

shinkolite led diffusion sheet

TECHNICAL BULLETIN

Mitsubishi Rayon has developed several diffusion sheets specifically designed for backlit LED sign applications. Depending on the application customers may choose the most suitable product from the list below.

FEATURES & BENEFITS

- High diffusion factor with excellent brightness levels.
- Uniform brightness, even with the light source close to the back of the diffusion panel.

FABRICATION

Machining

LED Diffusion Sheet can be cut, drilled and shaped using traditional acrylic fabricating techniques. To avoid scratching during such procedures, masking should remain in place as long as possible.

Cementing

LED Diffusion Sheet can be cemented using solvent cement, embodied cement and two-component polymerizable cements.

Painting

LED Diffusion Sheet can be decorated using standard acrylic-based paints and silk-screen inks. As with any acrylic painting or screening operation, avoid heavy coats of paint or excessive flooding of screen inks which allow solvents or thinners to remain in contact with the acrylic surface and cause crazing.

Recommended Paints:

- Grip-Flex®, Wyandotte Sign Finishes, Norcross, GA.
- Lacryl®, Spraylat Corporation, Mount Vernon, NY.

Recommended Screen Inks:

- Multi-Vac Series® Inks, Advance Excello, Chicago, IL.
- 70,000® Series Inks, Naz-Dar Company, Chicago, IL.

RECOMMENDATIONS

Recommended Suppliers List

Any quality light source will illuminate the Light Guide Panel however we highly recommend the following suppliers.

SloanLED (V Series)

5725 Olivas Park Drive
Ventura, CA 93003
888-747-4533

www.sloanled.com

Light Board Technology

Peter Sussman
952-215-5274

www.lightboardtech.com

Seoul Semiconductor

www.seoulsemicon.com

Whiteoptics (for high diffuse reflective material)

www.whiteoptics.com

302-476-2055

Fulham Ballasts and Lamps

Vann Ness Avenue
Hawthorne, CA 90250
800-2-Fulham
www.fulham.com

T5 (5/8" diameter) Lamps are also available from local electrical retailers.

Recommendations for Manufacture and Designers

Mitsubishi Rayon Light Guide Panels can be purchased directly from LuciteLux™ at 1-800-458-2483. However, if you would prefer to purchase a finished or semi-finished product incorporating our Light Guide Panel you can contact the following manufacturer who has many years of experience with Light Guide Panels.

Jim Annestedt

UMP Inc.

7530 Priority Lane
Olive Branch, MS 38654
662-895-9600

www.umpinc.com

Mick Fisher

Schupan Aluminum & Plastic Sales
4200 Davis Creek Court
Kalamazoo, MI 49001
800-531-3434
www.schupanalum.com

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please contact Jane Nash
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THERMOFORMING

LED Diffusion Sheet can be thermoformed to any contour – from subtle curves to complex shapes.

Heating Methods

There are two basic heating methods utilized in forming LED Diffusion Sheet:

- Vertical oven heating
- Horizontal oven heating

If a vertical oven is used, it may be necessary to trim off the edges where clamp marks are present. Clamp along the short edge, exercising great care to ensure the sheets are not exposed to temperatures above 320°F; otherwise stretching of the sheet may occur.

To prevent surface marring, sheets should be loaded onto supporting trays covered with layers of felt or similar material.

Dimensional changes will occur when an acrylic sheet is heated freely in an air oven and drape molded without clamping.

The inherent strain present in continuous cast acrylic sheet is relaxed when heated, giving rise to some shrinkage. Precise shrinkage is dependent upon variables such as cycle time, heating temperature, and forming method.

Notes:

(1) Based on laboratory tests conducted in a Q-Panel Company Q-U-V Accelerated Weathering Tester equipped with UVA-340 lamps.

CLEANING

To clean acrylic sheet:

1. Dissolve mild liquid detergent in cool water.
2. Dip soft, clean cloth in solution and wring out.
3. Wipe the surface of the sheet.
4. Allow surface to dry naturally, or wipe with a separate cloth slightly dampened with solution.

WARNING: Do not allow concentrated disinfectant, surgical or methylated spirits, any liquid containing alcohol or any other solvents to come in contact with LED Diffusion Acrylic Sheet.

DISINFECTION

To disinfect acrylic sheet:

1. Dilute an antiseptic or hospital concentrate with cool or cold water in the amount recommended on the label for general disinfection.
2. Wipe the surface as described under CLEANING.

CAUTION: When using acrylic sheet in conjunction with applications where electrical units are attached, the unit must be unplugged before cleaning or disinfection. Great care must be taken to see that no water or solution enters the electrical compartment.

DUSTING

Use a soft, clean, slightly damp cloth when dusting. Never use a dry cloth. This tends to generate a static charge which will attract more dust.

POLISHING

If the surface of Lucite® acrylic sheet becomes scratched, it can generally be restored by using a polishing paste designed for use with acrylic or a mild abrasive metal polish applied on a soft clean cloth. If the scratches are too deep to be removed by this method, use a piece of 600 grade waterproof sandpaper (wet). When the surface is smooth, the gloss can be restored with metal polish. Power buffing is only recommended for professional fabricators.

The information and recommendations in this publication are, to the best of our knowledge, reliable. Users should perform their own tests to determine the suitability of these products for their own particular purposes. Statements made herein should, therefore, not be construed as representations or warranties. The responsibilities of Lucite International, Inc. for claims arising out of breach of warranty, negligence, strict liability, or otherwise is limited to the purchase price of the material. Statements made herein concerning the use of the products or formulations described herein are not to be construed as granting a license to operate under any patent of Lucite International, Inc. or another, or as recommending the infringement of any patent of Lucite International, Inc. or another, and no liability for infringement arising out of any such use is assumed.

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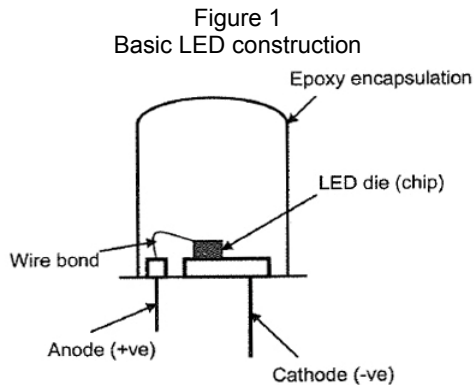
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WHAT ARE LEDs?

Light Emitting Diodes (LEDs) are becoming ever more popular as light sources for use in illuminated signage and display applications. Their small size, low energy requirement and long lifetime mean they are gradually replacing more traditional light sources.



An LED is a “solid state” electronic component with the features of a diode, i.e. it only allows electrical current to flow in one direction. When an electrical current is passed through an LED in the right direction, the LED emits light. The LED die is similar to a filament in a lamp as it emits the light.

- **Colored LEDs**
The color of the light emitted from an LED is primarily dependent on the chemical composition of the material from which the die is made. Colored encapsulations are also sometimes used.
- **Multicolored LEDs**
Light from individual LEDs can be mixed together to produce a wide range of colors. Normally red, green and blue LEDs are combined in LED modules where the overall emitted color can be controlled by blending the colors from the individual LEDs. They are sometimes referred to as RGB LEDs. These modules require an electronic control unit to blend the colors together.
- **White LEDs**
White LEDs are the most common type. They provide high output and do not require sophisticated control circuits and are becoming more readily available in lighting applications.

LED dies produce light that is virtually monochromatic. To produce white light a technique similar to that used in fluorescent lights is used. A phosphor is either added to the normally clear LED dome or is applied on top of the die. Normally a blue die is used to stimulate the phosphor which emits a yellow tinged light. By combining the phosphor and blue LED white light of different color temperature can be obtained. It is also possible to produce white light using RGB LED's but this technique is not as popular as phosphor-based LEDs as it requires a control unit circuit to blend the individual colors together.

- **LED Modules and Strips**
Individual LEDs are called discrete LEDs. To be of practical use discrete LEDs are populated onto printed circuit boards, usually with additional electronic components to control the electrical current. An assembly of one or more discrete LEDs can be combined in a module to be used for backlit signs or lighting. Alternatively discrete LEDs can be combined together in strips of varying lengths that can be rigid or flexible. Therefore they can give the designer or sign maker greater design flexibility. The LED modules or strips can either be mounted behind the sign or display or along the edge for edge-lit applications. It is also possible to mount LEDs into channels machined into the display material e.g. channel lighting.
- **LED Brightness**
The normal unit used to express light output is lumens and this allows some comparison to be made between different light sources e.g. LED and incandescent bulb. However, many traditional light sources are rated by power (Watts) and therefore as LEDs use less power a direct comparison is more difficult to achieve.

Typical LEDs have a light output of about 50 to 100 lumens/Watt (lm/w) although developments are continuing all the time to increase light output still further. The color of the LED will also have an influence on the light output; white LEDs typically have highest light outputs across the visible spectrum. A typical example assuming a light output of 100 lm/w would show that a 4 Watt LED will have about the same light output as a 40 Watt incandescent bulb i.e. 400 lumens.

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Of particular relevance to signage, luminance is often measured in lux and can be considered as the amount of light per area. Luminance: lux= lumens/m².

- Construction
However some general guidelines can be given. The luminance of any internally illuminated sign or display is determined by five factors:
 1. Lamps- their number, type, light output, color and position in the sign case.
 2. Materials- the light transmission, reflection, absorption and diffusion factors of the Perspex grade and thickness used.
 3. The Sign Case- its dimension, particularly its depth and the reflection factor of the paint or other finish used on the inside of the case.
 4. Light Absorption- the effect of absorption of light by the lamps and electrical equipment within the case.
 5. Maintenance- the reduction in the light output of the lamps with increasing age and the influence of dust inside the case.The lamp spacing ratio for LEDs is similar to that for other light source i.e. ratio=1, the same distance between the LEDs as that between the LED and the front panel.

BENEFITS OF LEDs in SIGNAGE APPLICATIONS

- The development of elegant backlit signage solutions and improved aesthetics:
 - Slim signs
 - More even illumination: (a) LEDs installed correctly in combination with Shinkolite diffusion sheet can provide a much more even illumination than tube lighting. (b) Small size: LEDs can be very small (smaller than 2mm²), enabling the corners of challenging light boxes to be better illuminated e.g. the letter "K"
 - On / Off time: LEDs light up very quickly.
 - Dimming: LEDs can be easily dimmed
- Environmental & cost benefits
 - LEDs have a much longer lifetime than alternative light sources e.g. 50,000 hours in comparison to fluorescent tubes rated at 10,000 to 15,000 hours, resulting in:
 - Lower costs over the lifetime of the sign.
 - Reduced maintenance costs.
 - Fewer outages

- Energy savings as fewer and lower energy LED light sources can be used to achieve the same level of brightness.
- Efficiency: LEDs produce more light per watt than incandescent bulbs. Energy savings up to 80% have been claimed for LEDs in comparison to equivalent fluorescent tubes.
- Low heat output (Cool light): In contrast to most light sources, LEDs radiate very little heat. Wasted energy is dispersed as heat through the base of the LED.
- Quick on and off as well as easy dimming saves energy.
- Slow failure: LEDs mostly fail by dimming over time, rather than the abrupt burn-out of incandescent bulbs.
- Safer to maintain with a lower working voltage of 12v.
- Durability: LEDs, being solid state components, are difficult to damage with external shock, unlike fluorescent and incandescent bulbs which have fragile glass tubes or bulbs and delicate filaments.

BENEFITS OF USING LED WHITE DIFFUSION SHEET

- Diffusion
A critical factor when illuminating signs with LEDs is the diffusing power of the acrylic sheet. LEDs are small, intense sources of light and incorrect sign box construction will result in uneven illumination- so called "hotspots". LED White Diffusion Sheet has been formulated to optimize diffusion whilst retaining vibrant, attractive colors both transmitted and reflected, enabling the construction of thinner, more elegant signs.
- Type of LED
Although specially designed to excel with white LEDs, Shinkolite diffusion sheet will perform equally well with colored LEDs. As with any other light source, the color of the LED will have an impact on the transmitted shade. Our market research suggests that the signage market is moving in favor of white LEDs.

Light boxes built with Shinkolite diffusion sheets will show no "hotspots" above 2" depth when used with typical LEDs at correct spacing, and still maintain a high light transmission level.

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LED White Diffusion Sheet also excels with High Brightness LEDs, however the depth of the light box may need to be adjusted to give optimized even illumination.

- **Design flexibility**
The excellent brightness and evenness of illumination allows sign makers and specifiers to develop back-lit solutions that are slimmer, brighter and more cost-effective in operation.
- **Other Light sources**
LED White Diffusion Sheet can successfully be used with other light sources where a high degree of diffusion and light transmission is required.

POINTS TO CONSIDER WHEN USING LEDs

Fundamentally LEDs are light sources just as incandescent and fluorescent bulbs and tubes. Therefore the same considerations should be used when using LEDs in signage or display applications.

- **Sheet brightness**
LED White Diffusion Sheet colors have been specially developed for use with LED light sources to give strong and bright colors. The level of brightness can be reduced by using either fewer or less bright LEDs.

The quality of the overall construction is of direct relevance to the lifespan of an LED illuminated sign box. Units should be designed to provide sufficient weatherproofing as well as ensuring the removal of the small amount of waste heat generated by the LEDs. Most LED units fail not with the LED but rather the total product e.g. moisture ingress or heat build-up affecting electronic components.

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