

The impact of digital printing with ceramic inks on decorative and functional glass

Bernd Hoffman* explains the benefits of digital printing technology and outlines recent examples of how it has been used in projects worldwide.

◀ The Fletcher Hotel in Amsterdam

Digital printing technology was introduced to the glass printing industry less than two decades ago. Initially printing with a single spot colour, black, the technology made inroads in the automotive industry. Over time additional ceramic ink colours were developed and the printing technology advanced to where many bright colours could be digitally mixed¹ and printed simultaneously. These advances paved the way for the first use of digital ceramic in-glass printing in architecture, and in 2007 a satellite image of the town of Eiserfeld was printed on the Eiserfeld Municipal Bank glass façade². Digital printing with ceramic inks on glass has since had a visible impact on architectural glass.

Decorative glass has traditionally been considered to be any glass with a basic dot or line pattern or spandrel glass, and it often included some functionality; namely solar heat gain reduction. Today the definition, role, cost-effectiveness, and added value of decorative glass with functionality has expanded far beyond the traditional description mainly due to the technological advances of the past few years. These advances must be examined more closely to better understand the modern day capabilities and advantages of digitally printing on glass.

Dip-Tech, manufacturer of Digital Ceramic In-Glass Printers and Digital Ceramic Inks, is at the forefront of the revolution in decorative and functional glass. It was the first to overcome the challenges of adapting digital printing technology to glass and ceramic inks. Key challenges included printing on a non-absorbent and transparent surface, developing durable inorganic ceramic

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inks in a multitude of colours, and maintaining circulation and jetting through a print head an ink comprised of sub-micron particles of glass. There was also the challenge of integrating graphic digitalisation standards into the glass printing workflow.

Dip-Tech offers solutions designed for all interior and exterior printed glass applications, spanning artistic and functional requirements. AR Series Printers are in-glass digital printers that jet specially designed Digital Ceramic Inks. The Single Pass Printing feature is comprised of Drop Fixation³ and an integrated inline dryer that together make single registration for multi-layer printing, inline double vision⁴ and overall high-resolution package possible. Printing Throughput Efficiency focuses speed; High-Definition Print Heads and a smooth colour switch increase print speed so that overall throughput increases without losing quality.

Dip-Tech's portfolio of inks includes six colours that combine to mimic CMYK, and functional inks such as Slip-Resistance, Digital Etch, and Conductive. The inks meet industry standards for durability and are proven to be resistant to scratching, UV and weather.

DXP XL software is a design-to-glass workflow solution. Features such as digital mixing for colour matching and opacity control allow the software to turn standard graphics files into ready-to-print images that are tuned for optimal results with printing on glass.

The fully integrated solution makes it possible for glass processors to print finer, sharper and smaller elements in full colour with smooth transitions, allowing the images to come to life the way the designer envisioned.

The impact Dip-Tech has had on decorative and functional glass has been game-changing. The ability to print any graphic illustration or photorealistic file, the capability to imitate materials such as wood, marble, and stone, and adding the illusion of textures have drastically expanded the scope of decorative glass. The combination of decorative glass and functionality makes glass more versatile than was previously thought possible.

Digital Ceramic In-Glass Printing has raised the bar in terms of potential applications, but it is also important to note that the use of digitally printed glass is more cost-effective than using natural resources, while bringing added value. The façade of the Origami Building⁵ in



► The AR6000 digital ceramic in-glass printer.

Paris was originally intended to be created from marble, but the architects ultimately opted for digitally printed glass to maintain control of structural and aesthetic quality and to avoid the danger of decrystallisation that can occur with extremely thin slices of marble. The final product is affordable and offers a higher level of protection and exclusivity than if it had been made from natural resources.

Many architects have made the bold choice to use digitally printed glass in projects around the world. Each reflects the new possibilities in decorative glass.

Traditional dot pattern

The intricate construction of the glass dome of Mansueto Library⁶ at the University of Chicago, USA, with its distinctive panels, uses solar control to reduce energy needs. The traditional dot pattern was used to create a double vision effect with black dots printed directly on top of white dots. The digital printing allowed for precisely controlled density and placement on all the different sized panels, enabling the dome's glass to block 73% of solar heat and 99% of UV light, while letting through 50% of visible light.

Functional work of art

The Fletcher Hotel⁷ in Amsterdam marks the entrance to the city with its façade. The circular motif and shades of blue enhanced with the printed blue dots on the bent glass interact with the sky. The façade is comprised of an inner and outer shell which provides functionality in noise reduction and lighting, and it is not just for aesthetics.

The beauty and functionality of the structure can be appreciated day and night.

Individualised glass

The Glass Farm⁸ in Holland was inspired by the traditional Schijndel farm. All of the remaining historical local farm buildings were photographed and the images were pieced together to create the overall image that was printed on the glass. The printing capabilities allowed designers to play with the levels of translucency depending on the need

for light and views throughout the structure. The theme of the glass design expresses the history of the town.

Façade Replacement

A project at 618 S. Michigan Avenue, Columbia College, Chicago exemplifies all of the previously-mentioned benefits.

The new façade was designed by Gensler, printed by Oldcastle in the USA, and completed in 2012. The original building designed in 1913 featured a grid-like façade, with large windows and minimal masonry surfaces. In 1958, the original terra cotta façade was removed and replaced with a modern curtain wall, but in 2010 the City of Chicago determined the curtain wall had to be replaced for safety reasons. Columbia College Chicago, the current owner, explored façade replacement options, including replicating the original terra cotta. However, according to Alicia Berg, Vice President of Campus Environment, as reported by the Chicago Tribune's Cityscapes Journal⁹, it would have cost an estimated \$8 - \$10 million compared to the \$2.5 million for replicating the original look with digitally printed glass. Use of original materials was not an option, and neither was traditional glass printing technology.

Gensler's project director David Broz, and technical architect Sarah Jacobson said: "Digital printing gave us the design flexibility that we would not have had with traditional ceramic frit silk screening. We were able to create a custom image for unique glass panels that could scale the entire façade. The logistics and cost to do this with digital ceramic printing made it feasible."

The result was the image of the original terra cotta façade with a dot-matrix pattern whose graphic elements are small birds. In addition to reducing bird collision, the frit also covers 46% of the

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► Columbia College Chicago, USA.

glazing area, reducing the overall solar gain of the facade. With this one project Gensler captured history, art, and multi functionality, all with full consideration of the project's bottom line.

Broz and Jacobson of Gensler also stated: "Along with steel and concrete, glass is one of the basic elements of contemporary architecture, and the use of glass in architectural projects is a constant."

Expanding on this point, Dip-Tech CEO, Yariv Matzliach said: "Dip-Tech is turning a commodity into a high-end

revenue product for glass processors. The ROI is attainable; glass processors who turn as little as 2% of their business into printed glass will feel the direct impact on their bottom line."

The impact of digital printing with ceramic inks on decorative and functional glass is being strongly felt across the glass and architectural worlds. In the words of Broz and Jacobson: "This technology really opens up a range of possibilities for architectural expression. It allows for a degree of customisation that was not achievable before". Glass fabricators must take heed and prepare to become part of the digital revolution and future of decorated glass. ■

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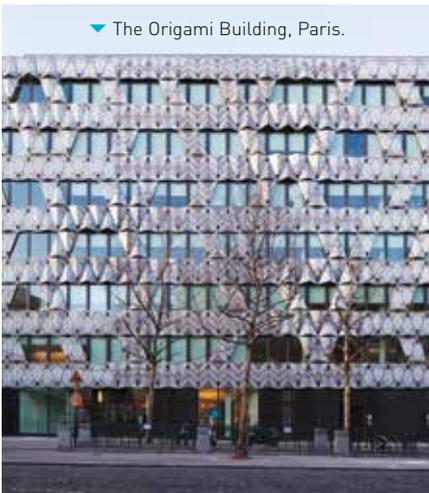
References

- 1 Digital mixing is the colour mix produced during printing which is determined through the graphic process with ink percentages.
- 2 Glass Processor: Interpane Sicherheitsglas GmbH, Glass Designer: Bernd "Bernie" Hoffman, completed in 2007.
- 3 Drop Fixation is the jetting and immediate drying of a drop of ink. The drop is immediately



- "fixed" in place to prevent dot gain.
- 4 Double vVision is creating a different vision depending on which side of the glass is being viewed it is achieved by printing different graphics one on top of the other.
 - 5 Glass Processor: INTERPANE Sicherheitsglas & Architect Manuelle Gautrand, completed in 2011
 - 6 Glass Processor: FLACHGLAS Wernberg GMBH, Germany & Architect: Murphy & Jahn, completed in 2011
 - 7 Glass Processor: Lisee Shanghai & Architect: Benthem Crouwel Architects, completed 2013
 - 8 Glass Processor: AGC Glass Europe & Architect: MVRDV, completed in 2013
 - 9 <http://featuresblogs.chicagotribune.com/the-skyline/2011/11/for-decades-now-the-old-office-building-at-618-s-michigan-ave-has-been-a-minor-blot-on-the-magnificence-of-chicagos.html>

▼ The Origami Building, Paris.



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