Photo by Jim Bartsch

Windows 101:

More than just letting the light in

By Dennis Allen

Windows perform more functions than any other component of our buildings. They provide daylight, natural ventilation, and glare control. They control fading, sound intrusion, water tightness, and thermal buffering. They determine condensation, durability, clarity of views, and maintenance schedules. And, of course, they need to be attractive and affordable.

Innovations in glazing technology have transformed window performance over the past 30 years from being one of the worst-performing elements of a home to now being one of the best and most versatile. Because of all the functions windows perform, it's advisable to purchase the highest performance units you can afford. Windows now have standardized labels that list insulating effectiveness, solar heat gain (amount of heat that passes through a window), and visible transmittance (control of daylight, views, glare, and fading).

There are many types of coatings that can now be added to glass. The most common, a low-E coating (low-emittance), improves the insulating value of a window, roughly equivalent to another pane of glass. These coatings keep the summer heat out and the winter heat in. Most new houses today have windows with two low-E coatings (low-E squared).

Other films, using thermochromic or photochromic applications can now darken transparent glass in bright sunshine. When the temperature of the glass increases from the sun's infrared rays, the transparency decreases, and the glass becomes clouded or frosted. With photochromic treatments, the glass occludes because of increased light intensity. Shades, awnings, or drapes are no longer needed.

Window self-darkening coatings were adopted from eyeglass lenses that change their tint in sunlight. These perpetually reversible rearrangements of molecules that respond to solar radiation yield big energy savings in a building's air-conditioning demand, sometimes by as much as 25 percent.

The latest window research holds the promise of reducing a building's cooling demand while also generating electricity. When perovskites, highly effective and inexpensive crystals, are injected with a solvent vapor into the gap between the panes of glass, electricity is generated. As temperatures rise, the vapor triggers a chemical reaction that rearranges the crystals into different shapes, increasingly opaque, while simultaneously generating electricity. This progressive blocking and subsequent tinting happen at temperatures ranging from 95-115 degrees Fahrenheit and take only a few seconds to occur.

Swapping out single-glazed windows in old buildings with high performance multiple pane units is costly. A less expensive possibility is to install an insulating window film. The large choice of offerings can yield greater or lesser heat gain, visual clarity, ultraviolet blocking, and insulating values, to name a few of the available options. Low-E films, for a fraction of the cost, can improve a single pane window to insulate almost like a double pane unit with no impact on view (no darkening or distortion) and no fading of rugs, upholstery, or artwork. For reasons of energy savings, modest cost, comfort, and fade protection, low-E window films are important to know about.

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