# GLASS INNOVATION EXPERTS

## Weaving nanoscience into architecture: The story behind Carnegie Mellon's Scott Hall

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Architect Michelle LaFoe discusses the decision to choose NARIMA dichroic color effect glass for their latest project.

When Michelle LaFoe and Isaac Campbell set out with a team of architects to design the new 109,000 square-foot Nanoscience, Bioscience and Energy Technologies Building for the College of Engineering at Carnegie Mellon University, they had one overarching challenge:

How to capture in the building's exterior the science and engineering work being done in the interior.

The result, known as Scott Hall on campus, is stunning. The choices and insights Michelle, Isaac and the OFFICE 52 Architecture design team made to arrive at this final product are just as interesting.

Michelle spoke with us to explain how this project was brought to life, and the ways in which it was inspired by the research taking place inside the building - especially nanotechnology.


Isaac Campbell, AIA and Michelle LaFoe, AIA Co-founders of OFFICE 52 Architecture, Photo by Dina Avila.

# How did you conceive the design of this building?

One of the things that was really exciting about this project was the prospect of using architecture to weave together elements of what happens inside the building through innovative glass fabrication techniques.

The science and research that takes place inside is interdisciplinary, collaborative, and cutting-edge. It draws expertise from a lot of different scientific and research communities.

Scott Hall houses a class 10 | 100 research-grade clean room for nano-scale exploration, the Department of Biomedical Engineering, the Wilton E. Scott Institute for Energy Innovation, the Disruptive Health Technologies Institute, and the Engineering Research Accelerator.

We conceived a curtain wall that metaphorically embodies concepts of nanoscience, scale, photons, and light, making the interior and exterior spaces of Scott Hall glow with luminosity.

Dichroic glass used on facade of Scott Hall at Carnegie Mellon University, photo by Jeremy Bittermann.

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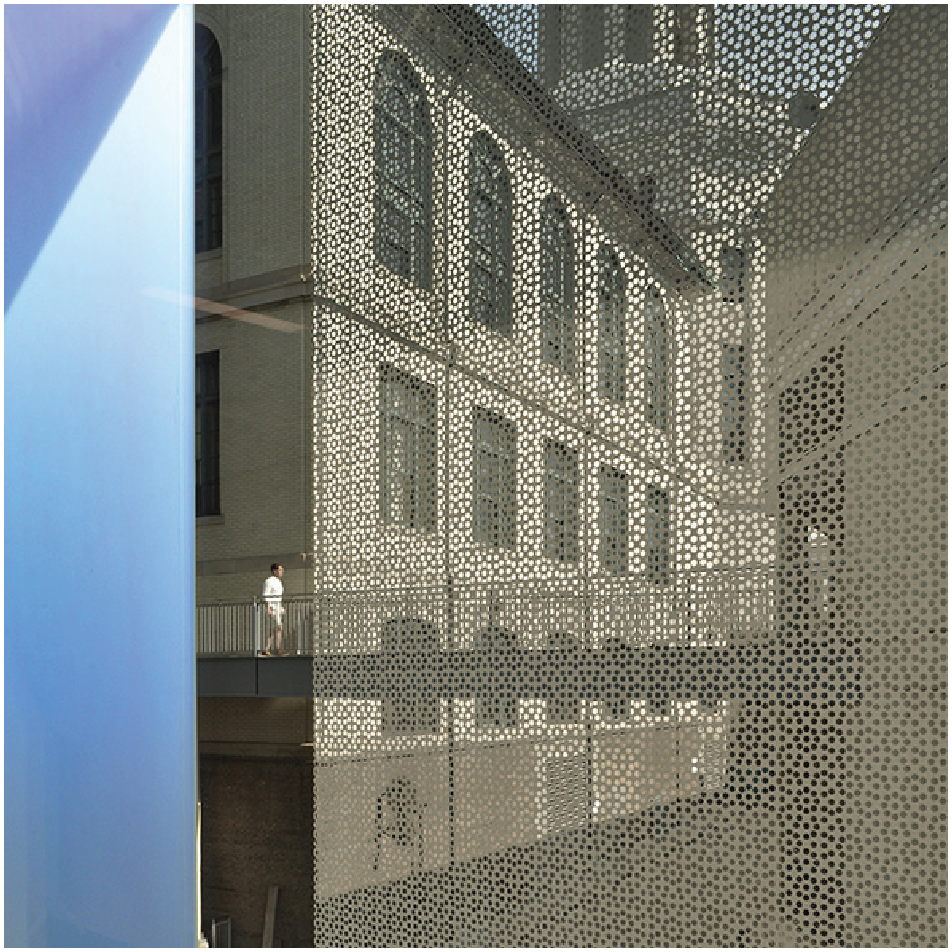
glass made of ideas

# How did you achieve those effects? What's the science behind them?



Close up of the NARIMA blue-sliver used for the vertical fins and blue-gold used for the vertical fins, photo by Isaac Campbell.

Dichroic glass transmits certain colors and reflects others because certain wavelengths of light pass through the metal oxides vaporized onto the glass surface in thicknesses less than 100 nanometers each. That means that dichroic glass appears to be different colors depending on where you're standing or the angle of sunlight.

After conducting a series of light and color studies with SCHOTT NARIMA glass samples in our design studio, we decided to use the NARIMA blue-silver for the vertical fins and blue-gold for the horizontal.

We custom designed the exterior glass sun-shading fins, which consist of a dichroic glass center pane laminated between two low-iron exterior panes, one of which is frosted. They are attached via custom stainless steel clips.

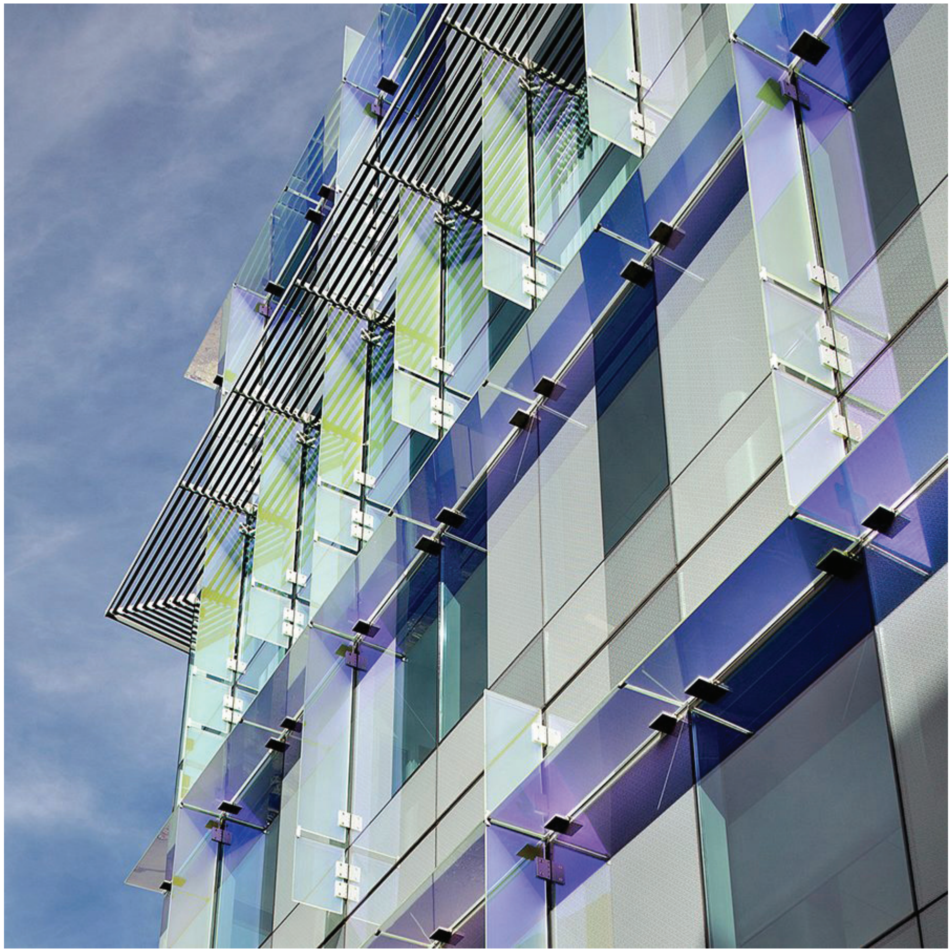
Our custom design of the ceramic glass frit on the number two surface of the insulated glass unit, to which the NARIMA sun-shading fins are attached, is a geometric representation of a photonic quasicrystal structure, which is used in nanoscience as an optical material.

# How does the design relate to nanoscience?

The frit can be read at a variety of scales - as semi-transparent bands from farther away to a dot matrix when closer. The perceived change in scale is similar to what is seen in nanoscience, in which materials look and behave differently at different scales.

Quasicrystals, for example, have a structure that doesn't repeat the way a crystal's structure does. Instead, it has rotational symmetry, meaning it looks the same no matter which way you turn it. When scientists are imaging a regular crystal, they can deduce the entire structure from a few molecules. For a quasicrystal, they can't; the scale at which it's observed impacts the understanding of it.

This structure lends photonic quasicrystals some interesting properties, including one that only lets certain wavelengths of light through. This influences optical transmission and reflectivity, and can be used in telecommunications and in scanning and imaging. Thus the ceramic frit and NARIMA glass add visual depth and patterns to create an evocative world of constantly changing color, texture, and light, the perception of which changes with the seasons, angle, intensity of the sunlight, and the viewer's position.



The facade of the new 109,000 square-foot Nanoscience, Bioscience and Energy Technologies Building for the College of Engineering at Carnegie Mellon University, photo by Jeremy Bittermann.

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