GLASS CANADA Endorsed by the Canadian Glass Association

GO NANO: Nano-scale spray coatings compete well with film and low-E glass.

Written by: Peter Tung, eTime Energy, and Leon Wasser, Wasser Resources

Reflective glass is made by applying a reflective metal-based (usually silver) film or coating onto the glass. Unlike tinted glass, this film or coating works by reflecting the solar radiation away from the glass. The more reflective the film or coating, the more of the visible spectrum of solar radiation is reflected away, creating a mirror-like look to the glass and reducing visibility. The more reflective the coating, the more difficult it is to see through the glass.

When it comes to retrofitting older buildings to meet modern energy standards, a solution that avoids removal and replacement of the windows is always preferred. New nano coatings can provide that solution in some situations, saving building owners money and time without losing use of the building.

Technological developments over the last decade have addressed these shortcomings and improved performance. Low emission, or low-E, glass has a microscopically thin, virtually invisible coating usually made from metallic oxide that is highly reflective of thermal radiation. However, unlike earlier tinted and reflective glass, low-E glass is more transparent to visible solar radiation. When applied to an interior surface of a single pane window or to the interior-facing surface of the exterior light of an IGU, it allows sunlight to penetrate into the building interior but traps the thermal radiation on the other side of the glass by reflecting it back to sun.

In recent years, different types of coatings have been developed to allow even more of the visible solar radiation to penetrate the glass. These coatings are referred to as spectrally selective coatings because they allow penetration of some segments of the solar spectrum (visible light) while reflecting other segments (infrared and UV) of the solar spectrum. Low-E/high solar gain (visible and infrared radiation) coatings are best for colder, heat-dominated climates, while low-E/low solar gain (visible radiation only) coatings are best in hotter, cooling-dominated climates.

Spray-on nano-scale coatings, such as eTime Energy's HPS Heatshield Transparent, are new products that possess some unique attributes that can potentially give it a near-term competitive advantage for certain product applications. Specifically, HPS Heatshield's simple field application process makes the product uniquely well suited for retrofitting older single pane and non-low-E coated IGUs, skylights and doors.

Its nearest main competitors in this market segment are magnetic sputter vacuum deposition or sputter coating (soft coating) applied metallic-oxide coatings on polymer film because of their ability to be installed in the field on existing glazing. Like their glass coating counterparts, insulating films have gone through technological improvements from three standpoints: energy performance, optical clarity and durability. However, these products continue to face issues with durability including shrinkage, scratching, bubble, pealing, ease of removal, optical clarity and thermal performance.

Review of the range of products currently on the market suggests that while manufacturers are increasingly focused on driving energy efficiency, product features and performance characteristics continue to be tailored principally for southern, cooling-dominated markets. For example, only a few products currently on the market have U-values and SHGCs that classify them as low-E/high solar gain products. Still fewer can be classified as spectrally selective low-E/high solar gain. In contrast, the stated performance characteristics for HPS Heatshield are suited for both northern, heating-dominated and southern, cooling-dominated climates.

Other than window film, the only alternative to field-applied nano coating is to replace existing glazing systems with new IGUs coated with low-E coating. This is costly. These products have much stronger thermal and solar protection performance data than window film, because much of the performance is derived from the assembly rather than the insulating coatings alone. If the additional efficiencies provided by the IGU assembly are disregarded, the performance characteristics of both pyrolitic and sputter glass low-E coatings appear to be comparable to the stated performance characteristics of nano-scale sprays. Low-E coating has to be applied in factory, inside two sealed glass compartments that are filled with gas. If the IGU leaks in later days, which will happen regardless of how good the sealer is, low-E coating will oxidize and make the coating useless. Nano coating can avoid this problem. The return of investment versus a low-E window is normally five to seven times that of a nano coating application.

Nano coating does not require expensive equipment to coat the glass. Low-E window coating production lines cost millions of dollars. Its major ingredients, nano-scale particles of titanium nitride, have a special property which will selectively absorb, block and reflect near-infrared radiation to achieve the energy conservation purpose. Because it is using such tiny particles, the coating will bond to the glass permanently. It blocks over 90 per cent of UV light as well, preventing damage to humans and furniture.

Both low-E coating and nano coatings can effectively cut down the total solar energy transmittance, especially in near-infrared 1,000- to 2,500-nanometer range. But nano coatings are much greener, environmentally friendly products. They have low VOC, lead and mercury content. Nano coating cuts down on landfill use compared to removing and replacing existing IGUs with low-E.

Even though both technologies have the ability to block the heat, they work on different principles. Low-E works by coating the inside glass surfaces to reflect the sun light to block heat. Nano coatings work by absorbing sunlight then dispersing the heat through secondary radiation. If nano glass coating is applied in a region with dramatic differences between indoor and outdoor temperatures, such as Canada, it can conserve heat in the winter.

Like-to-like comparisons among these three are still tricky, however, for two reasons. First, most performance data provided for hard and soft glass coatings are usually given as part of an IGU assembly, not for the coatings alone or for single-glazed windows.

Second, window film manufacturers do not always report performance using the same metrics. Because of their target market, window-film makers have traditionally reported performance data which focus on solar protection, not on energy efficiency specifically.

Despite the challenges associated with comparing product performance, available market data do support the assertion that nano coatings offer a significant and immediate market opportunity, especially in the retrofit market for existing glazing systems.

About the authors

Peter Tung, P. Eng., is CEO of ETime Energy.
ETime Energy is the developer of the innovative eTime HPS Heatshield nanotechnology window coating.

Leon Wasser, MBA, P.Eng., is president of Wasser Resources Inc.
Wasser Resources provides product development, marketing and sales support to Canadian innovation companies to help them achieve the full economic potential of their creations and inventions.