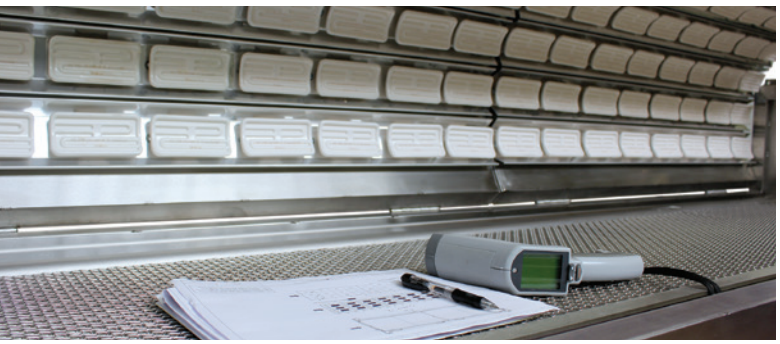
Left, 1.5kW bench top material test unit. Centre, 8kW bench top test unit supplied with 3 interchangeable infrared heating platens consisting of Ceramic, Quartz and Quartz Tungsten/Halogen Tubes.

The three pieces of lab test equipment shown are tools for determining the best emitter for a given material or job. All are available from Ceramicx, where the first two should be found in the arsenal of any serious user of infrared heat. The unit on the right was designed and manufactured to suit a customers specific requirement.

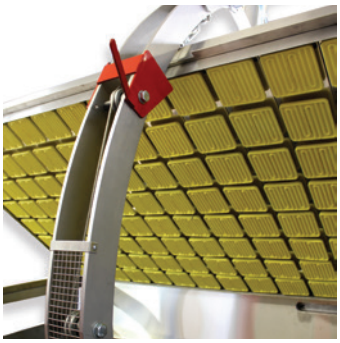
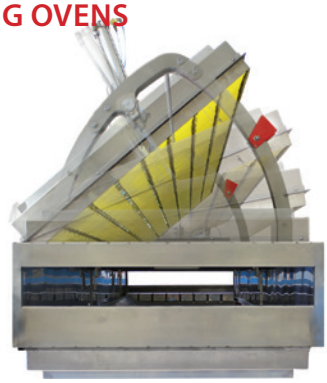
Infrared Solutions

The Ceramicx Industrial ovens and infrared solutions guide can be viewed on line ,downloaded from www.ceramicx.com/catalogues1/ or if you would prefer a hard copy, email a request with your details to david.hayward@ceramicx.com.

CONVEYOR OVENS

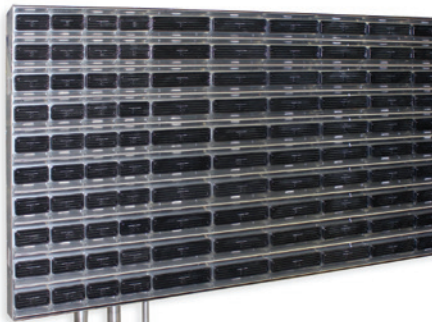


IN LINE THERMOFORMING OVENS

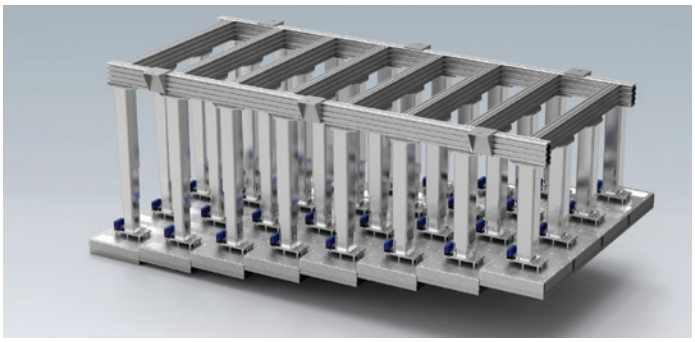




CUT SHEET THERMOFORMING OVENS

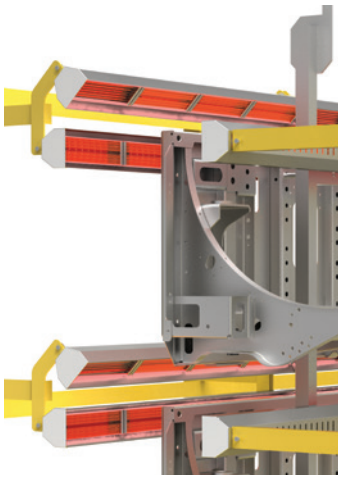




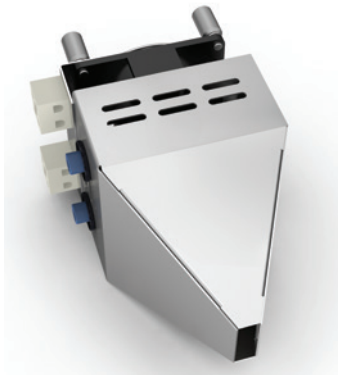
COMPOSITE THERMOFORMING OVENS



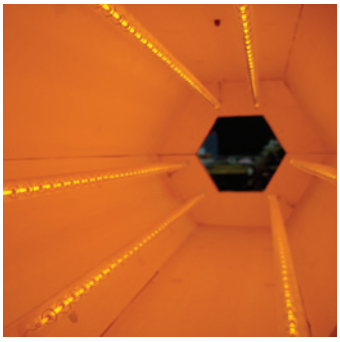

DRYING LINES AND CURING

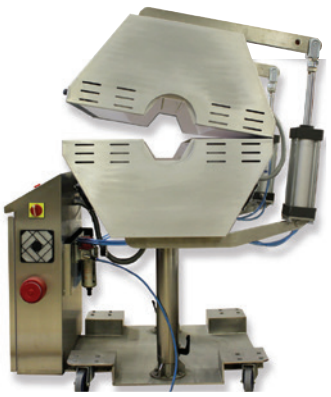


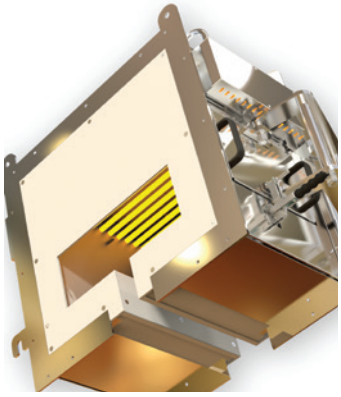
PROCESS WELDING AND ADHESIVES



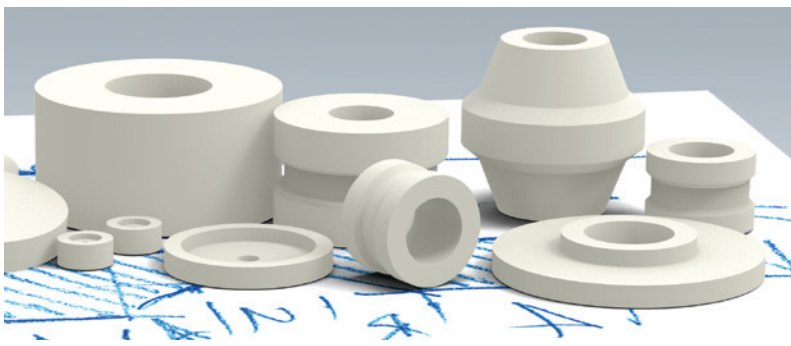
FURNACE OVENS







STEATITE AND ALUMINA DUST PRESSING



Talk to us today about your infrared heating needs.

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SFS offers a selection of tailored asset finance options for manufacturing businesses* - including Hire Purchase, Finance Lease and Operating Lease.

So if you are an established business with a strong business plan purchasing an infrared solution from Ceramicx, there is a financing solution for you.

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Product Guide

Research and Development Services

INDUSTRIAL OVENS AND

Infrared Solutions

The Ceramicx Guides.

Our 'Product Guide' outlines the complete range of Ceramicx infrared heating products. The guides companion 'Industrial Ovens and Infrared Solutions' looks at the application of these products in key industrial processes and market places and opportunities for infrared.

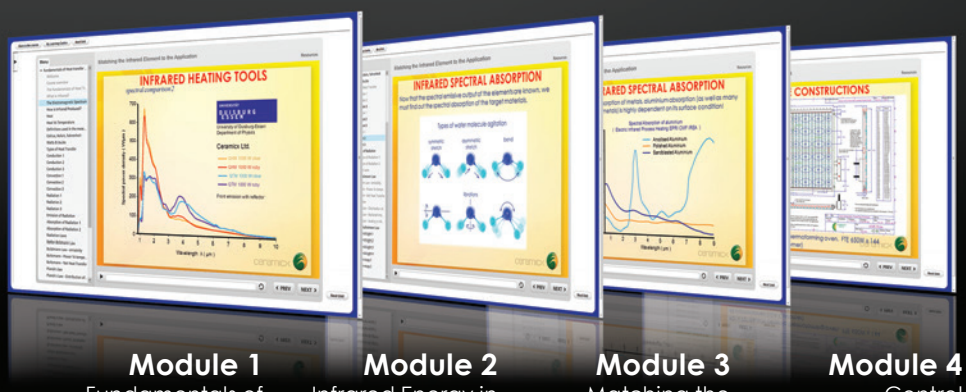
The Guides are intended for buyers and users of our infrared heating components and equipment.

The Guides will also be useful to stockists, distributors and agents around the world and to general readers who wish to gain an understanding of the world of infrared heating.

ONLINE INFRARED TR@INING COURSE

The course is divided into four modules that set out the basics of Infrared from an Industry perspective.

Each module will take 60-90 minutes to complete and finishes with a short online test. The modules can be taken online, or taught as part of a classroom course.



Module 1
Fundamentals of Heat Transfer and Infrared

Module 2
Infrared Energy in Process Heat

Module 3
Matching the Infrared Element to the Application

Module 4
Control of Infrared

The course is now available online at

www.ceramicx.com/applications-training/