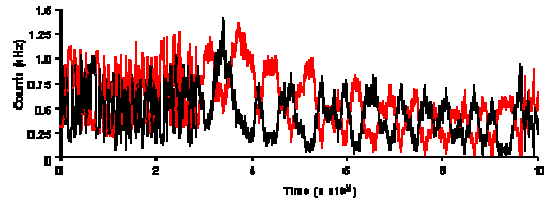


- General
- Technical
- Advantages and benefits
- Energy Conservation



General	
Questions	Answers
What are SPD – smart glass™ products?	<p>SPD – smart glass products integrate suspended particle device technology.</p> <p>This film-based technology allows users to instantly and precisely control how clear or dark glass or plastic is, and to adjust the light transmission by either turning a knob or having the device adjust itself by means of a photocell or other common sensing or control device (e.g. a rheostat).</p>
What types of products can be made?	<ul style="list-style-type: none"> <li>• Architectural windows, window coverings, skylights and interior partitions.</li> <li>• Automotive windows, mirrors, sunroofs, sunvisors, and sunshades. Sunglasses, prescription glasses, ski goggles, helmets, and visors.</li> <li>• Brighter and easier-to-read display screens for laptop computers, cellular telephones, instrument panels, electronic games, and devices such as personal digital assistants.</li> <li>• Advertising displays, billboards, and road signs.</li> </ul>
How does the technology work?	<p>Suspended particle devices, more frequently described as "SPD's" or "light valves," use either a liquid suspension or a film within which droplets of liquid suspension are distributed. Light-absorbing microscopic particles are dispersed within the liquid suspension. The liquid suspension or film is then enclosed between two glass or plastic plates coated with a transparent conductive material.</p> <p>When an electrical voltage is applied, the particles are forced to align. This gives users a range of transparency where light transmission can be rapidly varied to any degree desired depending upon the voltage applied.</p>



Technical	
Questions	Answers
What is the range of changeable light transmission?	First Generation SPD : Transmission ranges (0.5-30%, 2-35%, 5-45% and 10-55%) Next Generation SPD : Ultra Dark – 60, Dark – 64, Medium – 68, Light -75
Is the light transmission continuously changeable?	Yes. One major advantage of SPD technology is that the user can "tune" or adjust light transmission instantly to meet a user's specific preferences.
Are there any unwanted colors?	No. The light absorbing particles currently used, block all areas of the visible spectrum except for dark blue. Thus, when in the "off" (dark) state, the products have a blue hue because dark blue light is the only light being transmitted. However this tint is basically color neutral so you will be able to see different colors through SPD windows and other products.
What is the largest possible size of a product using SPD technology?	Unlike electrochromic light control products, which exhibit some performance degradation as the size of a medium (a window, for example) increases, the response time of SPD technology is not affected by size. The only limiting factor to the size of an SPD-Smart™ product is the width of the coating web presses used to make SPD film. These machines typically coat 5- and 6-foot wide regular films. It is possible that suppliers will offer SPD film in sizes up to this width. Currently, SPD film and glass is being produced with a maximum width of 1.2 meters (47.24 inches). Large glass panels up to 98.4 inches tall are currently available in flat or curved glass.
What is the amount of time needed to change tint?	Typically, a complete tint change takes about one to two seconds, regardless of the size of the product (e.g. a small car window or a large commercial window).
What is the operating temperature range?	Working at temperatures from -40C to +120C (-40F to +248F). At temperatures below -40C, the switching speed may slow somewhat. However, even at such an unusually cold temperature, SPD's switching speed still is significantly faster than that of a product using electrochromic technology.
About how much power is needed?	At line voltage, a maximum of about 0.06 watts of power per square foot. This occurs when the SPD product is in its fully clear state. <b>No power</b> is used when the product is in the fully dark state. When operating at light transmission levels in between these two points, the power requirements are correspondingly lower than the maximum. SPD devices can operate at a wide range of voltages and frequencies, but have maximum efficiency in the 5 to 60 volt range. Exact voltage depends in part upon the thickness of the SPD film used for a specific application.
What kinds of weight considerations are posed by the use of these products?	SPD film can be produced as thin as 1/1000 of an inch thick or less. Thus, the incremental weight of the film is minuscule. The film is then surrounded by conductive-coated glass or plastic that can be as thick or as thin as one would like. The only additional weight is for the small gauge wiring and switches needed to operate the products. In some cases such as window applications, the minimal incremental weight of the film, wiring and switches likely will be more than offset by the avoidance of the need for shades, blinds or curtains.
Can SPD technology be applied to plastic products?	Yes.
How is SPD film incorporated into a SPD product?	SPD film is placed between either glass or plastic material, with the film covering the entire surface of the product. Once the film is in place, "leads" on the film are connected to standard electrical wiring systems that, for example, are found in homes, buildings or vehicles. The leads also can be easily connected to a battery. After the SPD product is installed, the amount of light transmitted can be controlled manually or automatically
What is the risk of toxicity, fire or explosion?	The product inputs used to produce SPD film are not hazardous nor are they flammable. In fact, SPD film has passed stringent FAA flammability tests for use in aircraft.
What is the expected lifetime of SPD film?	Based on testing, SPD film performs well even after years of continuous on and off cycling (millions of cycles). In addition, SPD film's performance does not appear to be adversely affected by power surges or other significant electrical impacts. Conversely, electrochromic products have been shown to be adversely affected by even minor electrical surges.



<b>Advantages and benefits</b>	
<b>Questions</b>	<b>Answers</b>
What are the advantages?	<ul style="list-style-type: none"> <li>• Can be applied to curved surfaces, which expands the scope of potential end-products.</li> <li>• Minimizes concerns about leakage.</li> <li>• Opens up retrofit possibilities for products like architectural windows and automotive sunroofs.</li> <li>• Can be mass-produced on high-speed coaters and easily integrated into end-products</li> </ul>
What are the benefits?	<ul style="list-style-type: none"> <li>• Nearly instantaneous control of light.</li> <li>• Improvement in users' comfort and privacy.</li> <li>• Greater security.</li> <li>• Energy savings.</li> <li>• Cost-effectiveness relative to either custom shades or other smart window technologies.</li> <li>• Durability.</li> <li>• Specific control over the exact amount of light transmitted.</li> <li>• Wide range of light transmission levels without the blocking of one's view.</li> <li>• Protection of interior furniture and other valuable items from UV damage.</li> <li>• Exceptional optical qualities.</li> <li>• Elimination of the need for expensive window dressings like drapes, blinds and shades that are used in architectural applications</li> </ul>
<b>Energy Conservation</b>	
How do SPD products affect the transmission of infrared (IR) light?	<p>When used in combination with other coatings, SPD windows, skylights, sunshades and sunvisors can significantly reduce the transmission of IR light which causes heat. When heat is transmitted through windows, for example, this increases cooling needs in the summer and heating needs in the winter. Office buildings consume \$150 billion of energy each year, and lose at least 25% of their total energy use through conventional windows. If smart windows were used, this would result in an energy savings of more than \$20 billion per year (Solar Industry Association). In addition, research shows that smart windows could reduce peak electric loads by 20%-30% in commercial buildings (MIT graduate study).</p> <p>Further, a 2000 study of U.S. window manufacturers ranked "reduction glare and heat" and "UV protection" as being among the most important attributes to end-users (Townsend Research). Heating and cooling costs can be reduced if used in architectural windows and skylights.</p>
How do SPD products affect the transmission of visible light?	<p>SPD windows, skylights, sunshades and sunvisors allow users to control the amount of visible light passing through the glass or plastic in these products. These smart products reduce solar build-up as well as reducing the need for artificial indoor/interior lighting, thereby reducing energy consumption, and for many, increasing the level of comfort and sense of well-being. In an effort to reduce glare, for example, the windows of many commercial buildings are permanently tinted, which then requires more lighting inside the building than that which is optimally needed. Residential homes using window experience a similar limitation. Natural day lighting, which can be regulated using SPD products, has been shown to improve health and well-being, and thus its regulation is considered by many to have a strong influence on one's attitude and productivity.</p>
How do SPD products affect the transmission of ultra-violet (UV) light?	<p>SPD windows, skylights, sunshades and sunvisors also significantly block harmful UV light. In so doing, these smart glass products:</p> <ul style="list-style-type: none"> <li>• Reduce the fading of carpets, furniture, and automotive interiors.</li> <li>• Protect valuable artwork.</li> <li>• Protect skin from damaging UV rays.</li> </ul>