NEW CERAMIC APPLICATIONS IN ARCHITECTURE. FILTERS AND SKINS

M. Bartolomé Álvaro, J. Corrales García, M.Llorens Colera, J.Mira Peidro

Instituto de Tecnología Cerámica (ITC)

Asociación de Investigación de las Industrias Cerámicas (AICE)

Universitat Jaume I. Castellón. Spain

ABSTRACT

This paper focuses on the presentation of five projects related to the concepts of filters and skins, exhibited at the Trans/hitos 08 and Trans/hitos 08 expositions held in the Cevisama trade fair.

Both concepts have acquired considerable sway in current architecture, 'filters' being understood as those elements that serve to differentiate public spaces from private spaces, in turn creating transitional spaces, quite often by insinuation or suggestion, while 'skins' are understood as the external layers that mediate between buildings and their environments.

Projects carried out:

Filters: - Orbital waves (*ITC-Alicer).*

-Ceramic wicker *(Roldán+Berengué Arquitectos).*

-Penetrable *(estudio Entresitio).*

Skins: -Interstices *(ITC-Alicer).*

-Ceramic igloo *(ITC-Alicer).*

The following points were studied in each project:

- Concept.
- Project description.
- Development of the ceramic system.
- System analysis and innovation.

1. INTRODUCTION

The current phase that architecture is passing through is characterised by the singularity that projects acquire, largely due to the quest for an author architecture, in which each architect seeks to leave his own calling card. These new trends engage the ceramic sector in the development of new products and systems that permit the application of ceramics in today's architectural lines.

One of the lines of work being undertaken by the department of design and architecture at the Instituto de Tecnología Cerámica (ITC) consists of the performance of projects that demonstrate the new uses and different functions that today's ceramics can contribute, in a wide variety of suggestive ways.

2. PROJECT DEVELOPMENT

2.1. Filters.

By 'filters' we mean those elements that serve to differentiate public spaces from private spaces, in turn creating transitional spaces, quite often by insinuation or suggestion.

2.1.1. 'Ceramic wicker' (Roldán+Berengué Arquitectos).

In this project, the aim of the architects was to turn the clock back to the time before ceramics became repetition units, to when they were individual items, receptacles. The curved ceramic piece plays at weaving a vessel which, at the same time, has human dimensions and constitutes a preliminary idea of internal space and shelter. It reminds one of the fabrics hung over tent poles, like those of nomad tribes, while at the same time acting as a contemporary curtain of a textile and mineral nature.

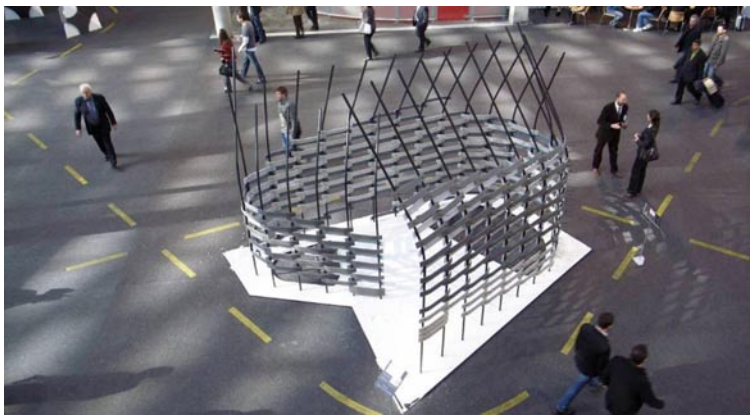

Figure 1.

The structure making up the space consists of a spiral formed by 32 metal poles of different heights, 3 to 4 metres tall, from which 400 ceramic pieces, folded

and cut in an elongated format of 60x8 cm, are draped. The poles simultaneously act as a warp, on which the glazed ceramic pieces are fastened, imitating a wavelike frieze that has yet to be finished.

There were many possible patterns for this fabric, and for the purposes of this project it was decided to select one of maximum transparency, in order to draw attention to the light passing through it.

In the development of the project, the architects designed a number of curved ceramic pieces, which were fastened to the poles forming the structure by clips that held the pieces in place.

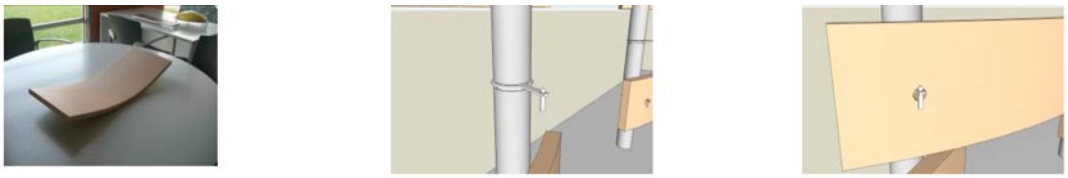

Figure 2.

To obtain these curved pieces it was necessary to create specific moulds on which to set the pieces as they travelled through the firing kiln, so that they would come out in the desired shape. Owing to the rise in price that the creation of the moulds would entail, new solutions were proposed which, though they simplified the process and reduced costs, stuck to the concept, until a solution was finally found in which the piece was only folded at its ends, while the centre part was kept straight.

During the manufacturing process, the first step involved waterjet cutting of the base pieces of glazed porcelain tile, measuring 60x60 cm, which came in two colours, light grey and dark grey, and were used to prepare the pieces that went into making up the space.

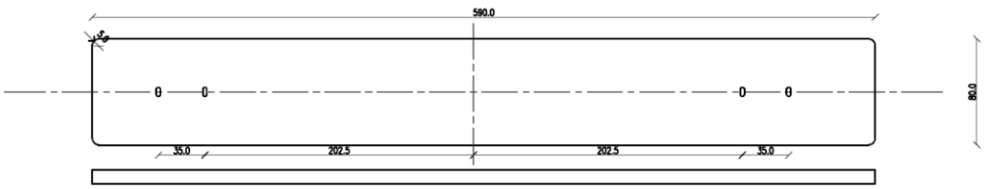

Figure 3.

As may be seen in the foregoing image, the piece comes with two pairs of holes that allow it to be fastened to the substructure. The shape of the holes varied depending on the fixing system used. Initially, two round shapes are made in relation to the first type of anchoring; an elongated design was eventually selected, which allowed clamps to be used.

Figure 4.

Once the preliminary piece had been obtained, it was folded. In this process, the ceramic item was put through a second firing, in which the item reached a plastic state and the shape adapted to the mould on which it rested. This was done using a standard refractory block with a rectangular prism shape as a mould.

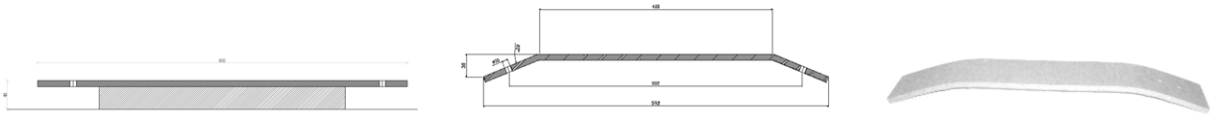

Figure 5.

Another evolving aspect of the creation of this new piece was the way it was fastened since, as previously remarked, it was first intended to use some clip-style fasteners for the curved pieces. However, finally it was decided to 'tie' the pieces onto the structure in order to simplify the overall assembly of the space.

The evolution of this concept led to the use of clamps that allowed the pieces to be fastened at two points on the poles, passing the clamps through the holes made at each end of the ceramic pieces.

Figure 6.

In the design process of systems with similar technical characteristics, the anchoring needs to apply sufficient pressure to keep the ceramic piece in place on the pole.

In order to obtain the desired pieces, the cutting and bending processes in the porcelain pieces were carried out together, and the variation in stresses which might influence the bending of the pieces due to the perforations was analysed.

These techniques have offered, and continue to offer, multiple formal possibilities that could be applied to ceramic pieces.

2.1.2. 'Orbital waves' (ITC-Alicer).

One of the accepted definitions of the word 'Wave', according to the dictionary

of the Spanish Royal Academy, is 'each of the S-shaped curves that are formed naturally or artificially in some flexible items...'

A wave is also defined as a movement that travels through space, bearing energy.

Figure 7.

This space consists of an installation built on a metal structure that travels a wavy path, which the viewer can move along by following a radial movement.

While the installation displays a neutral aspect or colour on the outside, different materials are combined on the inside, whose contrasts lead ceramics to evoke feelings: neutrality, warmth, sensitivity, abstraction… Here, ceramics rise from the ground and expand, exhibiting sinuous movements, producing geometries, and three different types of envelopes which are, in turn, examples of simultaneous successive models that are applicable as solutions to a building construction or interior design.

In the design of the space, two of the models used involved adapted consolidated commercial fixing systems, while the third model used a pressure-based installation system designed specially for this space.

This third model took the form of a lattice with great formal expressivity, achieved by varying the position of a few ceramic pieces, arranged on a metal grid structure; in addition the design of the lattice left the structure itself hidden, even in the hollow parts of the filter.

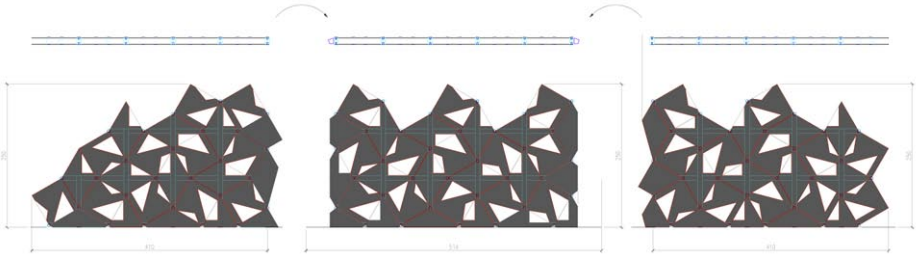

Figure 8.

To obtain the different pieces making up the lattice, we started out by using two base glazed ceramic tiles, measuring 120x60 cm and 60x60 cm respectively, which were cut by waterjet to achieve the desired effect.

Figure 9.

The pieces were installed on the substructure using a pressure fastening system, composed of a metal structure and a single anchoring. The anchorage consisted of a circular metal strip with four radially arranged holes, with a threaded bar welded in the middle with a rubber disk laid on the inner face of the metal strip to protect the ceramic piece after it had been installed.

The ceramic piece was put into position on the structure and the anchoring was then screwed into a threaded hole made in the structure, such that it applied pressure on to the piece at one corner. Each of these fasteners applied pressure simultaneously on to four pieces. Once the installation process had ended, each ceramic piece was held by the fasteners at four points, except the outermost ones, which were only held at two points.

A special tool was designed to make the four radial perforations in the metal strip, in order to make screwing on to the structure easier.

Figure 10.

In designing technical systems with similar characteristics, one should bear the following in mind: special attention needs to be paid to the resolution of joins at corners, appropriately controlling joint width along the entire length of the piece and, furthermore, taking into account the possible use of pieces of different thickness in order to enable the pressure fastening system to work correctly.

The use of pressure fastening opens up new avenues for ceramic applications.

2.1.3. 'Penetrable C' (estudio Entresitio).

Estudio Entresitio set up a space with ceramic hyperdensity, in the manner of the 'Penetrables' by the Venezuelan plastic artist Jesús Rafael Soto (1923-2005), considered to be one of the founders and leading figures of the Kinetism art movement. Sotto conceived 'Penetrables' as vibrant dense masses capable of absorbing the spectator, who 'penetrated' inside the work, with the idea of

demonstrating to humankind that humans are part of space. Thus, these works start off with geometric structures from which countless thin threads of plastic, metal, fabric, or other materials hang, grouped together in volumes that the spectator can cross.

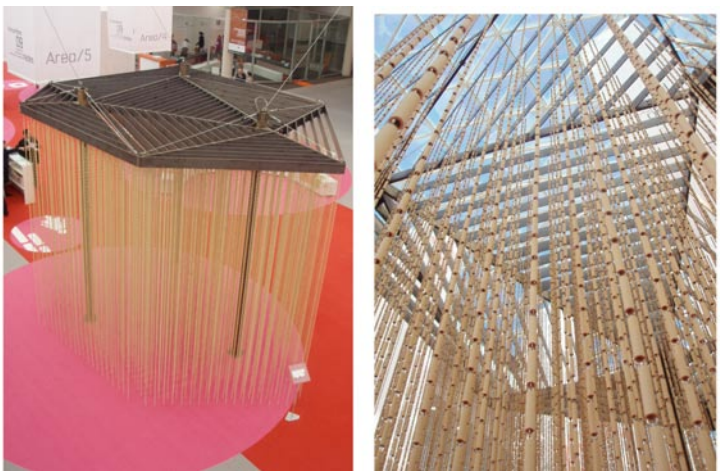

Figure 11.

The space devised by Entresitio, 'Penetrable C', was built of threaded ceramics and looks like the curtains that were formerly used to prevent insects from entering a house, except that in this case the 'bugles' that make up the curtain are ceramic.

The spectator can enter and become 'enveloped' in this place where ceramics, sound, and density seek to embody the idea of a sensory space that changes with the viewer and is capable of acting upon the viewer.

In the design process, it was initially thought to form the pieces with a manual extruder, a special extrusion die being designed for this purpose for that enabled bugles to be obtained. After various tests, this procedure was discarded, due to the curvature that the pieces acquired when they came out of the extruder, as a result of differences in pressure on the pieces as they exited the extrusion die.

Figure 12.

In the end, it was decided to use recycled ceramic materials that had been used in ceramic firing kilns to protect probe wiring against temperature.

Forty thousand ceramic bugle tubes, 50mm long, 9mm in diameter, and 1.5mm thick, were used.

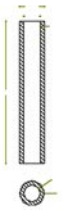

Figure 13.

The system used to form the ceramic strings consisted of successive long metal pins, bent at both ends in the form of a hook. The pins, which threaded the ceramic bugles, were hooked together at the ends.

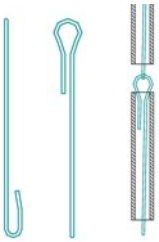

Figure 14.

In the design process for systems with similar technical characteristics, it should be borne in minds that these ceramic pieces need to be protected, in order to avoid breakage, when they occasionally come into contact with each other.

One of the values to be highlighted in the execution of this project has been the use of traditional techniques to resolve current situations. In this case, this technique would enable us to resolve a system that allowed the technique to be applied in filter design, as visual spacers.

2.2. Envelopes.

By 'skins' we mean the external layers that act as interfaces between buildings and their environments.

2.2.1. 'Ceramic igloo' (Alicer).

This project design embodied two readings: in the first, the space was related to the types of dwellings of peoples that need to live together and adapt to the coldest temperatures, in a sometimes savagely hostile environment. In the second reading, a relation was established with an observatory, because of its spherical shape and functionality, which involves being able to see further, a reading that ALICER-ITC took on board as an inspiration and launching pad for new ideas and product proposals.

Figure 15.

The project envisioned an exhibition space dedicated to showing the latest trends in interior design and architecture in a graphic and illustrational way, keeping in mind from the outset the principle of straightforward disassembly, transportation, and re-assembly in relocation, for other possible daily uses.

The basic aim of the space was to acquaint visitors with the latest trends in interior design and, thus, to familiarise the public with them. This led to the idea of using a semi-sphere as an exhibition space.

To resolve the cladding of this semi-sphere with ceramic material, after considering various options, a scale-like cladding was chosen. By breaking down the semi-sphere into 16 faces around its perimeter, and 12 sections in height, flat trapezoidal faces were created that could easily be produced in ceramics.

The support structure used for this cladding consisted of 16 wooden ribs, which were screwed on to a metal base at the bottom, and to a zenith at the top.

A further ring appeared in the middle section, to strengthen the assembly.

Figure 16.

The ceramic covering comprised 168 rectified, white-body porcelain tiles measuring 1200x600x12mm, with a density of 2.05 g/cm^3 and rough surface finish.

To fit the ceramic pieces well to the form defined by the ribs, the pieces were waterjet cut to provide them with a trapezoidal shape, so that when mounted they formed a triangular shape made up of the trapezoidal faces between two consecutive ribs.

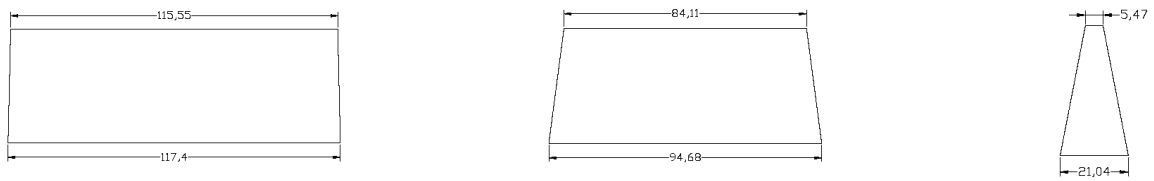

Figure 17.

The pieces were fastened to the structural ribs with an anchorage consisting of two symmetrical clips swivelled at a certain angle to hold pieces that were not on the same plane. Each clip held the bottom part of the ceramic piece immediately above it, while at the same time holding the top of the piece below it. In this way, each double-clip fastener held four pieces, each piece being concurrently held by four anchors.

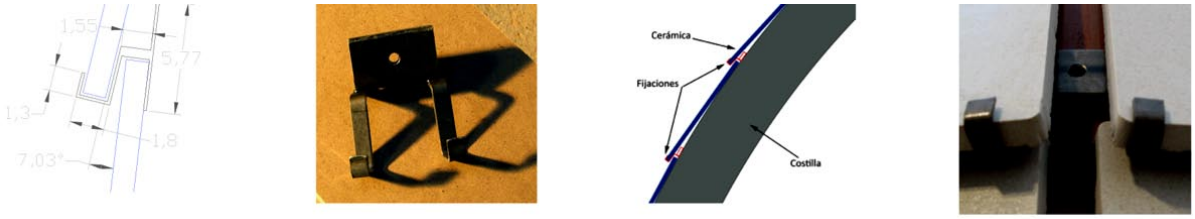

Figure 18.

The cladding was assembled by superimposing the ceramic pieces, which were mounted as follows:

- First, the piece was set by its top edge in the bottom part of the top clips.
- The piece was then turned around the axis that defined the two points at which it touched the two clips at the bottom.
- Finally, the piece was slid until it rested on its two bottom clips, ensuring that the side edges of the pieces remained equidistant to the rest.

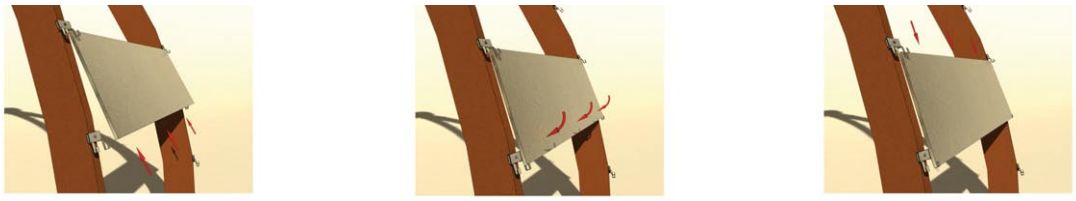

Figure 19.

As a final point, it may be noted that this system enables curved surfaces to be successfully covered with ceramic materials, as an envelope, which serves as closure and roof.

2.2.2. 'Interstices' (Alicer).

This action sought to respond to the current sensibilities of the neo-nomad by creating a space that could be viewed from the perspective of motion, in accordance with the ever-greater speed of modern social interactions. At the same time, it sought to enhance the character of the modern day nomad, which is characterised by liquid, ephemeral, tangential, spaced out, and perishable traits, as characteristic as they are contemporaneous, caused by the speed-up of communications, transport, the flow of ideas, advances in technological development.... without going into their positive or negative repercussions for different social groups. What definitely appears beyond discussion here is that without these high-speed global changes, it would be very difficult to explain current interconnections.

Figure 20.

The project comprised three metallic polyhedrons, lacquered in white, about three metres tall on a base a little over one metre tall, arranged in a non-centralised route which the visitor travelled around in a tangential way.

The design of the three polyhedrons focused on a lattice construction that would let motion and light through. In accordance with this profile, the space was characterised as ephemeral and fungible, without any environmental impact. We live between spaces, and are in continuous movement: thus, interstices are the main features of the new contemporary space.

Each of these volumes was covered with 21 pieces of porcelain tile, with several different finishes; the shape of the pieces allowed each to be joined to the next, fitted through the vertices of the joints. The lattice was made up of seven pieces and their symmetrical equivalents.

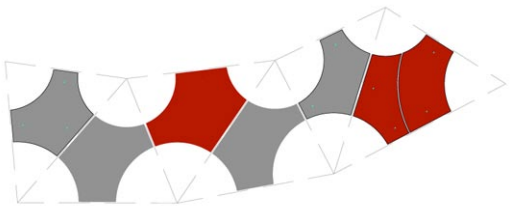

Figure 21.

To produce these, three base pieces of glazed porcelain tile were used as a starting point, measuring 90x60, 49x98, and 120x60, which were waterjet cut to obtain the final pieces with the desired shapes. During the final cutting stage, transverse perforations were made in the piece for fixing purposes.

Some of these pieces were decorated with an organic pigment-based printing technology, thus enabling pieces decorated with images and texts, etc. to be obtained.

The pieces were screwed on to the steel substructure, metal bushings being set as spacers between them to keep a uniform distance between the two surfaces, while at the same time allowing the screws to pass through.

Figure 22.

Other notable points in this project were the great range of possibilities provided by the use of waterjet cutting for obtaining new effects in pieces and for adapting them to irregular surfaces.

It should also be pointed out that one of the fixing system requirements was that the system needed to be dismountable. Thus, systems like the screw-on fastening to the substructure allow ready replacement, an indispensable requirement when adapting this project to urban spaces as an information point.

3. CONCLUSIONS

The work demonstrates that ceramics, in addition to being outstanding materials due to their excellent adaptability to external requirements, also provide the possibility of addressing the new challenges posed by contemporary architecture.

ACKNOWLEDGEMENTS

We are grateful for the support received from the EU, through the European Fund for Regional Development (EFRD), from the Generalitat Valenciana, from IMPIVA, from the Spanish Ceramic Tile Manufacturers' Association (ASCER), from CEVISMA, and from the State Society for the Development of Design and Innovation (DDI).

REFERENCES

[1] Transhitos 2008, Exposition of Architecture and Interior Design in Ceramics. Networks. Nomads.

[2] Transhitos 2009, of Architecture and Interior Design in Ceramics. Networks. [Visited: 2009-02-21] http://www.impivadisseny.es/disseny/images/Bloque3/Actividades/2009/pdf/transhitos09.pdf