

# Energy saving and energy efficiency

research lines



Instituto de  
Tecnología Cerámica



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The Instituto de Tecnología Cerámica (ITC) is a concerted mixed Institute, established by agreement between the Ceramic Industry Research Association (AICE) and Universitat Jaume I of Castellón, which originated in 1969 in response to the needs of companies from the Spanish ceramic cluster. During its more than 40-year history, ITC has articulated a successful university–business cooperation system that has borne its fruits, witness the significant development of the Spanish ceramic tile manufacturing industry.

**ITC is committed** to providing solid support for Spanish ceramic companies in the defence and enhancement of their strategic positioning in the current global context, principally through innovation-enabling research and development actions, but also through whatever activities might serve to foster the competitiveness and growth of the sector, always based on sustainability criteria and commitment to societal well-being.

**ITC's mission** is focused on spearheading technology innovation and design processes in the Spanish ceramic sector, anticipating market and consumer needs regarding the uses and applications of ceramic materials, through professionalised management of a qualified human team committed to excellence in the sector.

The competence attained through ITC's wide-ranging research activity enables ITC today to extend its field of action to other types of processes and materials. Particularly noteworthy have been ITC's actions in the field of energy efficiency and the minimisation of industry's environmental impact, as well as in the functionalisation of ceramic surfaces and the achievement of new technical performance and aesthetic features of products related to the habitat hyper-sector and to other industries, such as the high-tech tool, advanced ceramics, automotive, petrochemical sectors, etc.

# energy saving and energy efficiency

From the outset, ITC has conducted R&D activities and technology consulting on energy issues in the ceramic and related industries. In 2006, given the ceramic sector's increasing interest in energy saving and energy efficiency, a specific work group, the Energy Unit, devoted to this line of action was created.

The Energy Unit's activity focuses on technology consulting with regard to energy saving in the ceramics manufacturing process. In addition, it participates in the performance of R&D&I projects relating to the optimisation and diversification of energy consumption in the companies, as well as in custom training activities.

ITC, in general, and the Energy Unit, in particular, are aware of the importance of energy saving in industry, not only with a view to enhancing corporate competitiveness but also to bundling efforts in pursuit of common policies of sustainable development and social commitment.

OVER 1000 R&D PROJECTS DEVELOPED THROUGHOUT THE HISTORY OF ITC, AMOUNTING TO ALMOST 40 MILLION EUROS.

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## Services

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Some of the services conducted in the field of energy saving and energy efficiency have been as follows:

- › Performance of energy audits.
- › Studies of energy reuse in industrial facilities.
  - In an installation: kilns, dryers, spray dryers.
  - Between installations: heat recovery.
- › Optimisation of energy consumption in industrial kilns.
- › Custom training.

The manufacture of ceramic products such as tiles and structural ceramics (roof tiles and bricks) requires a great thermal energy input. A major issue for ceramics manufacturers is ascertaining which energy saving actions can be implemented in the manufacturing processes in order to optimise energy consumption and enhance overall energy efficiency.

In addition, the Energy Unit participates in R&D activities aimed at identifying alternatives to the use of natural gas, a fuel of fossil origin, in ceramics manufacturing in order, thus, to reduce the environmental impact of such industrial activities. Some of these actions have involved:

- › Simulation of heat transmission in kilns.
- › Analysis of the use of hydrogen in the ceramic tile manufacturing process.
- › Study of the application of existing CO<sub>2</sub> capture and storage techniques to the ceramic sector.
- › Application of solar energy to ceramics manufacturing processes.

At present, the Energy Unit participates in the Spanish Hydrogen and Fuel Cell Technology Platform (PTE-HPC), and in the Spanish Energy Efficiency Technology Platform (PTE-EE).

ITC IS A [REFERENCE PARTNER](#) IN DIFFERENT NATIONAL AND INTERNATIONAL NETWORKS AND TECHNOLOGY PLATFORMS.

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### Tests

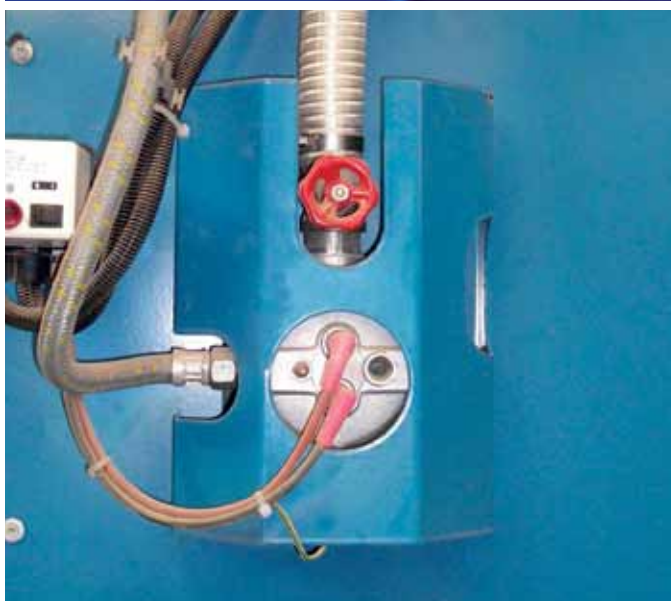
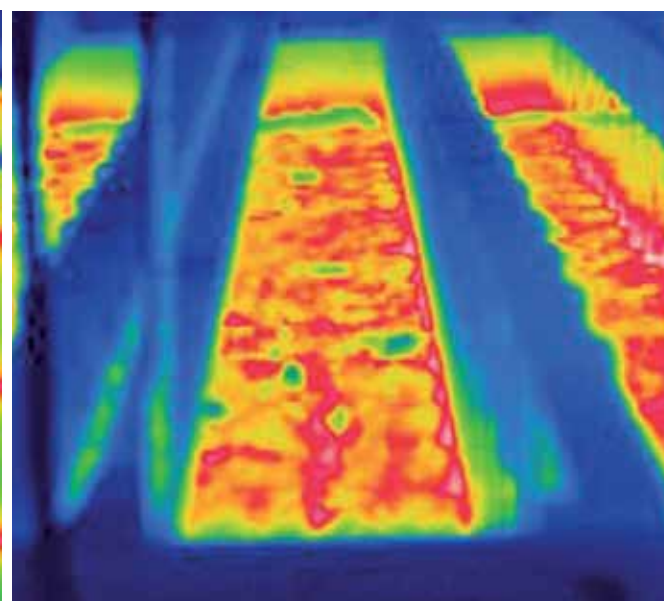
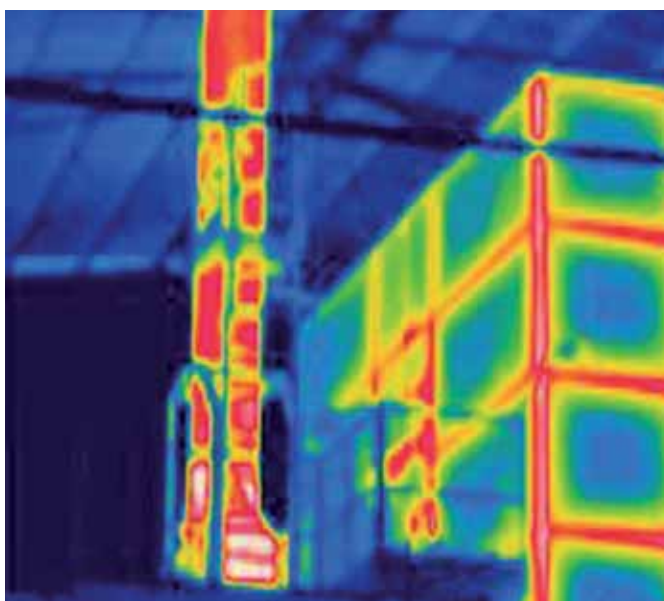
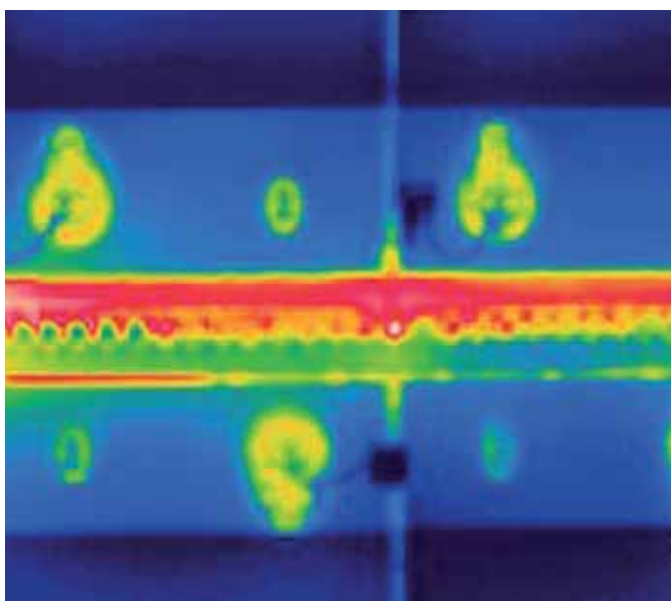
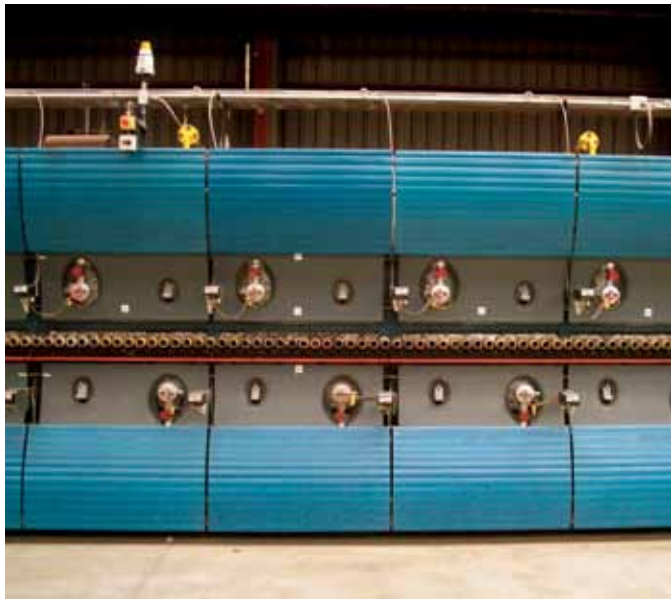
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- › Determination of the industrial firing cycle.
- › Determination of the static pressure curve inside an industrial kiln.
- › Determination of the oxygen partial pressure curve in an industrial kiln.
- › Measurement of transverse temperature gradients in single-deck roller kilns.
- › Analysis of kiln combustion systems.
- › Determination of the drying curve in industrial dryers.
- › Relative humidity measurements in industrial dryers.
- › Measurement of gas stream flow rates.
- › Energy balances of industrial facilities: spray dryers, dryers, and ceramic tile kilns, dryers and tunnel kilns for ceramic products.
- › Analysis of heat losses by thermographic images.

# available equipment

ITC sets at the disposal of companies a great technological infrastructure of technical competence endorsed by both ITC's high number of external accreditations and its highly qualified human and instrumental resources, which assure total reliability with regard to the results obtained in the characterisation of raw materials and end products, and in the determination of their behaviour during the production process.

ITC CURRENTLY HAS TECHNICAL AND SCIENTIFIC EQUIPMENT FOR CONDUCTING R&D VALUED AT OVER 9 MILLION EUROS.



- › Discontinuous combustion gas analyser (O<sub>2</sub>, CO<sub>2</sub>, SO<sub>2</sub>, NOX).
- › System of continuous CO<sub>2</sub> measurement.
- › Instruments for measuring gas flow rates: Pitot tubes, thermocouples, pressure gauges.
- › Thermography chamber for obtaining thermographs and non-contact surface temperature determination.
- › Capacitive hygrometer for the determination of gas stream humidity content.
- › Continuous temperature measurement devices inside dryers and kilns.



IN THE COURSE OF ITS 40-YEAR HISTORY, ITC HAS CARRIED OUT ABOUT 150,000 ANALYSES AND TESTS OF THE 475 DIFFERENT TYPES THAT IT CURRENTLY OFFERS.

# technical references

ITC has the capability to transfer the knowledge acquired through the ongoing training of its team of qualified human resources, who keep their knowledge up to date by conducting various R&D&I actions and studies, in addition to participating in numerous science and technology forums worldwide and in different international platforms and consortia. This knowledge, together with that acquired or assimilated from other production sectors, serves to generate the innovation that is transmitted to the companies, which need this to maintain or to enhance their competitiveness.

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## R&D&I projects with private companies

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Over 30 projects have been conducted on energy saving and energy efficiency with private companies, yielding energy savings of up to 15%. The main research lines have been as follows:

Characterisation and optimisation of spray dryers, dryers, and kilns used in ceramic tile manufacture.

Characterisation and optimisation of dryers and tunnel kilns used in manufacturing structural ceramics.

Analysis of the reuse of thermal energy contained in the exhaust gases of cogeneration systems used in spray dryers and dryers of ceramic tile bodies.

Reuse of residual energies from ceramics firing kilns in other process stages.

Study of the combustion process in industrial burners.

Complete thermal energy audits in industrial plants.

Studies of energy consumption and carbon dioxide emissions.

Influence of the composition in reaction heat, energy consumption, and CO<sub>2</sub> emissions.

These research projects were carried out at the following companies:

ARENAS MINERALES, S.L.  
ATOMIZADORA, S.A.  
AZULEJERA TÉCNICA, S.A.  
AZULEJOS ALCOR 1, S.A  
AZUVI, S.A.  
CERACASA, S.A.  
CERÁMICA SALONI, S.A.  
CERÁMICAS DEL FOIX, S.A.  
ENDEKA CERAMICS, S.A  
EMPRESA NACIONAL DEL GAS, S.A.  
FABRICACIÓN ESPAÑOLA SANITARIA, S.A.  
GAS NATURAL SDG S.A.  
HIJOS DE CIPRIANO CASTELLÓ ALFONSO, S.L.  
KEROS CERÁMICA, S.A.  
NUEVOS PRODUCTOS CERÁMICOS, S.A.  
PRODESCO, S.L.  
ROIG CERÁMICA, S.A.  
TAULELL, S.A.  
UNIÓN DE FABRICANTES AZULEJEROS, S.A.  
URALITA TEJADOS, S.A.  
VENÍS, S.A.  
ZIRCONIO, S.A.

THE DISSEMINATION OF THE RESULTS OF THE STUDIES CONDUCTED BY ITC FROM THE OUTSET HAS LED TO **600 PUBLICATIONS** OF SCIENTIFIC ARTICLES IN SPECIALISED JOURNALS, **700 COMMUNICATIONS AT NATIONAL AND INTERNATIONAL CONFERENCES**, AS WELL AS THE DEVELOPMENT OF **31 PATENTS**.

### R&D&I projects co-financed with public funding

#### Central Administration

FIT-120000-2006-1 - Reduction of company energy costs with cogeneration by means of hydrogen generation (2006-2007).

REN2003-09247-C04-04 - Application of solar energy in ceramic materials processing (2000-2003).

#### Autonomous Regional Administration

IMIDIC/2009/3 – Environmental sustainability in the ceramic industry (2009-2010).

IMDITE/2007/13 - Competitive intelligence system: Energy and environment observatory (2008).

IMIDIC/2007/117 - Environmental sustainability in the ceramic industry (2007-2008).

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CANTAVELLA, V.; MORENO, A.; MEZQUITA, A.; LLORENS, D.; BARBERÁ, J.; PALANQUES, A. Distribución de temperaturas en el interior de una pieza durante la cocción industrial. *Ceram. Inf.*, 331, 61-68, 2006.

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ENRIQUE, J.E.; MALLOL, G.; MONFORT, E.; CANTAVELLA, V. Racionalización de energía en hornos de cocción de baldosas cerámicas. *Ceram. Cristal*, 124, 21-32, 1998.

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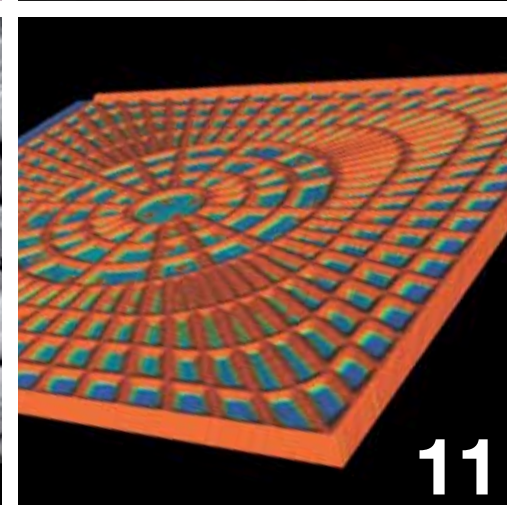
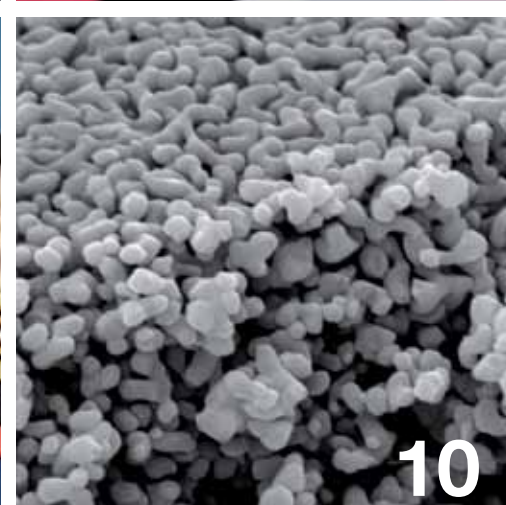
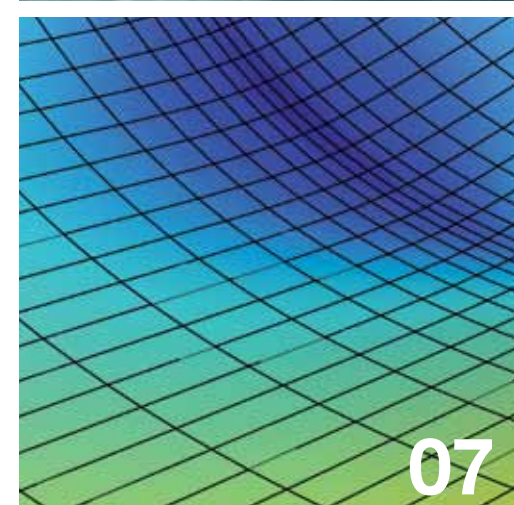
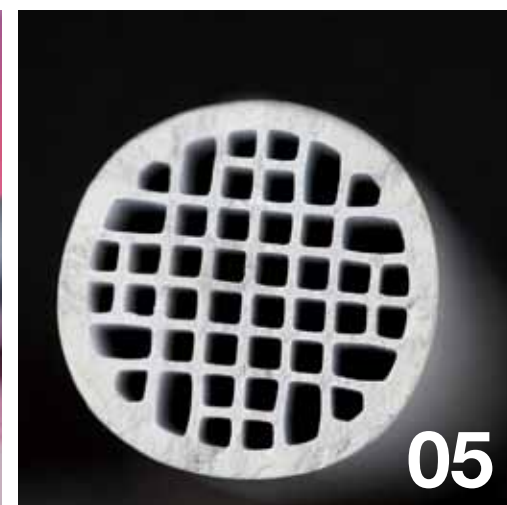
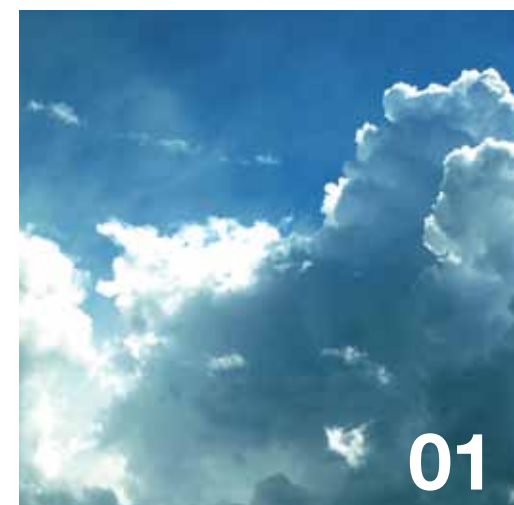
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8000m<sup>2</sup> SURFACE AREA DEVOTED  
TO RESEARCH AND DESIGN SPREAD  
OVER TWO HEADQUARTERS.



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