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## The World's Tiniest Building Blocks

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By Amanda Marsh

With the recent modification of daylight- saving time dates and Al Gore's campaign to reduce the effects of global climate change, energy conservation and the environmental impact of our personal and business practices are front and center in the country's collective consciousness. The building sector is also proving itself to be in the loop, as developers and architects are increasingly incorporating green and sustainable components into their designs. Nanotechnology-based products are joining the list of options.

Nanotechnology, the science of controlling matter on a one-to-100 nanometer—or one-billionth-to-100-billionths of a meter scale—has the potential to reduce carbon dioxide emissions and energy costs and create more durable products that require less maintenance. Offering some context to the nanoscale, the National Nanotechnology Initiative measures the thickness of a sheet of paper at 100,000 nanometers.

Nanotechnology "is in a period of rapid evolution," said David Sykes, managing partner for advisory and equity investment firm Remington Partners L.L.C. and lead manager for NanoNexis, the premier U.S. conference on the subject. He noted that the surge of capital into nanotechnology research and development and into the study of its effects on people and the environment, amounts to \$10 billion worldwide, including \$3.5 billion in federal spending.

Approximately 50 manufacturers of glass, insulation, steel, lighting, drywall, textiles, concrete, coatings and paint and energy and HVAC systems make up the nanotechnology building materials market, Sykes said. Some construction tools and electronics also integrate the technology.

Companies within the commercial construction industry have shown some demand for better traditional building products, noted R.J. Brennan, director & associate for IA Interior Architects. Nanotechnology materials on the market include composite steel, which is lighter than standard steel and corrosion-resistant and reduces the amount needed per project; glass that can shift from translucent to transparent at the flip of a switch; titanium dioxide-coated concrete that absorbs pollution; self-cleaning glass, also enabled by titanium dioxide; lighter drywall made of gypsum; and paints, fabrics and carpeting that repel moisture, staining and bacteria.

IA Interior Architects sometimes applies a sound-inhibiting silica aerogel to the panels of its demountable walls. That comes in handy when, for instance, a floor-plan change places noisy conference rooms near individual workstations. "We applied the aerogel to the skin of the panels, and it had an amazing impact on the acoustics of the meeting spaces," Brennan said. "It's almost like you're in a sound studio."

In healthcare facilities, the hard counters, tables and floors lead to concern about moisture and bacteria growth. "Enter the current generation of nano-enabled carpet and wall coverings, which are antimicrobial, as well as dirt and wear resistant," Brennan said. He noted that healthcare patients' recoveries positively correlate to their attitudes, so nanotechnology-based improvements of healthcare facilities could provide twice the benefit.

### The Nano Challenge

Even with the recent strides in nanotechnology, the new products face challenges gaining a foothold in the construction industry. Many developers and architects are not familiar with such products' benefits, said registered architect

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Brad Cronk, who heads project-strategy integration for construction law firm LePatner & Associates L.L.P. Facing a lack of available information, developers and architects—especially mom-and-pop operations—seem averse to spending money to educate themselves on such issues as whether the microscopic yet powerful particles could be harmful to workers, consumers or the environment, he said.

For this reason, many developers are uncomfortable commenting on nanotechnology-based products. Sykes also mentioned that the general public's suspicion of the technology could pressure builders to stay silent. The Woodrow Wilson International Center for Scholars "has been making a lot of noise recently about the societal effects," Sykes explained. He added that the center has requested more information from manufacturers about the safety of nanotechnology products and how the science affects elements like air and water. "This makes some people nervous."

Some developers and architects are not aware that they are using building products created using nanotechnology, Sykes said. He stated that some manufacturers do not disclose the fact that a product uses nanotechnology, which helps them produce high-quality products, in an effort to maintain an advantage by preventing competitors from following suit.

Additionally, many manufacturers do not know how to integrate or market them for commercial applications, Brennan said. "(The sector) needs to have a process that allows us to find opportunities that are not jumping out at you."

And some contractors and developers simply are not willing to buy into nanotechnology. "Some do not want to make that change." He suggested that developers scrutinize manufacturers' data to determine if a product will add to its sustainable design strategy. He also recommended that developers take a look at the life-cycle savings of nanotechnology-based products, noting that many will reveal better value and cost savings in the long run than do traditional products. Italcementi Group's TX Arca cement, which is mixed with titanium dioxide, for instance, is self cleaning and removes pollutants from the air. For Brennan, the product's value makes it an obvious choice. "(It's a) 30 to 40 percent one-time premium offset by a lifetime of no cleaning, no painting. And it cleans the air." n

Even the United Nations has addressed sustainable development and its impact on the environment. The United Nations Environment Programme's Sustainable Construction and Building Initiative released a report at the end of March that noted that a mix of appropriate government regulation, greater use of energy-saving technologies and behavioral change can substantially reduce carbon dioxide emissions from commercial buildings, which account for 30 to 40 percent of global energy use. If developers apply more ambitious standards to new and existing buildings, they could reduce the world's energy consumption by one-fifth and carbon dioxide emissions by as many as 45 million tons within three years, according to the report.

The partnership noted that several governing bodies, including Australia, Cuba and the European Union, have considered phasing out or banning incandescent light bulbs. The International Energy Agency estimates that a global switch to compact florescent bulbs would reduce carbon dioxide emissions by 460 million tons by 2010.

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