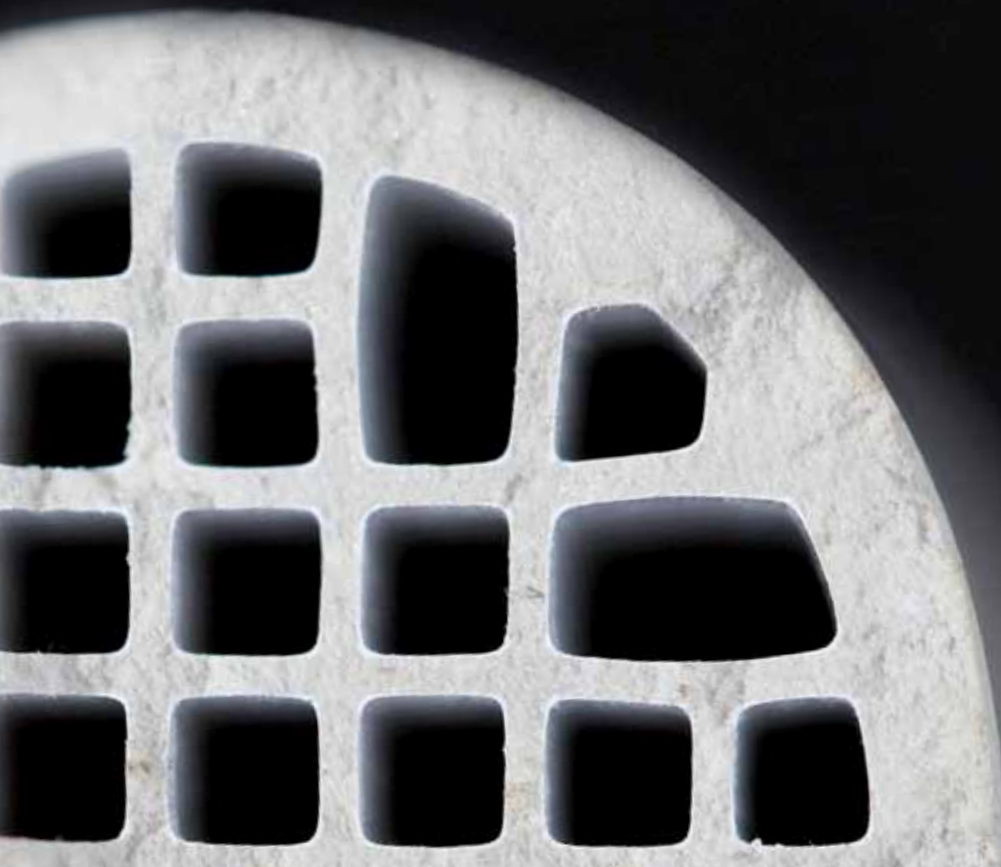


Advanced ceramics

research lines



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.

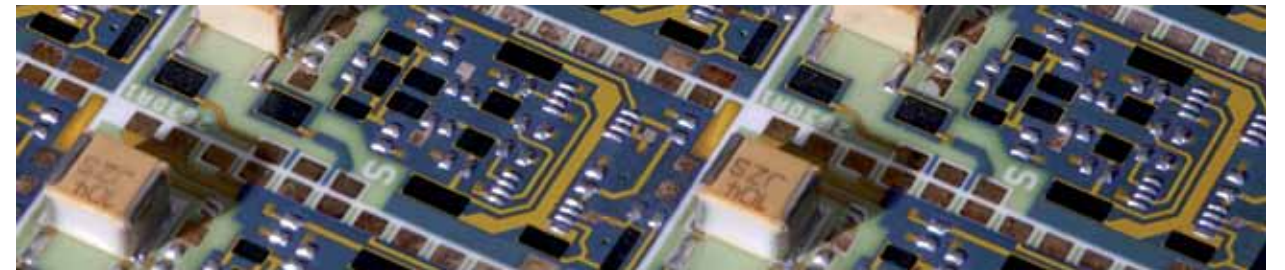
The competence attained through ITC's wide-ranging research activity enables ITC today to extend its field of action to other types of processes and materials. Particularly noteworthy have been ITC's actions in the field of energy efficiency and the minimisation of industry's environmental impact, as 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.

knowledge-based multifunctional ceramic materials

ITC is currently a member of the governing council of the KMM-VIN Virtual Institute, stemming from the European Network of Excellence, 'Knowledge-based Multicomponent Materials', KMM-NoE, which was funded by the European Commission and is devoted to the study and development of new advanced multicomponent materials.

The materials studied in the Network are known as **multifunctional or 'smart' materials**, since they perform special functions that provide enhanced properties and greater resistance or strength under extreme conditions. These materials have a direct application in the aeronautical and aerospace sector, in the automobile sector and, closer to hand, in the capital goods sector.

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



Development of so-called functionally graded materials

In this context ITC is collaborating in the development of so-called functionally graded materials (FGMs). The controlled development of the properties gradient in the constituent coatings yields notable improvements in mechanical properties at high temperatures and pressures, and provides high resistance to fracture, wear, corrosion, oxidation, physico-chemical attack, etc.

Development of ceramic matrix composites (CMCs) and metal matrix composites (MMCs)

ITC is also participating in the development of ceramic matrix composites (CMCs) and metal matrix composites (MMCs). In the CMCs, the matrix is reinforced with metal inclusions in the form of particles, discontinuous fibres or multiple layers; in the case of MMCs, the metallic matrix is reinforced with ceramic particles. Both types of composites provide greater resistance at high temperatures and greater conductivity.

other advanced ceramics

With a view to contributing to the diversification of the ceramic tile sector, ITC is conducting research into the obtainment of ceramic products for **applications with added value**, at the same time attempting, as far as possible, to use similar processes to those available in the sector in order to allow direct transfer of the results to ITC's industrial environment.

'For the development of these materials, new forming technologies have been fine-tuned, such as gel casting and tape casting or injection, as well as adapted thermal cycles for the removal of additives (debinding) or sintering in non-oxidising atmosphere.' ITC's current research lines in the advanced ceramics field are shown below:

ITC IS A **REFERENCE PARTNER** IN DIFFERENT NATIONAL AND INTERNATIONAL NETWORKS AND TECHNOLOGY PLATFORMS.

Synthesis of ceramic membranes for different applications in which organic membranes display insufficient stability owing to the presence of chemically aggressive media or high temperatures. Membranes have thus been synthesised for use in an electrochemical regeneration process of the spent chromium plating baths of surface treatment industries, membrane feasibility being demonstrated on both a laboratory and a pilot scale. This research line has enjoyed the direct support of IMPIVA since the year 2005, in the High Specialisation Programme, and has led to projects whose results, in knowledge as well as in individual products, will be transferable to the ceramic sector.

The synthesis of ceramic microwave absorbers, a line that has already generated prototypes, which have been tested as active elements in semi-anechoic chambers (chambers designed to absorb the sound that impinges upon chamber walls, floor, and ceiling, minimising echo and sound reverberation effects), and in a micro-organism elimination system in air conditioning systems.

The obtainment of ferrite-based radio frequency-absorbing ceramics, the processing of zirconium oxide-stabilised oxide ceramics for their great structural, mechanical, and thermal properties, and the processing of certain ceramic components of solid electrolyte fuel cells (SOFC).



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.

- › MIGL-28 low-pressure injection machine.
- › HOMMELWERKE T8000 roughness meter.
- › WYCO NT 1100 optical profiler.
- › Tape casting (thin-film application equipment).
- › XPS/ESCA. X-ray photoelectron spectroscopy for nanometre-scale surface chemical analysis. SPECS SAGE 150 instrument.
- › Glossmeter. Statistical Novo-Gloss, Rhopoint Instruments.
- › FEI XL30 scanning electron microscope (SEM).
- › FEG-ESEM Quanta 200S scanning electron microscope.
- › Nanotest (nano-indentation, scratching, wear, impact, pin on disk).
- › Tribometers (Gabrielli and Taber abrasion testers, Calotest, pin-on-disk tribometer).
- › Goniospectrophotometer.
- › Plasma spray equipment.

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.

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

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

European Commission

KMM-NoE 502243-2 - Knowledge-based Multicomponent Materials for Durable and Safe Performance (2004-2007).

Central Administration

CTQ2008-0675-C02-02 – Development of advanced electrochemical reactors based on ceramic membranes for the recovery of liquid effluents with hexavalent chromium (2008-2011).

FIT-040000-2003-8 - Development of ceramic membranes for the treatment and recovery of chromium plating baths with high Cr(VI) content (2001-2002).

MAT2008-05590 – Effect of grain size on the electro-magnetic properties of NiZn ferrites (2008-2011).

Regional Administration

GVEMP06/029 – Design and manufacture of a system for suppression of legionella by thermal shock (2006).

IIARC0/2004/49 – Design, development, and in-plant demonstration of a continuous reactor for the recovery of spent chromium plating baths (2004-2005).

G46271144 – Synthesis of magnetic ceramics for their application as absorbers in semianechoic chambers. IMPIVA (1997-1998).

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.

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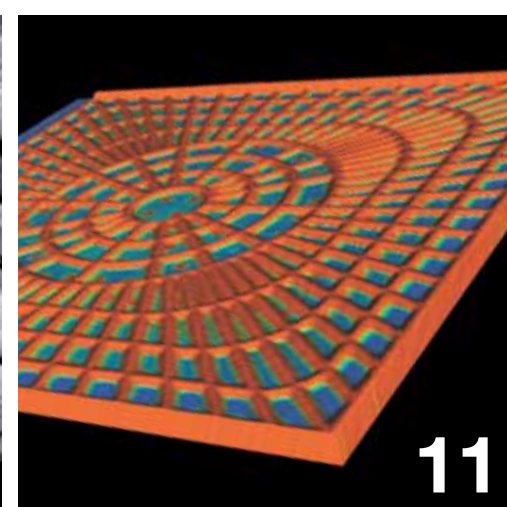
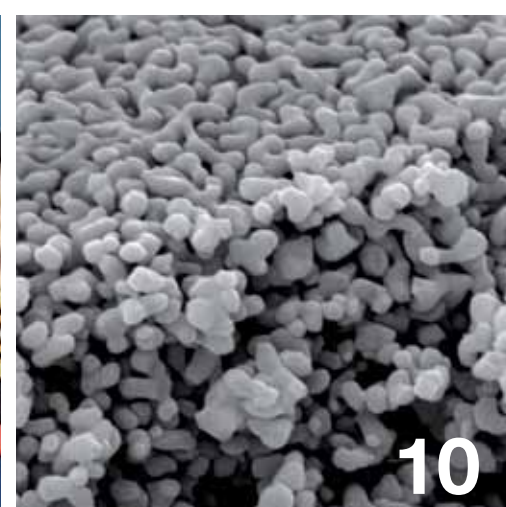
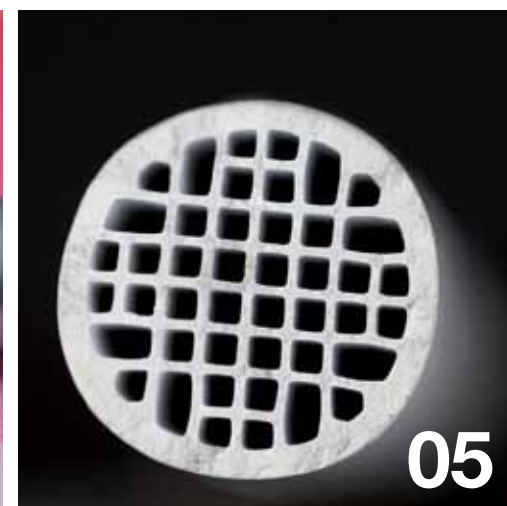
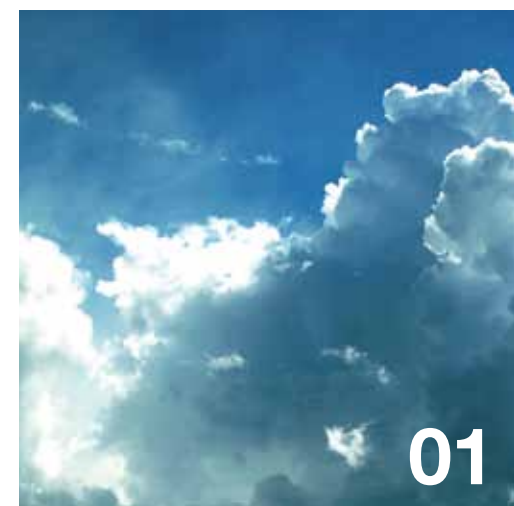
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 - 06 Construction systems and energy-efficiency for architecture
 - 07 Simulation of processes and materials
 - 08 Design
 - 09 Energy saving and energy efficiency
 - 10 Nanotechnology
 - 11 Smart manufacturing
-



8000m² SURFACE AREA DEVOTED
TO RESEARCH AND DESIGN SPREAD
OVER TWO HEADQUARTERS.



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