

Retrofitting for safety & security. Solar control a bright option, too

Safety and security films are a special class of tough, self-adhesive films of high optical clarity, often composed of multiple layers of polyester films adhesively bonded together to form a high-tensile strength "skin" for glass surfaces. American company CPFilms Inc. is a worldwide leading producer of such products.

*Joseph Richard**

CPFILMS INC.

With every threat of terrorist bombings, natural disasters, or industrial accidents, there is a flurry of newspaper reports about the severe human injury and extensive property damage caused by falling-or flying-broken glass. Vandals and thieves systematically attack hapless drivers caught in highway traffic jams or home and business owners by penetrating the weakest entry points of a vehicle or building: the windows. While glass adds sophistication and beauty to a building, it is also fragile. Glass treatment film manufacturers are increasingly, and justifiably, making their case that a class of retrofit products can provide a substantial and cost-effective remedy, with many such products having surprising spin-off benefits. In response to consumer recognition of their value, sales of these products are surging as never before.

One such company, CPFilms Inc. of Martinsville, Virginia, has recently formed

an alliance with DuPont Teijin films, so that their LLumar safety and security film products are now made with polyester substrates under the exclusive DuPont Teijin Mylar® trademark.

There are variations of these products that yield very high solar performance values, and coincidentally add to the visual appeal of architectural design. These products are an excellent way to give commercial buildings a clean, uniform appearance from the outside in situations where every tenant has a different window treatment. Solar control safety films provide the perfect mask to hide the hodge-podge from the outside, yet maintain clear and unobstructed views from the inside.

MEETING CONSUMER NEEDS

The market driver for these specialized film products is clearly a consumer concern for personal safety and security. If glass fragments are the safety issue, the solution is to either prevent the glass from shattering or to safely contain the fragments in the event of breakage to avoid injury. If the concern is rather one of "security," the goal is to convert the relatively fragile glass into a very tough barrier, too tough for a thief to easily penetrate.

While laminated glass is also an effective solution, there are difficulties in retrofit operations. Laminated glass is often more than twice as thick as conventional glass, making removal of old glass and installation of new laminated glass enormously difficult and expensive, often requiring either modification or wholesale replacement of the framing system for each window unit. Thus, the practicality and cost-effectiveness of safety films make them an extremely attractive option.

Cost-effectiveness is enhanced when using solar control versions of these safety films. Increasing oil prices and air-conditioning costs mean that owners prefer high performance products. By blocking a large percentage of radiant heat

energy from the sun, metallized or sputtered security films can pay for themselves via a dramatic reduction in the solar heat loads, reducing air conditioning costs. Energy savings can recover the cost of installation generally within 2-3 years in warmer climates or cooler climates with higher energy costs. (Energy analysis software, incorporating DOE-2 modeling standards, is available to provide reliable annual energy savings estimates.)

Cost considerations such as this are driving decisions in many countries to opt for the use of films in new construction applications, performing film installations on new glass prior to on-site glass installations.

WHAT ARE SAFETY AND SECURITY FILMS?

Put simply, these products comprise a special class of tough, self-adhesive films

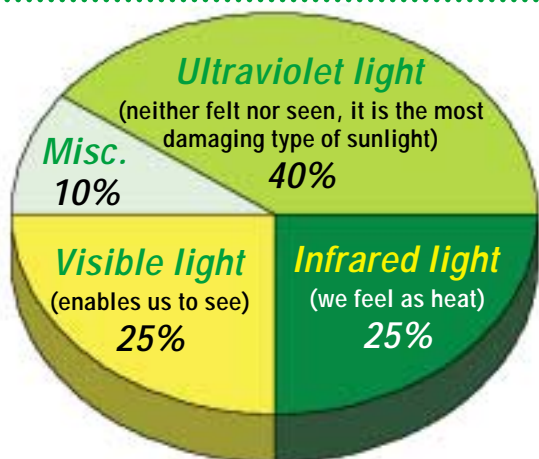
The developer of the Cathay Financial Building in Taipei, Taiwan, chose LLumar 100 micron clear safety film to protect his high profile VIP tenants from the potential hazards of broken glass



of high optical clarity, often composed of multiple layers of polyester films adhesively bonded together to form a heavy gauge, high-tensile strength “skin” for glass surfaces. An extremely aggressive adhesive (protected by a liner until the moment of installation) is used to affix the film to the glass. The qualities of this pressure sensitive mounting adhesive are critical for impact-energy absorption, glass fragment retention, and in conjunction with the toughness of the polyester film, extreme penetration resistance. Installation by professional installers is almost always required since specialized tools and techniques must be used for best performance and appearance. Generally, these films are installed on the interior (room-side) surfaces, but many new products are designed for exterior use in special cases. These films are designed with highly weatherable, ultraviolet- and scratch-resistant coatings.

FILM PRODUCT SELECTION

Consumers have a range a reasons for selecting a given film product. For example, many high-rise buildings with glass facades are designed to feature spectacular views. So architects and occupants prefer glass to be clear and non-reflective, but they still need the benefit of heat reduction. Which product is selected is often strictly dependent on its primary intended function, and this is especially important when it comes to safety and security. In the list of product functions below, we will move up the scale of solar control benefits to the increasingly rigorous requirements of safety and security standards.



Ecco Restaurant, Sao Paulo, Brazil.
Reducing glare and heat enhances comfort while allowing restaurant patrons to enjoy the view

SOLAR/RADIATION CONTROL ...

UV Protection: Virtually all professional glass treatment films, even “clear” ones, do an extraordinarily effective job of blocking the transmission of ultraviolet radiation, the major source of fading, in percentages ranging from 95% to well over 99%. This is an important feature for many reasons.

The medical community is unanimous in their findings linking UV exposure to various forms of skin cancer, from basal and squamous cell carcinoma (associated often with UVB) to the more serious melanoma (increasingly attributed to UVA, which penetrates deeper into the skin to inflict genetic damage). While the earth’s ozone layer and atmosphere block nearly all the UVC radiation from the sun (100-280 nanometers, very short wavelength), and ordinary glass can filter most UVB (280-320nm), very little UVA (320-380nm) is stopped by unprotected glass. Glass treatment films can do the job, restricting the inward flow of UVA through glass to a trickle. The near elimination of UV protects the film itself from rapid degradation, reduces sun damage to floors, draperies, and furnishings, and removes a possible source of melanoma and a known catalyst for a host of other eye and skin disorders.

Glare Reduction: Glass treatment films are wide-ranging in their glare reduction values. They work by either absorbing or reflecting visible light, in ratios that are a function of product construction, with layers of metal alloys, dyes, or various oxides. Glare reduction is often sought to reduce eyestrain, but visible light also carries

substantial heat energy, and in excess can elevate building cooling costs. Certain safety and security films can bring along this added bonus of glare reduction along with an improvement in heat-gain reduction. Glare reduction numbers range from 0-80%.

Heat-Gain Reduction: While reducing visible light transmission is important for heat-gain reduction, the more effective way is to reflect infrared heat energy back to the outdoors. About 53% of the sun's energy lies in the invisible infrared part of the spectrum, and high performance films, even many safety and security films, can do this very well.

It is common for some films to reject 79% of the sun's total incident energy, with actual heat-gain reductions ranging from 1-76% on standard glazing systems.

RF Shielding: While some films selectively block UV, visible light, and infrared radiation, specially formulated glass treatment films can also work to block the emission or penetration of radio frequency signals, especially useful in many high-tech business and government applications.

... PLUS SAFETY & SECURITY

While solar-control and RF screening features of films confer these benefits, there are profoundly important safety benefits that come along with increasing film thickness, various laminate constructions, and improved adhesive and attachment systems.

Protection from "Spontaneous" Glass Failure: The sudden, explosive failure of large tempered glass lites is statistically rather common. Tempered glass is manufactured so that its surfaces are under extreme compressive stress. These surfaces can be invisibly flawed (one culprit has been identified as nickel sulfide inclusions), and over time "spontaneously" burst into a shower of small pellets, opening a home or building to the outside weather. A safety film, at least 2 mils in thickness, can physically hold the shattered mass in single sheet. In high-rise buildings, the

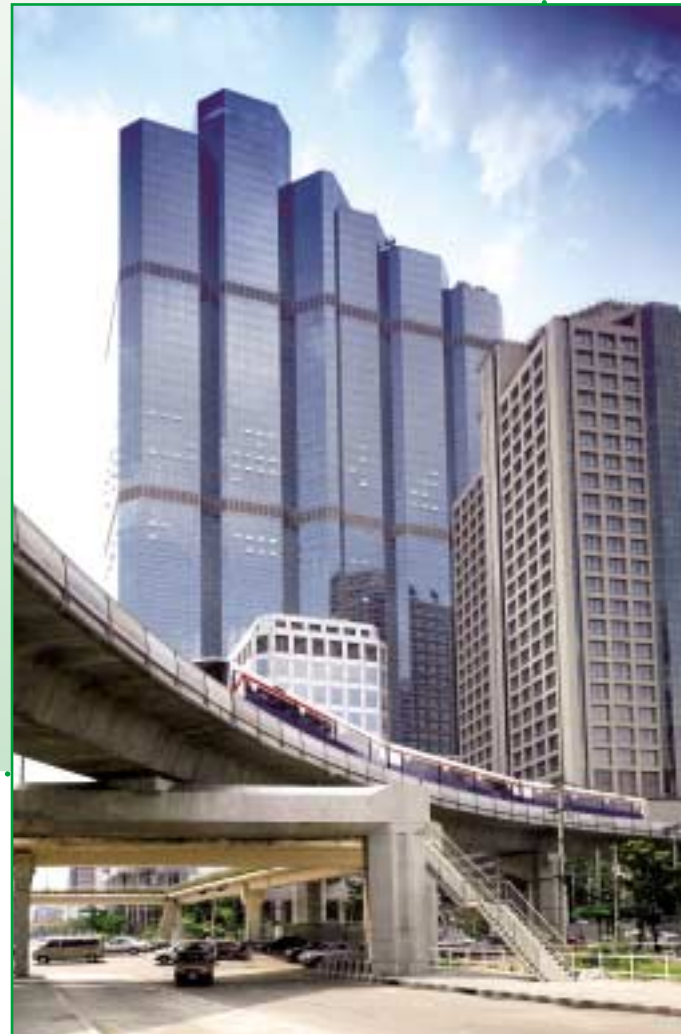
use of a perimeter attachment system can safely maintain the shattered pane in place (often in a completely weatherproof fashion) until it can be replaced.

Personal Injury Protection: One of the most common uses for these films (4 mils or thicker) is simply to upgrade existing glazing to meet safety codes, to prevent or minimize physical injury in the event of breakage. Human impact was the primary concern when the ANSI Z97.1 code was established in the United States in 1972. Testing under this standard was motivated by the need to protect a child running headlong

CASE STUDY WORLD RENOWNED OFFICE COMPLEX IMPROVES SAFETY

Empire Tower in Bangkok, Thailand, one of the world's largest office complexes, features 20,000 panes of glass in its 62-story structure. With all of that glass, shattered windows and falling glass shards were a real concern. T.C.C., the property management company, wanted to ensure that the building's tenants and neighbors were working and living in a safe environment. They sought a retrofit solution that was less cost prohibitive than reglazing. Techno-Sell (Frey) Co., Ltd., Thailand's LLumar distributor, recommended 4-mil. clear safety and security film to solve the problem. Techno Sell contacted the CPFilms technical team to train 26 installers to tackle the massive project. Over 55,000 square meters of 4-mil. safety and security film was installed, including 20,440 square meters of custom-made 4 mil. safety film with weatherable hardcoat that was installed to the exterior surface of the spandrel glass.

Management reports that the film is performing to its function holding the glass well in place. Tenants and neighbors are impressed with the results. In addition the film is providing 95-96% ultraviolet rejection that will help to protect the building's interior furnishings and fabrics from fading.



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into a sliding glass door, and the testing protocol was designed accordingly. LLumar 2- & 4-mil films pass this 100 ft-lb impact test. The largest single building in the world to use a glass treatment film product was for just this purpose: preventing human injury due to flying or falling glass. In 1999, the 62-story Empire Tower in Bangkok, Thailand, required the installation of well over 55,000 square meters of LLumar's clear 4-mil safety film, covering approximately 20,000 panes.

Graffiti Protection: Vandals intent on defacing glass or other smooth surfaces in public places, from shopping malls to restrooms, can be foiled with special "invisible" film applications, 4-7 mils in thickness. Hard-coated films behave like glass when mechanically etched and are highly acid-resistant. Heavy-gauge films with special easy-release adhesives serve as sacrificial surfaces on metal bathroom stalls and mirrors. It's far less expensive

Retail Computer Store, Perth, Australia. The heaviest gauge security films provide a tough barrier to illegal, forced entry

to replace a piece of film than a huge storefront window or bathroom fixture.

Blast Hazard Mitigation: Explosions, either from industrial accidents or terrorist bombs, cause powerful pressure waves that strike glass, shattering it into a lethal spray of high-speed shards. In standard testing, LLumar 4- and 7-mil security films installed on 6mm annealed glass produced protection with almost all glass shards held together by the security film and no glass traveling farther than 3 meters from the window. Adding a four-sided attachment system achieved a higher level of protection, with all glass maintained within the frame. (Testing involved the use of 190.5 kg of C-4 explosive, detonated at 58 meters from test structure, with nominal peak pressure of 0.239 kPa. Test reports are available from CPFilms Inc.)

Forced Entry Barrier: Malicious forced entry during burglary attempts often targets the windows of storefronts, homes and office buildings. Heavy-gauge films, up to 15 mils in thickness, provide astonishingly effective penetration barriers, especially in inside/outside dual-surface installations. (15-mil on the inner surface with 4mil on the outer surface can easily meet UL 972 testing protocols.)

One of the curious things about all of these film products is that they are virtually invisible to the casual observer, and thus, to the chagrin of installers, do not advertise themselves well. Nevertheless, word is increasingly circulating about the important benefits these products have to offer. No greater proof of this is the fact that, according to CPFilms, their LLumar safety and security films are installed in many US Embassies and other government buildings around the world. And with the range of spin-off benefits and special-purpose applications enumerated here, the surge in sales is likely to continue for the foreseeable future. ■

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