



i.light

Transparent cement

1. What is meant by "transparent cement"?

"Transparent cement" is meant to be a "precast cementitious element" that, by including appropriately sized and transparent polymer-based inserts, is able to take advantage of its transparency properties on a macroscopic scale. Such transparency properties become apparent not only in the element's ability to transmit natural and artificial light, but also in the fact that the human eye can reconstruct images of objects placed beyond the built element.

Italcementi developed this technology to meet the needs of Architect Giampaolo Imbrighi, designer of the Italian Pavilion at Expo 2010 in Shanghai. The architect wanted to have the pavilion's envelope built with large surface areas made of a transparent cementitious material surrounded by areas built in traditional cementitious material. From an architectural point of view, the building's dynamic effect was obtained by alternating the materials and by providing panels with different shades. Seen from the outside, the transparent effect is caught especially at night when the transparent cement allows interior lights to filter through. From inside the Pavilion, daylight allows one to clearly perceive the varying brightness of the surroundings, with significant improvement in indoor comfort and appreciable energy saving.

2. What is i.light?

i.light is the brand that identifies the range of products featuring "transparency" properties.

3. What targets has Italcementi Group for i.light?

i.light is part of a broader innovation effort by Italcementi Group in the cement and concrete field aimed at introducing products featuring above-the-standard performance levels, low environmental impact and tailored to customer needs. From the launch of the MURACEM, EMMETI and CALIX ranges of special building products up to the TX Active range of de-soiling and self-cleaning photocatalytic products, Italcementi's focus on innovation has always been intensive and constant offering a new vision for an inherently traditionalist industry.

With i.light, Italcementi Group wishes to offer to the building community a new solution of using concrete that, traditionally regarded as a building's solid portion, is finally capable of communicating with the outer space. Very large, extremely strong, and highly luminous surfaces can be built while preserving privacy and security in a building of great architectural value. The many customization possibilities offered by the product ensure a great deal of freedom to both owners and architects when designing façades.



4. How does it work?

The **i.light** panel is composed of mortar and high-performance polymer-based materials that give transparency to the final product. Light is allowed to easily cross the organic material with minimum dispersion, with the result of having strong yet bright and translucent concrete walls. Luminous transmittance, i.e. the ratio of visible light incident on a medium and the light transmitted by the latter, of the resins used in **i.light** is higher than that of glass.

5. What advantages does resin have over fibre optics?

There are products on the market whose matrix contains fibre optics suitably arranged to allow light to pass through. The differences between resins and fibre optics are mainly three. The first two are technical in nature: i.light's ability to capture light is greater because resins allow a larger light cone to pass through than fibre optics. This feature actually increases the transparency of the material and the lighting effects delivered to the buildings. Moreover, i.light is more tenacious than products containing fibre optics. On the top of that, i.light is definitely cheaper.

6. What are the sizes of a typical 'Shanghai' panel?

The "Shanghai i.light" panels used for the Italian Pavilion at the Expo 2010 in Shanghai were 500-mm high, 1000-mm wide and 50-mm thick and had an overall weight of 50 kg each. As technology advances, different sizes will soon be possible. Size must however comply with the strength requirements specified for the panel's application.

7. What are the physical and mechanical properties of the panel?

The cementitious matrix is characterized by the following strength properties at 28 days:

- | | | |
|--------------------------------------|--------------|--------------------|
| • Average cubic compressive strength | > 60 MPa | acc. to EN 12390-3 |
| • Average flexural strength | > 8 MPa | acc. to EN 12390-5 |
| • E-modulus | 38-40000 MPa | acc. to UNI 9771. |

Moreover, the cementitious matrix has been reinforced with stainless steel fibres to impart toughness, thereby ensuring good resistance to cracking.

The collaboration between the cementitious matrix and the polymer-based resin inserts has proven particularly effective as evidenced by a flexural test performed on a prototype panel.

The panel's flexural response revealed a remarkable post-failure ductility which ensures a smooth and uniform fracturing process without dangerous material collapse.

The flexural response also pointed out how the panel, under the conservative assumption of simple support, is able to withstand wind pressure corresponding to speeds in excess of 500 km/h.

The test was carried out according to an internal CTG protocol.



8. What is the degree of transparency of a Shanghai-type panel?

About 20% of the surface of the panels is transparent. For semi-transparent panels - produced to comply with the Pavilion's architectural requirements - transparency percentage decreases to 10% or 15% by arranging the resins in a different way.

9. How were the Italian Pavilion's walls built?

The walls of the Italian Pavilion in Shanghai were designed and built as a ventilated wall cladding system to ensure excellent thermal behaviour. The Shanghai i.light panels were fastened to a metal frame through the introduction of inserts in pockets drawn along the outer edge of the panel.

Panels were bonded one to another using an epoxy sealant. For closing the wall inward while providing a ventilated air space, panels in ETFE (Ethylene tetrafluoroethylene) were used.

ETFE is a kind of transparent plastic, with insulating properties, which is lighter and more tenacious than glass and other transparent plastics.

i.-light panels have contributed significantly to thermal insulation and light diffusion: thermal and lighting engineering performance will soon be assessed by a certified institute.

10. How long is the lifetime of a transparent cement panel?

i.light's lifetime is comparable with that of an excellent precast concrete panel. Moreover, transparency does not change over time as the resins have been properly treated to prevent adverse effects of UV rays.

11. What major works have been built with i.light to date?

The Italian Pavilion at Shanghai's Expo 2010 Shanghai is the product's test accomplishment. Its great success has convinced Italcementi to start marketing the product in 2011.

12. What can it be used for?

It may be used mainly as the outer envelope of curtain walls for museums, commercial and exhibition spaces, or as inner partitions. **i.light** is highly customizable and therefore most suitable for use in both design and arts.

13. What customizations are possible?

The 'Shanghai' **i.light** panel is just a first design example. New versions entailing a different colour of the cementitious portion, variations in the translucent portion as well as different shapes for both panels and plastic elements are being developed. Therefore, the final panel may not necessarily be rectangular; it may also include different transparent elements of varied shape forming a drawing or an inscription and come in a mix of different colours.



14. Can i.light be considered an eco-friendly material?

Together with the TX Active ® "smog-eating" cement, by now renowned and applied worldwide and included among the innovative products on display at the Shanghai Expo 2010, the new "transparent cement" follows in Italcementi Research's tradition for eco-friendly products. Thanks to its ability to carry light, "transparent cement" saves electricity for interior lighting of buildings thereby contributing to overall energy saving.

15. Are i.light panels recyclable?

i.light panels are composed of a fibre-reinforced cementitious portion with polymer-based inserts. Like concrete, the cementitious portion can be recycled and reused in construction. Plastic inserts have a thermoplastic behaviour and are therefore reusable as well.

16. How much electricity could be saved using i.light?

We are working with university laboratories to define working standard to properly quantify the amount of energy saved.

17. What's the state of the art of i.light marketing?

After developing the panels' production technology, Italcementi has forged partnership with several precast companies will be manufacturing and marketing the final products. Italcementi will provide them with the process know-how and the cementitious preparation. Marketing will start soon in Thailand and Italy.

18. What's the price of i.light?

Since the product sales are also going to be managed by the partnering precasters, the final price will depend on the production processes, the trade policies as well as the raw materials they decide to implement. In general, we expect the price of a panel to be an order of magnitude lower than that of materials with fibres optics, the price of which is around 2000 €/m².

19. Is there any patent pending on i.light?

Italcementi has filed two worldwide patent applications on the product.

Italcementi S.p.A.
Via G. Camozzi 124
24121 Bergamo - Italia
T 035 396 552
www.italcementigroup.com

Media Relations
press@italcementi.it

Commercial Contacts
info-i.light@itcgr.net

Updated May 2012

