ACRYLITE®

ACRYLITE® LED color changing back lit
Physical Properties

ACRYLITE® LED color changing back lit acrylic sheet is an extruded, gloss sheet that, when unlit, the sheet appears black but when illuminated appears white thanks to its color-inverting quality.This material eliminates the need for perforated diffusion panel or film. This material contains all the characteristics of our premium sheet including its strength, lightweight nature, and durable formulation.

Characteristics

ACRYLITE® LED color changing back lit is a lightweight, rigid and weather-resistant thermoplastic that is dimensionally stable, resistant to breakage and can be easily fabricated and cemented. Because of its uperior light diffusion and unique color changing properties, it is well suited for use in a variety of applications such as signage, retail displays, and exhibition booths.

Availability

ACRYLITE® LED color changing back lit sheet is available in thicknessesfrom .118" (3.0 mm) to .472" (12mm) and actual sheet sizes from 48" x 96" to 51 X 100. Custom sizes are also available. All sheets are protected with recling polyethylene masking.

Safety

ACRYLITE® LED color changing back lit sheet is more impact resistant than glass. If subjected to impact beyond the limit of its resistance, it does not shatter into small slivers, but breaks into comparatively large pieces. ACRYLITE® sheet meets the requirements of ANSI Z97.1 for use as a Safety Glazing Material in Buildings (for thicknesses .080" to .500" [2.0 mm - 12.0 mm]).

Weather Resistance

ACRYLITE® LED color changing back lit sheet will withstand exposure to blazing sun, extreme cold, sudden temperature changes, salt water spray, etc. It will not deteriorate after many years of service because of the inherent stability of acrylic resins.

Dimensional Stability

Although ACRYLITE® LED will expand and contract due to changes in temperature and humidity; it will not shrink with age. Some shrinkage occurs when ACRYLITE® is heated to forming temperature, but post-forming stability is excellent.

Light Weight

ACRYLITE® LED sheet is only half the weight of glass and 43% the weight of aluminum.

Rigidity

ACRYLITE® LED sheet is not as rigid as glass or metals. However, it is more rigid than many other plastics such as acetates, polycarbonates or vinyls. Under wind load an acrylic sheet will bow and foreshorten as a result of deflection.

If ACRYLITE® LED sheet is formed into corrugated or domed shapes, rigidity will be increased and deflection minimized.

Cold Flow

Large, flat ACRYLITE® LED sheet, if insufficiently supported, may deform permanently due to continuous loads such as snow, or even their own weight. Increased rigidity obtained by forming will minimize cold flow.

Heat Resistance

ACRYLITE® LED color changing back lit sheet can be used at temperatures from -30°F (-34°C) up to +190° F (+88°C), depending on the application. It is recommended that temperatures not exceed 160°F (71°C) for continuous service, or 190°F (88°C) for short, intermittent use.

Components made of ACRYLITE® LED sheet should not be exposed to high heat sources such as high wattage lamps, unless the finished product is ventilated to permit the dissipation of heat.

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Strength and Stresses
Although the tensile strength of ACRYLITE® LED color changing back lit is 10,000 psi (69 Mpa) at room temperature (ASTM D 638), stress crazing can be caused by continuous loads below this value. For glazing applications, continuously imposed design loads should not exceed 750 psi (5.2 Mpa) at 73°F (23°C). Temporary loads of up to 1,500 psi (10.4 Mpa) may be imposed for short durations of time at 73°F (23°C).

Localized, concentrated stresses must be avoided. For this reason, and because of thermal expansion and con-traction, large sheets should never be fastened with bolts, but should always be installed in frames.

All thermoplastic materials, including ACRYLITE® LED color changing back lit sheet, will gradually lose tensile strength as the temperature approaches the maximum recommended for continuous service–160°F (71°C).

Expansion and Contraction
Like most other plastics, ACRYLITE® LED color changing back lit sheet will expand and contract from 3 to 8 times as much as glass or metals. The designer should be aware of its coefficient of expansion and make appropriate provisions. A 48" pa-nel will expand and contract approximately .002" for each degree fahrenheit change in temperature. In outdoor use, where summer and winter temperatures differ as much as 100°F, a 48" sheet will expand and contract approximately 3/16". Sash rabbets must be of sufficient depth to allow for expansion as well as for contraction.

ACRYLITE® LED color changing back lit also absorbs water when exposed to high relative humidity, resulting in expansion of the sheet. At relative humidity of 100%, 80%, and 60%, the dimen-sional changes are 0.6%, 0.3% and 0.2%, respectively.

Cementing
ACRYLITE® LED sheet can be cemented using common solvent cements or polymerizable cements such as ACRIFIX®. The most critical factor is good edge preparation of the part to be cemented. The edge of the sheet must be properly machined in order to have a square flat surface and no stresses. Annealing of the part prior to cementing is re-commended. Cement and cement fumes should not contact formed or polished surfaces.

Light Transmission
ACRYLITE® LED color changing back lit sheet has a light transmittance of 25%.

Formability
ACRYLITE® LED color changing back lit sheet will soften as the temperature is increased above 195°F (91°C). As the temperature is in-creased the sheet passes through the thermo-elastic state to the thermoplastic state. The change is gradual rather than sharply defined. The forming temperature range is between 290°F and 320°F (143°C and 160°C). Because the sheet gradually becomes thermoplastic, certain procedures should be considered during thermoforming. I

If the sheet is to be hung in an oven, it is necessary to use a continuous clamp rather than several individual clamps. This will prevent the sheet from permanently deforming between clamps. If the sheet is to be heated by infrared heaters while clamped in a horizontal frame, it may be necessary to control the heaters above the center of the sheet. This will prevent the center from becoming too hot and sagging under its own weight.

The sheet will exhibit very little "memory" after forming and probably will not return to its original flat condition if reheated. Cutting and Machining ACRYLITE® LED color changing back lit sheet will shrink in the machine direction when heated without a frame. Sheet thicknesses of .118" (3.0 mm) and greater will shrink no more than 3%. Thinner thicknesses could shrink more.

Surface Hardness
The surface of plastic is not as hard as that of glass. Therefore, reasonable care should be exercised in handling and cleaning ACRYLITE® LED sheet.

Electrical Properties
ACRYLITE® LED sheet has many desirable electrical properties. It is a good insulator. Its surface resistivity is higher than that of most plastics. Continuous outdoor exposure has little effect on its electrical properties.

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Cutting and Machining
ACRYLITE® LED color changing back lit sheet can be sawed with circular saws or band saws. It can be drilled, routed, filed and machined much like wood or brass with a slight modification of tools. Because the sheet softens quickly, it is necessary to keep the cutting tool and machined edge of the sheet as cool as possible. Cooling of the cutting tool is recommended. Tool sharpness and "trueness" are essential to prevent gumming, heat buildup and stresses in the part. Heat buildup at the machined edge could lead to subsequent stress crazing and therefore must be avoided.

Laser Cutting
Laser technology is ideal for quick and accurate cutting, welding, drilling, scribing and engraving of plastics. CO2 lasers focus a large amount of light energy on a very small area which is extremely effective for cutting complex shapes in acrylic sheet. The laser beam produces a narrow kerf in the plastic allowing for close nesting of parts and minimal waste.

CO2 lasers vaporize the acrylic as they advance resulting in a clean polished edge but with high stress levels; annealing acrylic sheet after laser cutting is recommended to minimize the chance of crazing during the service life of the part.

Annealing
ACRYLITE® LED color changing back lit sheet may be annealed at 180°F (82°C) with the heating and cooling times determined by the sheet thickness. An approximate guideline is annealing time in hours equals the sheet thickness in millimeters and the cool-down period is a minimum of 2 hours ending when sheet temperature falls below 140°F. For example, 1/8" (3mm) ACRYLITE® sheet would be heated for 3 hours at 180°F (82°C) and slowly cooled for 3 hours.

Flammability
ACRYLITE® sheet is a combustible thermoplastic. Precautions should be taken to protect this material from flames and high heat sources. ACRYLITE® LED sheet usually burns rapidly to completion if not extinguished. The products of combustion, if sufficient air is present, are carbon dioxide and water.

However, in many fires sufficient air will not be available and toxic carbon monoxide will be formed, as it will when other common combustible materials are burned. We urge good judgment in the use of this versatile material and recommend that building codes be followed carefully to assure it is used properly.

The combustibility test data for ACRYLITE® LED sheet is: self-ignition temperature (ASTM D-1929) is 850°F (455° C), smoke density as measured by ASTM D-2843 is 6.4%, and the rate of burning as measured by ASTM D-635 is 1.0 in/min (25mm/min) for 1/8" (3mm) thick sheet. While this data is based on small scale laboratory tests, frequently referenced in various building codes, these tests do not duplicate actual fire conditions.

Chemical Resistance
ACRYLITE® LED color changing back lit sheet, has excellent resistance to many chemicals including:

- Solutions of inorganic alkalies such as ammonia
- Dilute acids such as sulfuric acid up to a concentration of 30%
- Aliphatic hydrocarbons such as hexane and VM&P naphtha

ACRYLITE® LED sheet is not attacked by most foods and foods are not affected by it.

It is attacked, in varying degrees, by:

- Aromatic solvents such as benzene and toluene
- Chlorinated hydrocarbons such as methylene chloride and carbon tetrachloride
- Ethyl and methyl alcohols
- Some organic acids such as acetic acid
- Lacquer thinners, esters, ketones and ethers

The table on page 4 gives an indication of the chemical resistance of annealed ACRYLITE® LED color changing back lit sheet. The code used to describe chemical resistance is as follows:

R= Resistance

ACRYLITE® LED color changing back lit sheet withstands this substance for long periods and a temperature of 120°F (49°C).

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LR= Limited Resistance

ACRYLITE® LED color changing back lit sheet only resist the action of this substances for short periods at room temperatures. The resistance for particular application must be determined.

N= Non Resistant

ACRYLITE® LED color changing back lit sheet is not resistant to this substance. It is swelled, attacked, dissolved, or damaged in some manner. Plastic materials can be attacked by chemicals in several ways.

The methods of fabrication and/or conditions of exposure of ACRYLITE® LED sheet, as well as the manner, in which the chemicals are applied, can influence the final results even for "R" coded chemicals.

Some of these factors are listed below:

Fabrication-Stress generated while sawing, sanding, machining, drilling, and/or forming.

Exposure- Length of exposure, stresses induced during the life of the product due to various loads, changes in temperatures, etc.

Application of Chemicals- by contact, rubbing, wiping, spraying, etc.

The table should therefore be used as only a general guide and, in case of doubt; it should be supplemented by tests made under actual working conditions.

Chemical Resistance of ACRYLITE® LED color changing back lit

Chemical	Code	Chemical	Code	Chemical	Code
	LR	Ethyl Acetate	N	Nitric Acid (40%)	LR
Acetic Acid (Glacial)	N	Ethyl Alcohol (30%)	LR	Nitric Acid (Conc.)	N
Allcohol	N	Ethyk Alchohol (95%)	N	Oleic Acid	R
Ammonium Chloride	R	Ethylene Dichloride	N	Olive Oil	R
Ammonium Hydroxide (10%)	R	Ethylene Glycol	R	Phenol Solution (5%)	N
Ammonium Hydroxide (Conc.)	R	Gasoline	LR	Soap Solution (Mild dish soap)	R
Aniline	N	Glycerine	R	Sodium Carbonate (2%)	R
Battery Acid	R	Heptane	R	Sodium Carbonate (20%)	R
Benzene	N	Hexane	R	Sodium Chloride (10%)	R
Butyl Acetate	N	Hydrochloric Acid	R	Sodium Hydroxide (1%)	R
Calcium Chloride (Sat.)	R	Hydrofluoric Acid (25%)	N	Sodium Hydroxide (10%)	R
Calcium Hypochlorite	R	Hydrogen Peroxide (<40%)	R	Sodium Hydroxide (60%)	R
Carbon Tetrachloride	N	Hydrogen Peroxide (>40%)	LR	Sodium Hypochlorite (5%)	R
Chloroform	N	Isopropyl Alcohol	LR	Sulfuric Acid (3%)	R
Chromic Acid	LR	Kerosene	R	Sulfuric Acid (30%)	R
Citric Acid (20%)	R	Lacquer Thinner	N	Sulfuric Acid (Conc.)	N
Cottonseed Oil (Edible)	R	Methyl Alcohol (30%)	LR	Toluene	N
Detergent Solution (Heavy Duty)	R	Methyl Alcohol (100%)	N	Transformer Oil	R
Diesel Oil	R	Methyl Ethyl Ketone (MEK)	N	Trichloroethylene	N
Diethyl Ether	N	Methylene Chloride	N	Turpentine	R
Dimethyl Formamide	N	Mineral Oil	R	Water	R
Dioctyl Phthalate	N	Nitric Acid (10%)	R	Xylene	N

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Property[a]		ASTM Method	Typical Value (0.250" Thickness) [b]
Mechanical	Specific Gravity	D 792	1.19
	Tensile Strength Elongation, Rupture Modulus of Elasticity	D 638	10,000 psi (69 M Pa) 4.5% 400,000 psi (2800 M Pa)
	Flexural Strength Modulus of Elasticity	D 790	17,000 psi (117 M Pa) 480,000 psi (3300 M Pa)
	Compressive Strength (Yield)	D 695	17,000 psi (117 M Pa)
	Impact Strength Izod Milled Notched	D 256	0.4 ft.lbs/in. of notch (21.6 J/m of notch)
	Rockwell Hardness	D 785	M-93
	Barcol Hardness	D 2583	48
Optical	Refractive Index	D 542	1.49
	Light Transmission, Total	D 1003	92%
Thermal	Forming Temperature	-	Approx. 300°F (149°C)
	Deflection Temperature Under Load (264 psi)	D 648	195°F (91°C)
	Vicat Softening Point	D 1525	220°F (105°C)
	Maximum Recommended Continuous Service Temperature	-	160°F(c) (71°C)
	Coefficient of Linear Thermal Expansion	D 696	0.000040 in/in - °F (.000072 m/m - °C)
	Coefficient of Thermal Conductivity	Cenco-Fitch	1.3 BTU/(Hr) (Sq.Ft.) (°F/in.) (0.19 w/m•K)
	Flammability, Burning Rate (0.125" thickness)	D 635	1.0 in/min. (25 mm/min.)
	Self-Ignition Temperature	D 1929	850°F (455°C)
	Specific Heat @ 77°F	-	0.35 BTU/(lb.) (°F) (1470J/Kg•K)
	Smoke Density Rating	D 2843	4.8%
Electrical	Dielectric Strength Short Time (0.125")	D 149	430 volts/mil (17 KV/mm)
	Dielectric Constant 60 Hertz 1,000 Hertz 1,000,000 Hertz	D 150	 3.6 3.3 2.8
	Dissipation Factor 60 Hertz 1,000 Hertz 1,000,000 Hertz	D 150	 0.06 0.04 0.02
	Volume Resistivity	D 257	10^{16}ohm-cm
	Surface Resistivity	D 257	10^{15}ohms
Water Absorption 24 hrs @ 73°F		D 570	0.2%
Odor		-	None
Taste		-	None

NOTES:

(a) Typical values; should not be used for specification purposes.

(b) Values shown are for 0.250" thickness. Some values will change with thickness or pigmentation.

(c) It is recommended that temperatures not exceed 160°F for continuous service, or 190°F for short intermittent use.

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Röhm GmbH and its affiliates are a worldwide manufacturer of PMMA products sold under the PLEXIGLAS® trademark on the European, Asian, African and Australian continents and under the ACRYLITE® trademark in the Americas.

Fire Precautions
ACRYLITE® sheet is a combustible thermoplastic. Precautions should be taken to protect this material from flames and high heat sources. ACRYLITE® sheet usually burns rapidly to completion if not extinguished. The products of combustion, if sufficient air is present, are carbon dioxide and water. However, in many fires sufficient air will not be available and toxic carbon monoxide will be formed, as it will when other common combustible materials are burned. We urge good judgement in the use of this versatile material and recommend that building codes be followed carefully to assure it is used properly.

Compatibility
Like other plastic materials, ACRYLITE® sheet is subject to crazing, cracking or discoloration if brought into contact with incompatible materials. These materials may include cleaners, polishes, adhesives, sealants, gasketing or packaging materials, cutting emulsions, etc. See the Tech Briefs in this series for more information, or contact your ACRYLITE® sheet Distributor for information on a specific product.