CERAMIC ARCHITECTURES

DIGITAL PLATFORM FOR THE TRANSFER OF CERAMIC INNOVATIONS IN ARCHITECTURE

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ABSTRACT

The Spanish ceramic industry stands out for its international leadership in sustainability, technology and design, and for its willingness to collaborate with architects and specifications writers in the development of unique proposals. However, the industry has difficulties in getting across its capability to meet this challenge with excellence, as there are no specific channels for knowledge transfer between the production and professional sectors.

The lack of competitive dissemination media to support this determined commitment by the Spanish ceramic sector is even more incomprehensible given the role of architecture and design as innovation drivers. Aware of the important benefits which bridging this gap would yield, the Ceramic Tile Studies Department at Valencia has built a bilingual digital platform (English / Spanish), for the creation of a database of works that use ceramics as key material in their configurations.

Aimed at technicians, students and researchers in architecture and design, CERAMIC ARCHITECTURES (http://www.ceramicarchitectures.com) / ARQUITECTURAS CERÁMICAS (www.arquiteturasceramicas.com) was conceived as a specialist dissemination medium for gradually providing sound knowledge about the characteristics of ceramic materials and their applications in the field of architecture.

1. NETWORK OF CERAMIC TILE STUDIES DEPARTMENTS

The drive witnessed in Spanish science internationally, thanks to a commitment to research and innovation over the last two decades, has been essential to a more balanced, diversified and sustainable progress, but this strategy based on knowledge economy still needs more in-depth relations between science and technology. To achieve this aim, knowledge transfer instruments —often relegated to a second level— need to be created, because they are the vehicle which enables society to be made aware of the importance of the research undertaken, thus increasing understanding about this unquestionable activity.

In recent years, some of the weaknesses in the system have been rectified, by promoting sponsorship in science, technology and innovation, and fostering the contribution of the private sector in the funding and implementation of R&D&I activities. Currently, thanks to this strategy, Spanish universities have among their priority actions an extensive programme aimed at approaching the business and industrial fabric, Business Studies Departments being the most important model for the strong commitment established between both parties.

In response to this aim and in order to promote new ways for developing ceramic materials applied to architecture, since 2005, the Spanish Ceramic Tile Manufacturers' Association (ASCER) has fostered with its sponsorship the establishment of a Network of Ceramic Tile Studies Departments (http://www.catedraceramica.es) comprising Schools of Architecture at the Alicante, Catalonia International, Madrid Polytechnic and Valencia Polytechnic Universities and the School of Building Engineering at Universidad Jaume I, Castellón. Once this link had been consolidated, motivated by the presence of the Spanish ceramic industry internationally, it was decided to extend this in 2010 by establishing collaborative projects with the Graduate School of Design at the University of Harvard, the Technische Universität in Darmstadt and the School of Architecture at the University of Liverpool.

Currently, with ongoing advice from the Instituto de Tecnología Cerámica, ITC, each of the Ceramic Tile Studies Departments (CC) is carrying out collaborative and complementary research aimed at conducting in-depth study in this field from different areas of knowledge:

CC Alicante Energy efficiency and sustainability (Installations Dept.)
CC Barcelona Product design and development (Building Dept.)
CC Castellón Specifications drafting and regulations (Building Dept.)
CC Madrid Architecture and design theory (Projects Dept.)
CC Valencia Innovation and knowledge transfer (Projects Dept.)
CC Harvard Digital technologies and robotic production (Technology Dept.)
CC Liverpool Daylight control and protection (Sustainability Dept.)

2. CERAMICS, INNOVATION AND ARCHITECTURE

The soft origin of ceramics, hardened in subsequent processes, is one of ceramics' most attractive qualities since it provides ceramics with a full range of possibilities for configuring and formulating their technical characteristics. This peculiarity has turned it into the ideal material for continuous reprocessing and, if the extraordinary lessons that tradition provides are taken into consideration, it can be said that ceramics have never stopped evolving over time and have always found the right way of doing so, contributing to the solution of new problems or proposing innovative ways for them to be used.

Currently, this specialization is not only far from exhausted, but we also find ourselves immersed in a technological and creative revolution similar to the one occurring in other areas of the construction industry. Technological, because of the industrial modernization undertaken in the Spanish ceramic sector in order to optimize the resources used, achieving, together with the Italian ceramic sector, the best energy efficiency ratio in the world per unit product; and creative, because of the gradual introduction of new digital technologies applied to the design and production process of advanced ceramic materials, which makes them ideal for contributing to the development of sustainable solutions.

Due to their extraordinary qualities, the use of ceramics is experiencing a considerable increase in recent architectural output, which requires ceramics to adapt to new technological and environmental paradigms and to innovate in practically all the process stages. On many occasions, these innovations are being proposed by the industrial sector through the launching of new products. But on many others, they are brought about by the professional sector, on having to design specific pieces to solve the needs required in projects.

Despite the fact that in recent years there has been a boom in significant works that use unique ceramic materials and, at the moment, it is where the most interesting innovations are taking place; the enormous potential that new ceramics provide has yet to be discovered.

3. NEW CHANNEL FOR KNOWLEDGE TRANSFER

The need for implementing architecture that is innovative, responsible and aware of social, cultural, economic and environmental factors opens up a new stage in which it is essential to find channels for bringing the latest advances into the marketplace.

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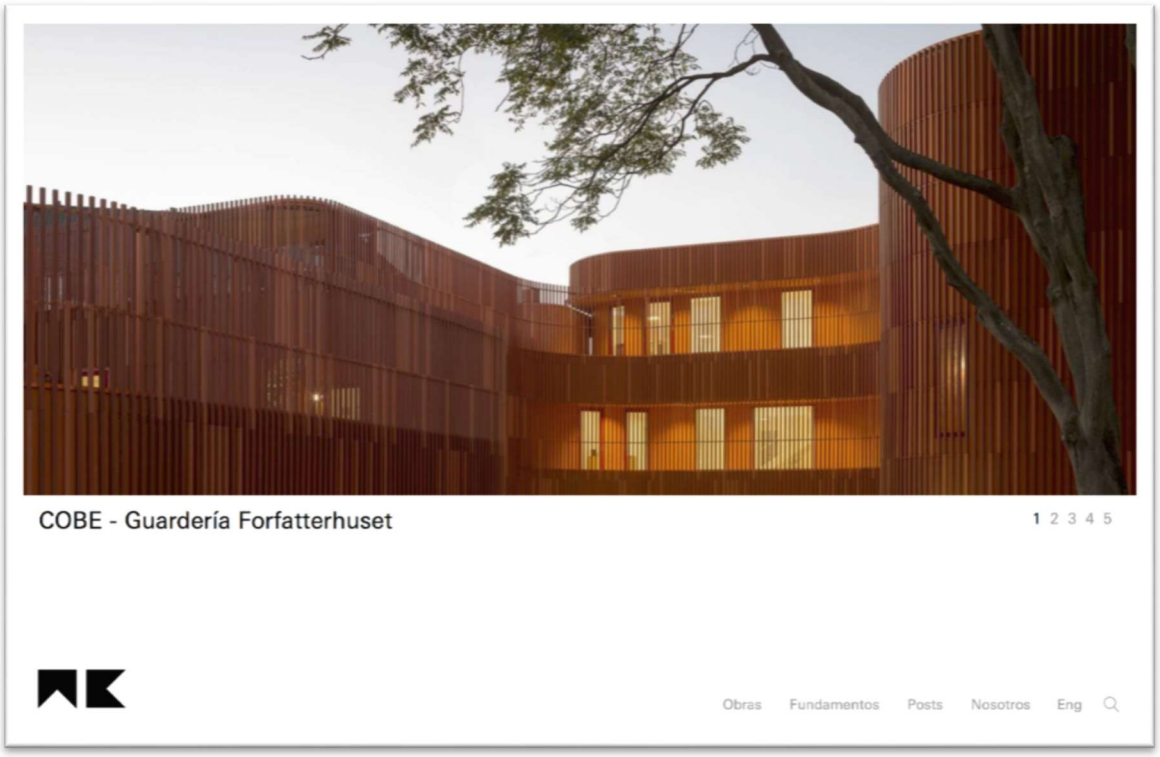

Figure 1. HOME page of the Ceramic Architectures digital platform

In this first stage of the digital platform, a set of important national and international works carried out since the year 2000 have been documented and the basics which enable greater in-depth knowledge about ceramic products have been defined. The main data has been structured around these two major areas.

3.1. Works

In this chapter of dynamic contents, in order to construct a specialised database, a set of projects selected for their quality and interest, which use ceramics as the key material in their configurations, was compiled. Depending on the particular interest of the user, search fields were

established using data relating to the work: author, use, location and date; and to the ceramic material: position, forming process, surface treatment and product.

The area devoted to each of the projects selected was divided into four sections which allow them to be analysed quickly and clearly.

- *Images*. Photographic sample of the built project describing the relationship between architecture and ceramic material.

- *Drawings*. Set of graphic documents (ground plans, cross sections, axonometric projections and scale models) which enable understanding and analysis of the project.

- *Details*. Information about the ceramic element, cladding arrangement, manufacturing process of the pieces and installation.

- + *Info*. Project data sheet, descriptive and building report, as well as the inclusion of interactive cartography for locating the project and relating it to the rest of the works.

3.2. Fundamentals

Using language accessible to non-specialist users, this chapter of fixed contents describes the main industrial processes used in tile production, as well as tile classification criteria, providing clear, concise and rigorous information inviting specifications writers to learn more about the material and helping them to define its technical characteristics.

In order to expedite access to the contents, chapter information is divided into five sections relating to the different production process stages:

- *Raw Materials*. List of the major components used and their corresponding milling processes.

- *Forming*. Description of moulding techniques used by the ceramic industry in shaping products.

- *Surface Treatment*. Selection of the most common procedures used for decorating pieces.

- *Firing*. Definition of the hardening process of the material and types of kilns used.

- *Products*. Classification of ceramic tiles according to the technical and functional characteristics of the material.

These two major chapters devoted to Works and Fundamentals are complemented by another two sections devoted to news linked to ceramic materials and to reporting on who we are.

- *Posts*. Catalogue of events and latest news relating to ceramic materials, listed in several categories according to type: events, installations, awards, research, publications and conferences.

- *About Us*. Complementary information defining the digital platform contents and whom it is aimed at. This section includes a sub-section where users are invited to take part by sending in their projects.

Since its launch two years ago, the incredible potential underlying this initiative has been evidenced, which has justified significantly developing the content and the functionality

throughout this last year, in order to position it as an undisputed international reference forum due to the importance of its contents. One of the most interesting changes has been the adaptation of the platform to the latest mobile devices, such as smartphones or tablets, through the responsive conversion of the whole website making it simpler and more intuitive to consult from anywhere.

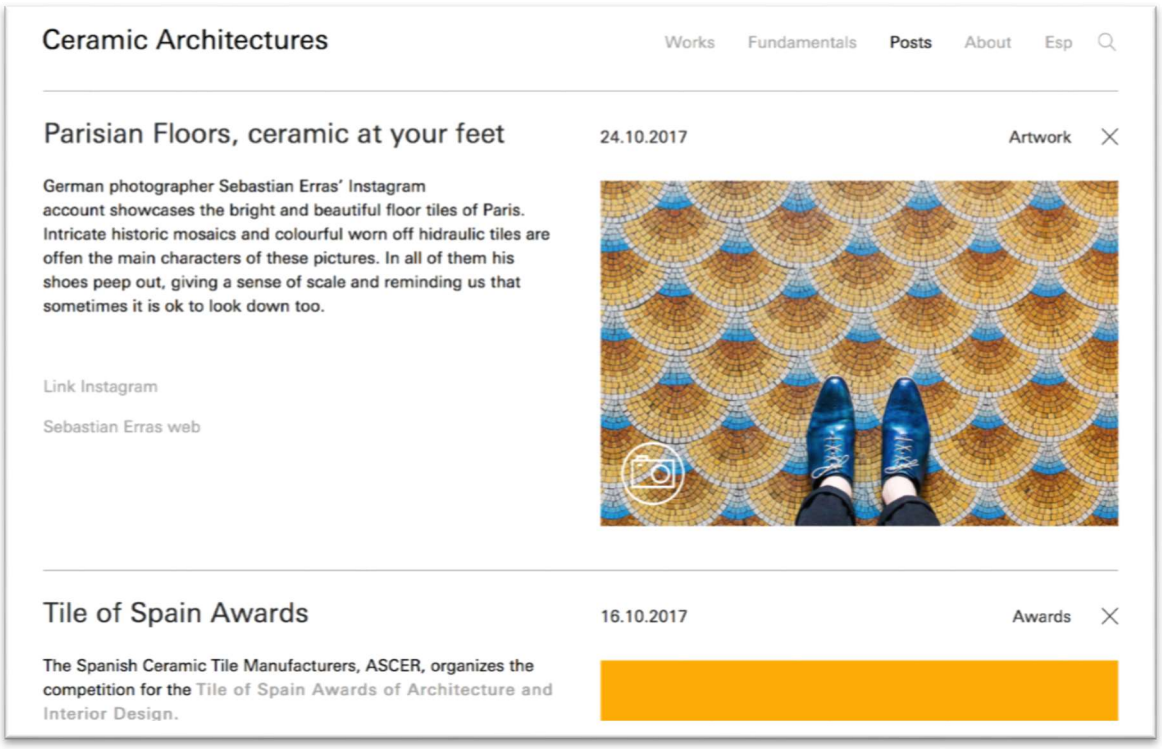

Figure 2. POSTS section devoted to events and latest news

4. SCIENTIFIC AND TECHNICAL, ECONOMIC AND SOCIAL IMPACT

It is considered that the international positioning of the digital platform will contribute to the development of the information society, defined as a priority objective in the Strategic Action in Economy and Digital Society of the National Research Plan, which pursues boosting the adoption of technologies that enable the economy and society to be transformed into a digital environment. It will also yield important social and economic benefits to the Spanish ceramic industry, by making available a specific instrument that highlights the suitability of these materials for the development of innovative, responsible and sustainable architecture.

4.1. Scientific and technical impact

Internationally relevant scientific and technical advances are foreseen, since it is a pioneering project for determining the state-of-the-art in innovations linked to ceramic materials applied to architecture, by examining recent national and international embodiments, distinguished by their unquestionable quality and backed by specialist critics.

In order to transfer and preserve the collective knowledge developed to create these new ceramics, the most important contributions linked to each of the stages required for implementing the digital platform are highlighted.

Selection Stage:

- Identification of national and international projects with high added value, in which new ceramic products and/or innovative forms of using them are present.
- Definition of the innovations implemented in the different production process stages: raw materials, forming, surface treatment, firing, post-production.
- Classification of innovations according to their functional performance, formal qualities and symbolic meanings.

Documentation Stage:

- Creation of a ceramic library of unique pieces, determining their technical performance, geometric definition, cladding arrangement and installation systems.
- Production of a video library recording the various configuration processes of the new ceramics in order to preserve the technical knowledge developed
- Photographic record of the product and development of three-dimensional digital models, for 3D interactive viewing from any angle.

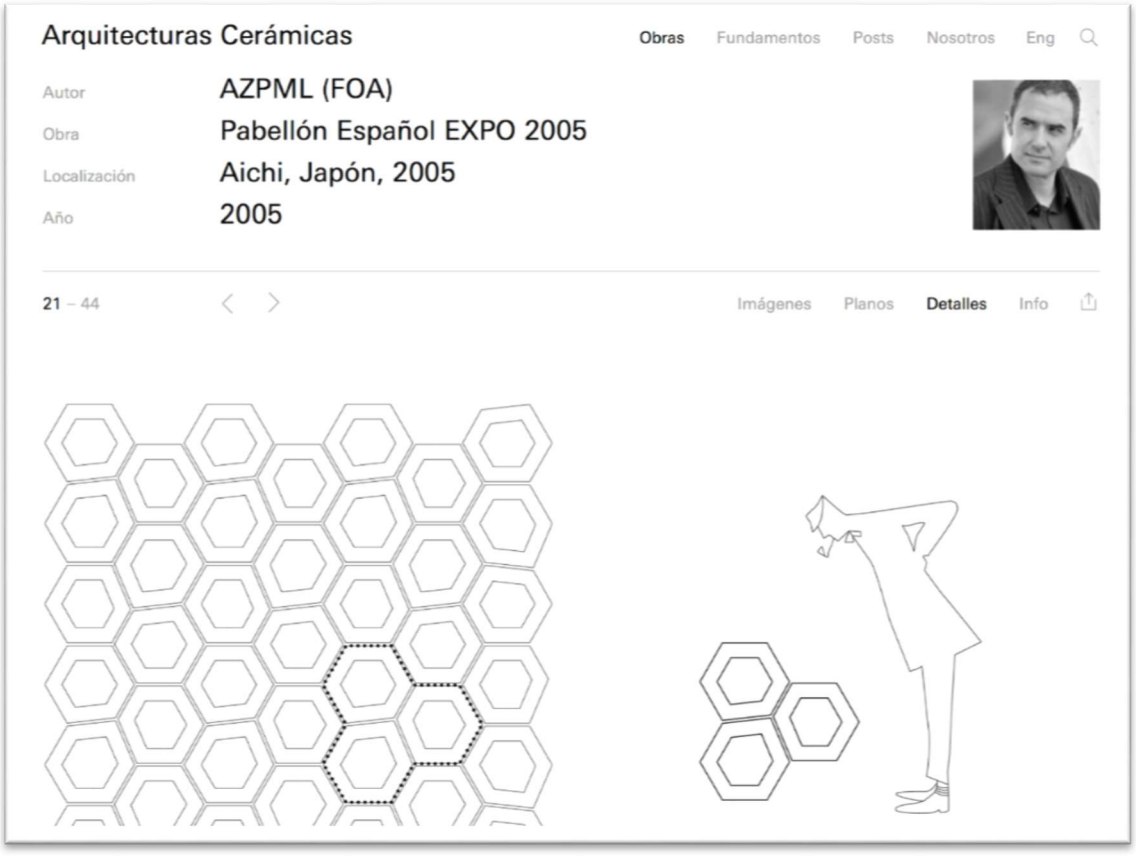

Figure 3. DETAILS section showing the arrangement and scale of the ceramic piece

Dissemination Stage:

- Creation of an open access database, specialising in contemporary architecture, which uses ceramics as key material.
- Archive of currently produced innovations, both in new ceramic products proposed by the industry and the way of utilising them.

- Transfer of the results achieved to the research, industrial and professional production sectors in architecture and design.

4.2. Economic Impact

Due to the latest crisis, a significant drop in ceramics consumption has taken place in the domestic market. One of the aims is to activate this market as the recovery of the Spanish economy strengthens. Despite these difficulties, the tile sector has a solid underpinning and an indisputable future thanks to its high degree of internationalisation and the substantial investment in R&D&I, its priority actions being to maintain Spanish ceramic products at the forefront of innovation, sustainability and design.

Aware of this reality, the launching of the platform could contribute to the economic development of the ceramic sector since it is estimated that:

- Developing an instrument for knowledge transfer in the production and professional sector, which enhances the prestige of ceramic materials applied to architecture, will activate ceramics consumption and bring doubtless benefits to the Spanish ceramic industry.

- Positioning the capacity for design of new materials and systems by considering the technological advances and industrial innovation processes will enable competitiveness and growth in the Spanish ceramic sector to be boosted, by placing it at the forefront of the international market.

4.3. Social Impact

The digital platform offers a great opportunity for disseminating the technical advances that are currently taking place and for studying in depth the exceptional plastic qualities of ceramic materials. However, a warning must be given regarding how, in the latest crisis, part of the industry linked to tile production has been destroyed; this part possessed incalculable knowledge which has been lost with its disappearance. A paradigm change is required to prevent the squandering of a heritage so deeply rooted in the region involved and one which belongs to the identity traits of its people.

For all these reasons, the project is considered to have great social relevance, since amongst its aims it proposes:

- To vindicate the qualities of ceramics applied to architecture through the study of projects endorsed by their unquestionable quality and unanimous recognition by specialist critics, using the new generation of services offered by ICTs, which enable information to be shared globally.

- To recover the legacy of all the technical, plastic and cultural knowledge used in the development of the functional, formal and symbolic innovations linked to ceramic materials, in order to avoid their loss since it is not usual to pay attention to the importance of their conservation.

5. CONCLUSIONS

Two years after its launch and taking into consideration the research projects which pursue similar ends, we consider that this is a pioneering initiative that vindicates the qualities of a particular material, in this case ceramics, through the study of projects endorsed by their unquestionable quality and unanimous recognition by specialist critics.

The worked carried out to date has been of undisputed interest to the industrial, professional and scientific sectors, because of the originality of its approach and the partial results obtained, albeit still very limited to the repercussions of some of the innovations arising in these last few years. For this reason, a new stage is opening up, in which it is deemed necessary to broaden the field of study from the innovations arising at the end of the 19th century, the time when industrialised manufacturing processes were developed and which constitute the current basis for ceramic technology, until those which will determine the advanced ceramic materials applied to architecture in the near future are included.

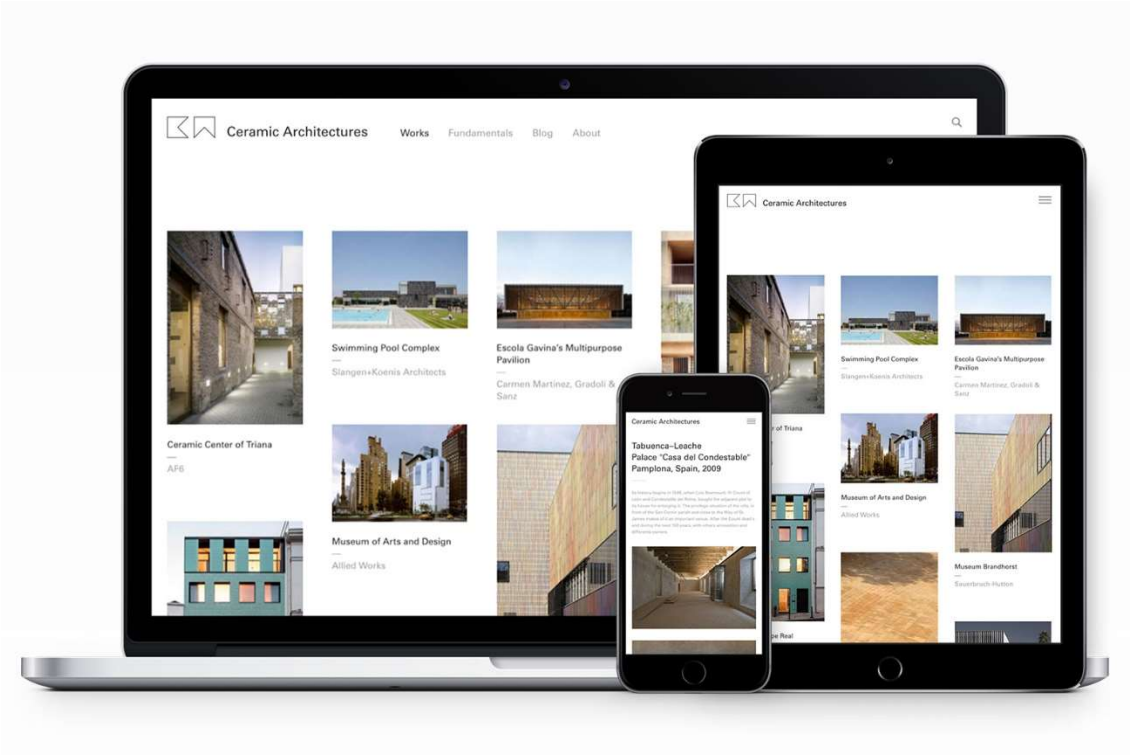

Figure 4. Adaptation of the digital platform to all mobile devices

Since starting its activity, the task of the Ceramic Tile Studies Department at Valencia has been to determine the innovations arising in ceramic materials applied to architecture, both in manufacturing processes and in their installation. Driven by the interest arising in the production and professional sectors, the development of the CERAMIC ARCHITECTURES digital platform is deemed to be of major interest in pursuing transfer of the knowledge acquired and thus contributing to the strengthening of Spanish ceramic products, keeping them at the forefront of the international market, and contributing to the development of the information society.

The editorial team of Ceramic Architectures wishes to thank all students who have collaborated with the Valencia Ceramic Tile Studies Department for their contribution, since the work performed over these years has motivated the creation of this digital platform, as well as to thank the Spanish Ceramic Tile Manufacturers' Association (ASCER) for its unconditional support

in conducting the project and the Instituto de Tecnología Cerámica (ITC) of Castellón for the advice given in preparing its contents.