CPFilms

Technical Updates

FOR THE WORLDWIDE LLUMAR COMMUNITY

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INFRARED TRANSMISSION: What the Numbers Mean and Do NOT Mean

IRT: The "mystery" of the missing number

For many decades, nearly all manufacturers' documents reporting the solar performance properties of their window film products have listed **UVT** (% ultraviolet light transmission) and **VLT** (% visible light transmission).

However, most of us in this industry know that the sun's radiant energy reaching us here on Earth across the vacuum of space is composed of not just *ultraviolet* and *visible* light, but also *infrared* (IR) light. So where are the transmission values for our films in the *infrared* band?

The story may be historically complex, but perhaps the best single answer is that, until now, no one in particular thought we really needed them. After all, the things that have been considered really important have been 1) reducing *UV transmission* (to protect home furnishings from fading, and human skin and eyes from damage from these energetic shorter wavelengths), 2) reducing *visible light transmission* (to cut excessive, uncomfortable glare, heat, and reduce fading), and 3) reducing *overall solar heat gain* in homes, commercial buildings, or cars (measured in terms of TSER—total solar energy rejected, or SHGC—solar heat gain coefficient.) *Solar heat,* after all, is produced by **all** the wavelengths of solar energy, not just infrared. So who really needs to know the IRT (infrared transmission)?

The problem is that claims are being made about infrared transmission and "rejection" in the marketplace that are either false or extremely misleading. People are making purchasing decisions based on these claims and what they infer from these claims. It's time for a closer look at what is going on, and separate the many myths from the realities. ...

Continued on page 4...

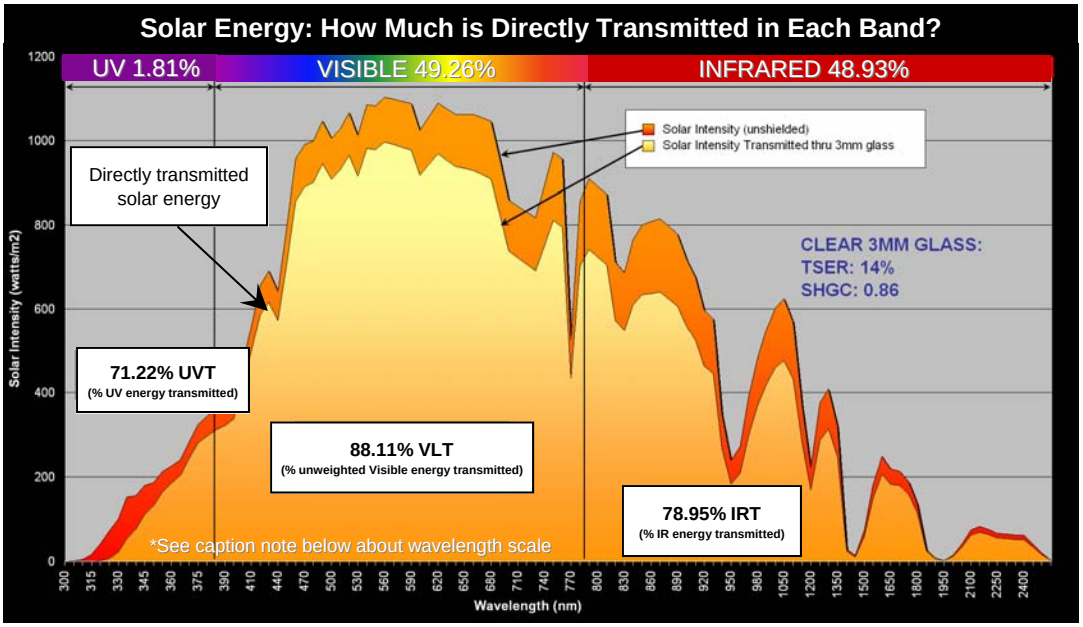


Fig. 1: This chart shows newly calculated energy distribution across the solar spectrum: 1.81% UV, 49.26% visible, and 48.93% infrared. The traditional claim of 3%, 44%, and 53% has not been correct. Also shown here is the direct solar transmission proportions through clear glass across the entire solar spectrum in the 3 bands. ***Note:** the wavelength scale in the 3 bandwidths varies due to the different sizes of each region.

AUTO FILM PATTERNS IN PCS™: The Meaning of "Precision-Cut"

Which is better: hand-cut or computerized Precision-Cut™ patterns?
In the minds of those who have long-resisted the idea of using improving technology to boost productivity in auto film installation, using "computers" to cut film will simply never take the place of human skill with its masterful Kung-fu Olfa-knife artistry. But most of those who have taken the leap to the LLumar PCS™ system never claimed that it will. The real questions about PCS are not addressed by simply asking, "Which is better, my knife or a plotter?" The real questions are:

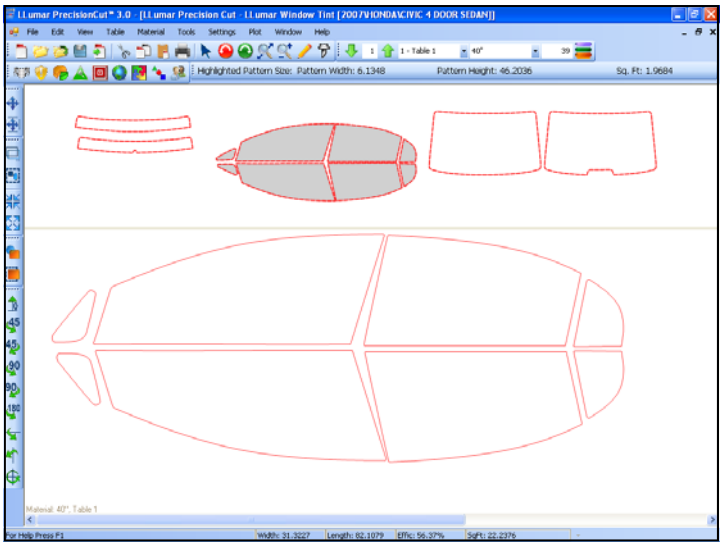
1) Compared to the PCS system, how fast, how safely, and how consistently accurately can you *actually* hand-cut the film for the windows of thousands of different vehicles of all levels of difficulty?

2) How much do you wish to grow your business and maximize the speed at which you can train new installers?

Only when you get honest answers to these questions can you reliably answer the question of whether the LLumar PrecisionCut™ System is the vehicle to drive your business, fast forward, into the future.

Where, after all, do the patterns come from in the first place?
Do you doubt the accuracy of the pattern database of the PCS system, compared with traditional "hand-cutting"? Would it surprise you to learn that all the patterns in the system come from digitally scanning patterns actually cut in the traditional way, on a vehicle with an Olfa knife? Highly skilled installers make these patterns in a way that they believe provide optimal fit. These patterns are scanned with extreme precision, small flaws and irregularities are corrected or smoothed out, then cut and compared with the original pattern for reliability. Installers in the field use them and report any discrepancies, and genuine errors (few that there are) are swiftly fixed and made available for downloading. Ironically, "errors" usually turn out to be not errors in the pattern, but slight irregularities in window and framing designs on vehicles.

Glass Shape Variability
Remember: the shape of a piece of glass can vary slightly because, often, more than one glass manufacturer supplies the "same" window for a given vehicle type. Is this a problem for PCS users? Not really, if they understand that the top edge contour of the pre-cut film can, in seconds, be cut to match exactly the glass contour by sliding the film upward a few millimeters and shaving off the overhang, a practice most installers use anyway for the "factory-edge" look.



Rear windows often have peculiar variations in side paneling or carpeted rear decks that can affect the "ideal" film cut. Further, dot matrix and black masking perimeters can vary in size for a given vehicle, again, because different suppliers are providing glass to the car makers. Our aim, in these cases, is to provide patterns that are slightly larger (rather than "ideal") so that, where occasionally necessary, the installer can do a minor trim rather than be caught short with an unusable piece of film. Always remember the power of the PCS software: you can instantly make changes to a pattern as you see fit: lower the bottom edge, increase the width, increase overall size, etc.

> Does computerized "precision-cut" mean an absolutely perfect fit every time? No, but it means far and away more combined consistency, speed, safety, and accuracy (human ego aside) than any other method, "hands down."

New FAQs!
In closing, please note that we have added 9 new FAQs (#30-39) to the PrecisionCut™ section of www.llumartech.com. The answers help explain, in practical terms, just how the PCS pattern databases are created and improved from day-to-day here, on site, at CPFilms.

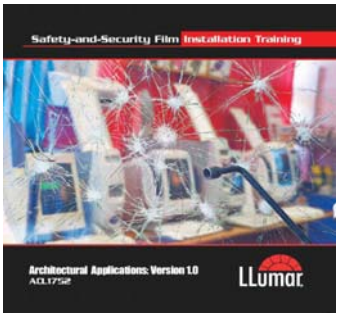
The Biggest Payoffs ...
So let there be no mistake about it: 1) There is a serious risk in always cutting patterns by hand on the glass. Gaskets can be occasionally cut in error and the glass surfaces can be scratched. We all know this, and have paid the price. 2) There is no installer on planet earth who can cut out film with the robotic speed and repetitive precision of a Graphtec plotter. 3) Complete kits can be cut in minutes, in advance of a car's arrival at the shop. 4) The LLumar PrecisionCut™ System can cut a whole lot more than just auto film. From 11 mil safety film to the infinite design possibilities of graphics and deco films, LLumar window film business horizons have never been wider or better looking. ■

SAFETY AND SECURITY FILM TRAINING: The DVD has arrived!

Shipping expected in the first 2 weeks of August

Years in the making, this comprehensive installation training program is now available on a single menu-driven DVD, 79 minutes in length. The LLumar Architectural Safety and Security Film Installation Training Program is designed to help installers master the full details and special challenges of safety and security film installation.

The program fully details the special tools, equipment, supplies, and techniques that will make the job faster and easier and yield the highest quality professional installations. Also demonstrated are the procedures for installing two of the most important edge retention systems in the industry.



Accompanying the menu-driven DVD is a complete and printable Installation Guidebook. It is based on the training program and contains additional information that may be used as a refresher or handy reference guide after viewing the DVD. The guidebook will be updated regularly and translated into multiple languages. You may download the latest copy at www.llumartech.com, in the Safety and Security Films section.

> The most complete safety and security film installation training program is now available on a single menu-driven DVD (ACL1752).

This training program is not intended as a substitute for hands-on experience in the field, but as a foundational reference guide to accelerate the learning process and avoid costly and time consuming mistakes on the job. Refer to it often as a refresher, and use it to help train new employees.

Please share your feedback in order to help us make ongoing improvements in this, and all other LLumar training programs.

Order your copy today through your Distributor (item # ACL1752). Then, go to www.llumartech.com to download the latest version of the DVD *Companion Installation Training Guide*, filled with photos from the video, the full text of the narration, and updated news about tools or other more detailed information regarding "thick-film" installation. ■

LLUMAR PRECISIONCUT NOW CUTS 11 MIL (275 MICRON) FILM!

Good News!

LLumar PrecisionCut™ and Graphtec FC7000 Series plotters can cut 11mil (275µ) safety and security film!

Have you ever wanted to cut 11-mil safety and security film for a commercial, residential, or even automotive installation but decided against it because of the difficulty of cutting the film accurately and safely? With new advancements in plotter research and development done at CPFilms in Martinsville, you can now proceed with ease.

The Graphtec FC7000 (CPF60A, Figure 1) plotter can be retrofit to cut these and other thick safety films with a simple knife and blade holder change. This industry leading cutting plotter along with the leading innovations in cutting technology included in the LLumar PrecisionCut™ software put you well on your way to exploring new profit potentials. If you are interested in cutting thick films, contact your LLumar regional sales manager today!

Note to all users of LLumar PCS: Beginning with this announcement, all plotters shipped from CPFilms will now come with condition settings preloaded to cut 11-mil film. Please order the red tip blade holder (ACL1464SF) and a 2 pack of 60 degree blades (ACL1463G60) for cutting films 6-mil (150µ) or greater in thickness . ■

INFRARED TRANSMISSION: What the Numbers Mean and Do NOT Mean (continued from page 1)

Over the years, film manufacturers have worked to improve film performance by maximizing solar heat rejection while maintaining high levels of visible light transmission. This has required focusing their efforts on reducing infrared transmission as much as possible by reflecting or absorbing more of it. The success of these efforts are obvious in the growing number of "spectrally selective" film products.

But not providing the *actual* infrared transmission numbers has opened the doors to great confusion and misunderstandings, generating a large number of ***myths***. Let's look at six of these myths, and explode each of them:

1) ***Myth #1*** *... Any metering device which displays an "infrared transmission" number must somehow accurately represent the overall solar performance of the film.* It does not. Generally, such meters do not even reliably indicate true IR transmission beyond a small sampling. Even if such a transmission meter gave an accurate value of the *total* IRT, it would not tell how much IR is being absorbed or reflected, facts that are critical factors in computing the overall solar heat gain.

2) ***Myth #2*** *... Solar infrared energy is where "all the heat" in sunlight is contained.* It is not. Less than half of it is. It is true that IR radiation penetrates several millimeters into the skin where it is more strongly sensed by our nerves as "heat" than shorter waves of visible or UV light. But UV and visible light together contain ***more than half*** of the sun's radiant energy and generate heat when absorbed by glass or transmitted into a room. The only physical differences among these "types" of radiation is their wavelength ranges, defined by whether our eyes are sensitive to them. Actual range sensitivity can vary slightly from person to person.

3) ***Myth #3*** *... If a film transmits, say, 3% of the sun's infrared energy, it therefore follows that 97% of the infrared is "rejected."* This is **absolutely false**. What is not transmitted may be absorbed or reflected, but what is absorbed is converted to *heat* and about one third (sometimes more) of that energy is transferred by conduction and re-radiation into the airspace in a vehicle or building. Energy that is not transmitted is **not** synonymous with what is "**rejected**." Many people may have come to believe this, but it is scientifically wrong, no matter how widespread this market misconception is. Consider this: Blackout film (NRMM-PS3-Black) transmits **0%** (that's ***zero*** percent) of all solar radiation, from UV through the IR. But it does NOT reject 100%, but only 71% of the total solar incident radiation (on 3mm clear glass). It's a very absorptive film, and much energy is *indirectly* transmitted by conduction, convection, and re-radiation.

> The sun's heat energy is spread across the solar spectrum, not just in the infrared. Stopping all the infrared would *not* mean stopping all the solar heat.

4) ***Myth #4*** *... If one film seems to block two or three times as much heat as another under an infrared heat lamp, it will therefore block two or three times as much of the **sun's** heat.* This myth is also false. Films especially good at blocking IR are marvelous, and heat lamps (shown here in Figure 3) do show how much more of the infrared they can "block" than other films such as dyed or neutral sputtered films. Indeed, you can feel the effect with your hands. But, unlike the sun, infrared lamps radiate more than 90% of their energy as infrared. They do not represent actual sunlight (the full solar spectrum), which contains only about 48.9% of its energy in the infrared. (No, it is *not* 53%, as has been wrongly assumed for decades—more of this interesting fact later.)

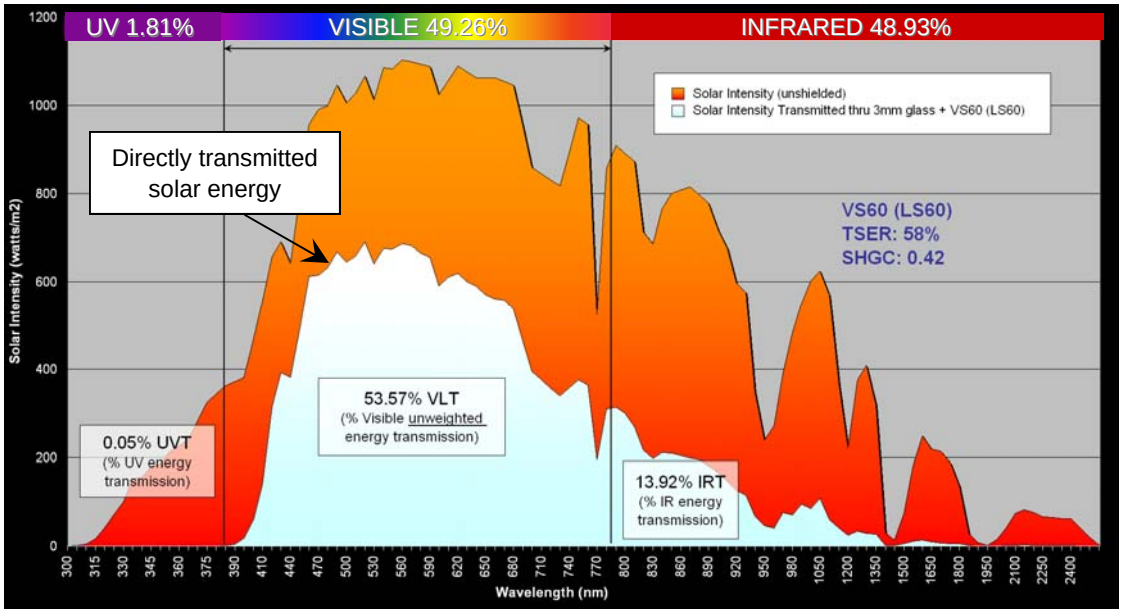


Fig. 2: This graph shows the solar transmission distribution for VS60SRCDF (LS60SRCDF). While graphs like this are interesting and show the actual proportions of the sun's *directly* transmitted energy, they do not show overall solar performance in terms of the % *total* solar energy gained (SHGC), since solar absorption is omitted.

Myth #5: *Meters do not lie.* We might call this the **"**Myth of the Meters." Of course "numbers" read from a metering device do not lie. But the real questions are: What do these numbers *actually* say, and what can we conclude from them? Look carefully at the meter in Figure 4. The stated UV, Visible, and IR ranges are not at all consistent with in-

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dustry standards. UV is claimed to range from "below 400nm;" Visible light from "400-700nm;" and IR ">700nm." Where do these number ranges come from? Certainly not from the NFRC (National Fenestration Rating Council) . Further, many questions need to be answered: What is the light source inside the meter? Does it represent accurately the distribution of energy that comes from the sun? If not, no conclusions at all can be drawn about how effective the film will be in filtering *solar* energy.

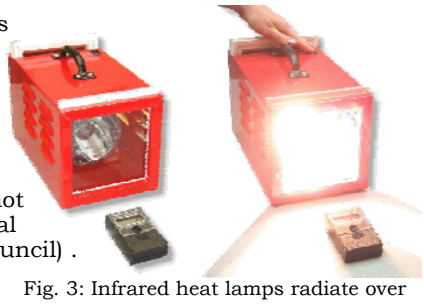

Fig. 3: Infrared heat lamps radiate over 90% of their energy in the IR. But the sun itself radiates less than 49% in the IR. Under such a lamp, a film that is spectrally selective may appear to only transmit, say, 10-15% of the radiant heat, but in reality may directly transmit 30% or more of the **sun's** radiant heat. TSER could be anywhere from 40-60%.

How accurately, then, and in what parts of the spectrum, does this meter sample the various regions? This is not an easy question, but then it is not easy to scientifically evaluate film performance without seriously complex pieces of laboratory equipment. Without an accurate, calibrated spectrophotometer (presently costing between $80,000-120,000), one cannot reliably sample transmission and reflection percentages at precise intervals from 300-2500 nanometers, the wavelength range of *solar* radiation.

Then, one also needs a computer program, say, Window 5 from LBNL (Lawrence Berkeley National Laboratory) to process all the sampling data from such a spectrophotometer to compute the various performance parameters. Such software contains essential additional data about the measured intensity of actual sunlight at a great many sampled wavelengths across the spectrum. None of this is easy or simple. The procedures embody complex principle of mathematics and physics, and are not up for grabs by any marketing department or "tool" manufacturer. This is one reason why CPFilms has its own Research and Technology Department, has its products tested and certified by outside, *independent* agencies, such as the NFRC, and has precise procedures for internal equipment calibration.

While everyone wants to sell more film, we (CPFilms *and its customers*) want to have the most accurate possible performance data.

Example: Using an IR meter that measures at 950 nanometers.
Using a metering device that measures infrared (IR) light transmission at 950 nanometers will NOT tell you the *true percentage* of *all* the solar IR that is transmitted by a window film. Such a device simply cannot do that, since it simply measures IR in a very tiny region, and one that is not at all representative of the full solar spectrum. Using this meter can, and often does, *radically* misrepresent the facts to consumers about a film's actual overall solar performance. The manufacturer might cleverly and legally absolve itself from the deception by declaring in the fine print on the flip side of the meter, "Measured at 950nm," but how many consumers know that at 950nm solar IR is very weak anyway? How many truly understand that such a device does not, in any way, give a true reading of the average solar IR transmission from 780-2500nm? We have calculated that a product whose solar transmission curve is shown in Figure 5 has a total direct IR transmission of about 13.4%, not the claimed 3%.

> In the end, TSER (or SHGC) still tells the most accurate story about how much *solar heat* is allowed to pass through a glazing system, no matter what the "IR transmission" value.

Look at the graph in Figure 5. This is a graph of the full spectral transmission of a competitor's product. We have computed the actual percentages of energy transmission in the UV, Visible, and IR bands by mathematically computing the area under each curve and comparing those values with the total amount of solar energy in those bands. The manufacturer claims on its web site that this product has an "infrared rejection" of "97%." In a footnote on that same web page, it is claimed:

"Performance data generated for a typical film on 6mm clear glass using applicable industry test methods and standards. Infrared rejection measured from 900nm-1000nm."

There are at least six direct problems with this "footnote" statement:

1) There is no published industry test method or standard anywhere that specifies the meaning of "infrared rejection."

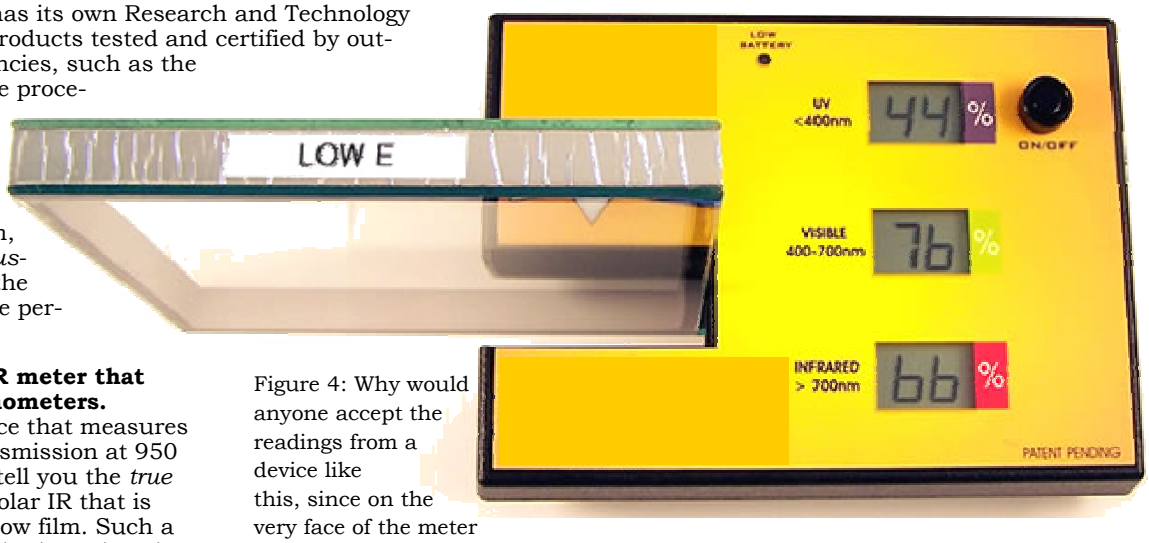

Figure 4: Why would anyone accept the readings from a device like this, since on the very face of the meter the bandwidths for solar UV, Visible, and IR light are utterly inconsistent with all industry standards? UV light, according to the NFRC, AIMCAL, LBNL, and the IWFA, extends downward from 380nm (not 400nm), and visible extends from 380-780 (not 400-700nm), and IR upwards from 780 to about 2500nm, surely not 700nm and up.

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2) There is no published industry standard that allows one to claim or compute or otherwise meaningfully assert "infrared rejection" from 900-1000 nanometers. There is none because such a term has not been deemed useful in specifying solar performance.

3) From the fact that measurements from a spectrophotometer indicate an average transmission of only 3% from 900-1000nm for this product, one cannot conclude that 97% of the IR energy is "rejected" (meaning "prevented from passing through the glazing system.") Solar absorption is extremely high for this product, and much of what is absorbed is *indirectly* transmitted. A claim of 97% rejection, given the film's extremely high absorption, could not possibly be true, contradicting the laws of thermodynamics. To have 97% *rejection* with a 3% *transmission* would require a 97% *reflection* of the IR in that region of the spectrum.

4) Even if it were true (contrary to fact) that 97% of the IR is "rejected" from 900-1000nm, why is the rest of the solar infrared (from 780-2500nm) not mentioned? (See Figure 5.) Could it be because, **in fact**, a total of **13.5%** of *all the IR* is directly transmitted?

5) What good does it do anyone to know that 97% of the IR from 900-1000nm is "not transmitted"? This alleged fact does *not* tell anyone how effective the film is at reducing solar heat gain. Only the Solar Heat Gain Coefficient (or the TSER value) can do that.

6) To claim that 97% of the IR is "rejected" from 900-1000nm is a very weak claim, given the little-known scientific fact that in the middle of that range (around 950nm) the actual amount of solar IR is very low (see Figure 5 at 950nm). The most intense IR is from 780-860nm, where this product has a 50-60% transmission.

A claim that only 3% IR from 900-1000nm is transmitted is inherently suspect: What about the rest of the IR, from 780-2500nm?

A Call to Cease and Desist

These are the kinds of claims that must not be allowed to go unchallenged in the industry. They represent very serious errors that mislead customers. Such claims are demonstrably and scientifically false or meaningless, manufactured for the sole purpose of "selling" a product. Our products, and many of our competitors' products, are very good products, and there is absolutely no ethical justification for continuing to propagate falsehoods and distortions to a marketplace that may not be scientifically educated sufficiently to see through these claims.

Many manufacturers, including CPFilms, have been forced to print some type of IR number in their literature in response to the claims of other manufacturers. You will note in the new AIR80 literature that the information has been changed to indicate IR transmission at various wavelengths. However, one should always use the SHGC or TSER values to assess the true solar performance of a film.

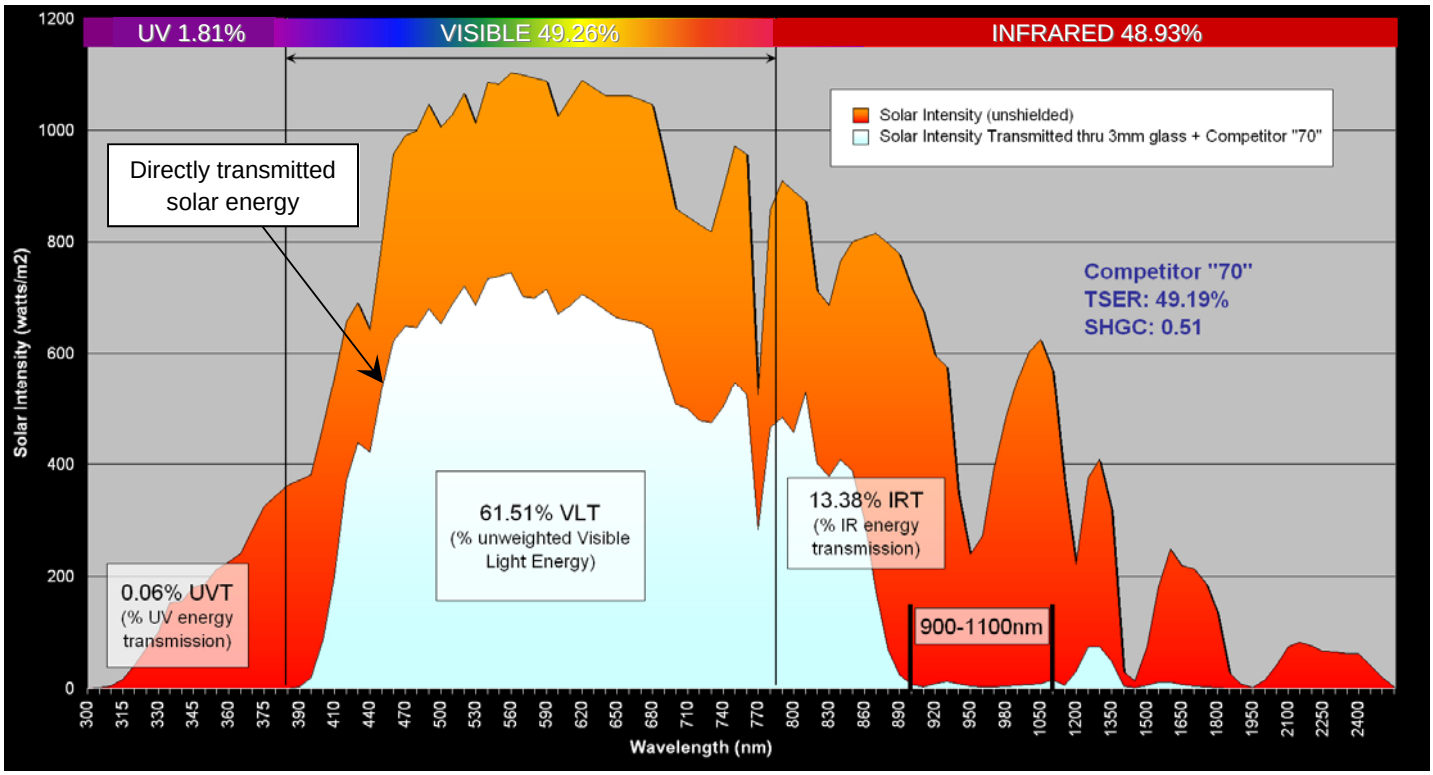


Fig. 5: This chart shows the solar transmission distribution for a competitive product. Note that IR transmission is very low from 890 to about 1100nm, but very high on from 780-890nm, a fact the manufacturer does not report in its advertising. Also not shown, of course, is the amount of energy being absorbed by the glass and conducted and re-radiated inwardly. **Total** performance is summed up by the **SHGC** or **TSER** values.

INFRARED TRANSMISSION: What the Numbers Mean and Do NOT Mean

Technical Footnotes

For the technically curious we'd like to explain a few scientifically interesting and important facts required to more fully understand some key points in this article:

1) **% Visible Light Energy transmitted is <u>not</u> the same number as the reported %VLT.** What is shown in each graph of Figures 1, 2, and 5, are (a) the solar intensity distribution from 300-2500nm at sea level (as given by the Lawrence Berkeley National Laboratory data file used by Window 5.0 to compute solar performance of glazing systems) and (b) the *calculated* direct transmission of that energy for a film product mounted on 3mm clear glass, via the transmission percentage measurements at 100 data points (as sampled by CPFilms' in-house laboratory spectrophotometer) along the solar distribution band width. The *area under each section of the curve* is calculated using the standard trapezoidal approximation and linear interpolation methods used by Window 5.0, in conformity with ISO and NFRC standards. The published VLT numbers, generated by Window 5.0, are **photopically weighted** to account for the greater sensitivity of the human eye to wavelengths of light in the neighborhood of 550 nm. The graphs in Figures 1, 2, and 5 therefore show the actual **unweighted** amount of visible light energy transmitted as a ratio of the incident solar energy. Weighted %VLT numbers are usually, but not always, greater than the actual percentage of transmitted visible light energy. Our eyes see yellow/green light as much brighter than other wavelengths. So, though the total transmitted visible light energy of two films may be exactly the same, one may appear "lighter" than the other. The weighting factor adjusts for this to better compare the visual appearance of films.

2) **The actual proportions of solar energy reaching sea level in the UV, Visible, and IR bandwidths are not what have been traditionally assumed in the film industry.** Traditionally, the common belief has been that 3% of the sun's energy lies in the UV region, 44% in the visible region, and the remaining 53% is in the IR region. These numbers are found in hundreds of locations in various pieces of literature, from virtually every film manufacturer. It turns out, upon checking the facts, that these numbers are not quite right. It seems no one has bothered to check the facts. We calculate that the energy content of solar UV is 1.81% of the total, Visible is 49.26%, and IR energy is 48.93% of the total, as shown in Figure 1. Our re-calculations are offered here in good faith and are open to public review. We welcome independent corroboration.

> IR transmission numbers allow you to compare how films differently transmit visible and IR light, but are **not** reliable guides to overall heat gain reduction.

3) **Published performance values for all films, from all manufacturers, are acknowledged to be an average, based on unavoidable manufacturing tolerances of (usually) plus or minus 3%.** It is not yet physically possible to assure, from master roll to master roll, or even across the width of a single roll, that performance numbers of every square inch of film will be exactly what the average is. Given the nature of the polyester substrates and the enormous complexity of manufacturing processes, consistency tighter than the specified tolerances cannot be hoped for. This is true for glass itself and most other manufactured items, from cars to shoes. Never forget this.

Finally, as a reminder to everyone, never forget to consult the **Film-to Glass Chart** in flat glass architectural projects. Highly absorptive IR "blocking" films have tighter restrictions on sensitive glazing systems because of the potential for higher thermal stress. ■

RED ALERT FOR AUTO FILM INSTALLERS: Watch Out for Water Damage to 2009 Audi A5/S5

Since its recent introduction, the 2009 Audi A5/S5 has generated a number of reports of installers facing the replacement of expensive electronics located on the trunk walls of the vehicle.

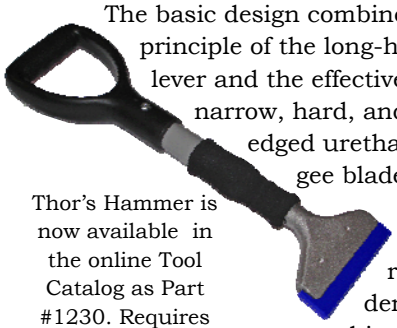
An amplifier for the car's Bang and Olufsen stereo system is mounted on the driver side trunk wall, covered by a panel that is easily removed to gain access. There are other electronic modules located in this compartment, but the amp (costing about US$1500) seems to be the one unit that is in direct line to receive any water running down along internal body seams from the installation of window film to the rear glass. We recommend the installer *cover these components with absorbent cloths or water repellent plastic sheets while the window film installation is in progress.* Never use more application solution than is truly necessary for a clean, professional installation. Needless flushing is an invitation to potential damage to hidden electrical components.

We suggest that after the installation is complete, either 1) allow the vehicle to remain stationary for a couple of hours to allow time for any excess pooling of application solution not visible inside the car body to evaporate or run off, or 2) drive the vehicle out of the shop and leave the absorbent cloths in place so that any motion-induced "flow-out" of water is caught without damaging the electronics. Remove the towels or plastic sheeting only after you are sure there is no further risk of water damage occurring.

Please remind your new employees that their standard operating procedure must be to carefully examine every vehicle for sensitive electronics *before* their installations! ■

THE TOOL CORNER — "Thor's Hammers" (Big and Small) Finally Make it into the Tool Catalog

"Thor's Hammer," much discussed in recent months, is a new squeegee designed for maximum effectiveness in safety and security film installation, especially for the heavier gauge safety films, 7 mils (175µ) and thicker. Two versions, a larger one for architectural use and a smaller version for automotive use, now have their own part numbers: ACT1230 and ACT1231.



Thor's Hammer is now available in the online Tool Catalog as Part #1230. Requires "Blue Narrow" (ACT1326) replacement squeegee blade.

The basic design combines the principle of the long-handled lever and the effectiveness of a narrow, hard, and sharp-edged urethane squeegee blade. Because of rapid rise in demand for this essential and powerful new kind of squeegee tool, there has been universal agreement that they must be made available to all installers, and as quickly as possible.

While these tools are now seen as essential for the best safety film installations (for speed, maximum application solution removal, virtually no "champagne bubbling," and ergonomic comfort), they are also the best way to finish installations of standard solar control films that have very long drying times. Low-e, sputtered, ceramic, and other spectrally selective films known for their very slow drying times and potential for water pocketing, can be dealt a final blow with Thor's Hammer. A final pass with this new squeegee knocks out the last traces of application solution for vastly improved drying times and instantly better looking installations.

Place your orders today through your distributor. We hope that supply can meet demand! (We'll do our best.) ■

Thor's Hammers (large and small, for architectural and auto applications) are now available as standard tools from CPFilms.

Thor's Hammer Jr. (for auto safety films) is also now available as ACT1231. Requires replacement squeegee blade ACT1315.

"Growth through Knowledge"

Information is power, and the worldwide Technical Services Group of CPFilms provides the most comprehensive informational, instructional, and product support services of any window film manufacturer. Our purpose is to help empower you to grow your business by sharing with you information and practical wisdom you can directly use to help you better serve your customers. The right information can greatly improve your installation efficiency and more effectively inform your customers of the impressive uses, features, and benefits the world of LLumar films can provide.

Future issues are wide open to directly address your comments and questions, to better serve and support the growing international LLumar community. Let us know what topics you want to see addressed!

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