



CYRO Industries  
100 Enterprise Drive  
Rockaway, NJ 07866

# Acrylite® df

LIGHT DIFFUSING MOLDING & EXTRUSION COMPOUNDS

## Introduction

Commercial requirements for diffusion products include the following characteristics:

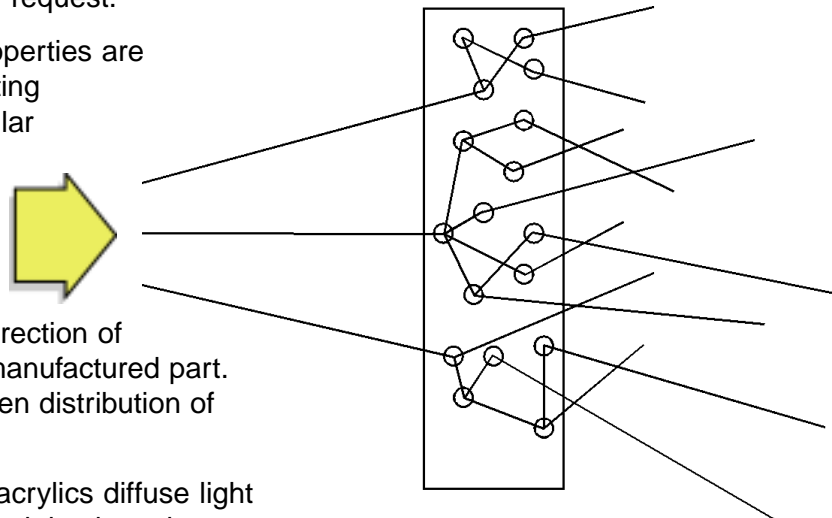
- High transmittance-lighting output ratio
- Diffusion-haze
- Light stability
- Service temperature

CYRO Industries' new grades of ACRYLITE® df light diffusing molding and extrusion compounds are acrylic polymers with superior light diffusion and transmittance, resulting in higher light intensity and output ratio compared to conventional pigment-diffusion polymers. This offers increased lighting efficiency with a 20-40% increase in light transmittance versus pigmented products.

The product is offered in four concentration levels (df 20, df 21, df 22, and df 23) and is available in all ACRYLITE standard grades, "S", "H", "M", and "L". It can be formulated to meet specific end-user requirements with the addition of ultraviolet absorbers and/or internal lubricants, and transparent colors are available on request.

The special optical properties are obtained by incorporating spherical, high molecular weight polymer beads with a different refractive index into the acrylic matrix. The difference in refractive indices changes the direction of light travel within the manufactured part. The net result is an even distribution of light exiting the part.

Traditional pigmented acrylics diffuse light by blocking or reflecting it backwards, thus reducing the transmitted light by as much as 30%.



**Figure 1: Light diffusion (forward direction) due to the diffuser particles embedded in ACRYLITE df compound matrix**

# Applications

The combination of optical efficiency (light diffusion/transmission), light stability, weatherability and high heat deflection under load (DTL) make ACRYLITE df compounds ideal for use in lighting and other applications where light diffusion properties are critical.

ACRYLITE df compounds can be made available in HID (high intensity discharge), impact modified, or higher flow versions if required.

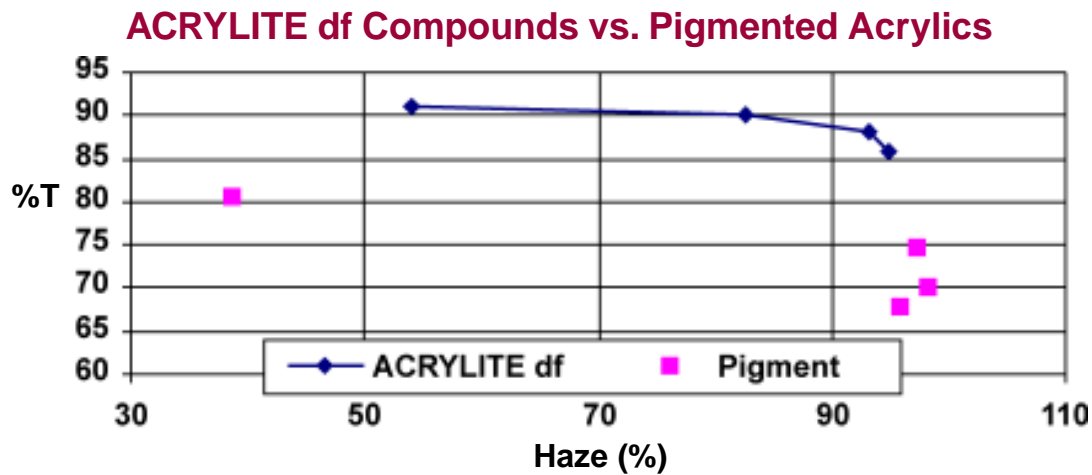
Suitable applications include:

- Lighting
- Optoelectronics
- Displays
- Monitor covers
- Projection screens

# Properties

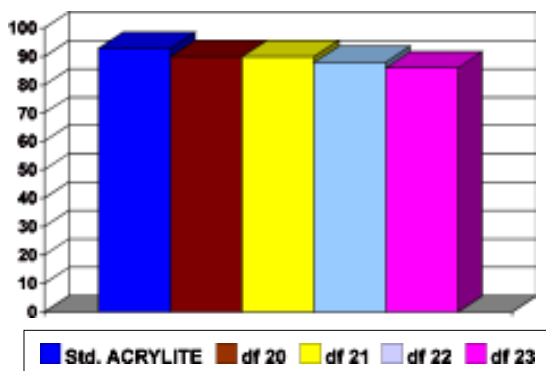
## Optics

Compared to materials manufactured with pigments as diffusion aids, ACRYLITE df compounds provide a much higher output ratio (more light from the source), or reduced energy consumption at the same output ratio. Because traditional diffusion grade acrylic products utilize pigments to scatter light, they *block* the light, while df products *transmit* the light while scattering it.

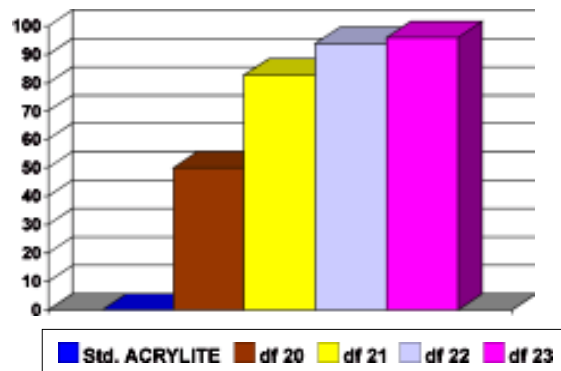


The level of diffusion material present has an impact on the transmittance and haze of the product. The measured values for these properties are outlined in the following graphs.

**% Transmittance of ACRYLITE df Compounds**

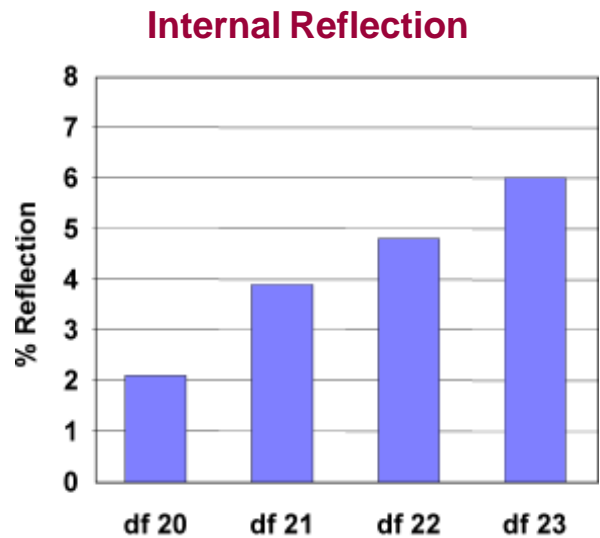
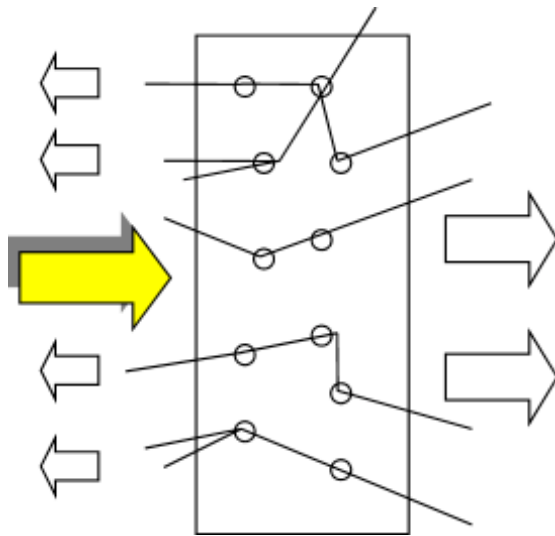


**% Haze of ACRYLITE df Compounds**



Transmittance and Haze are a function of wall thickness, thus will decrease slightly with increasing thickness. For example, a change in wall thickness from 1mm to 3mm for the ACRYLITE df 22 compound will result in an approximate 2% decrease in transmittance.

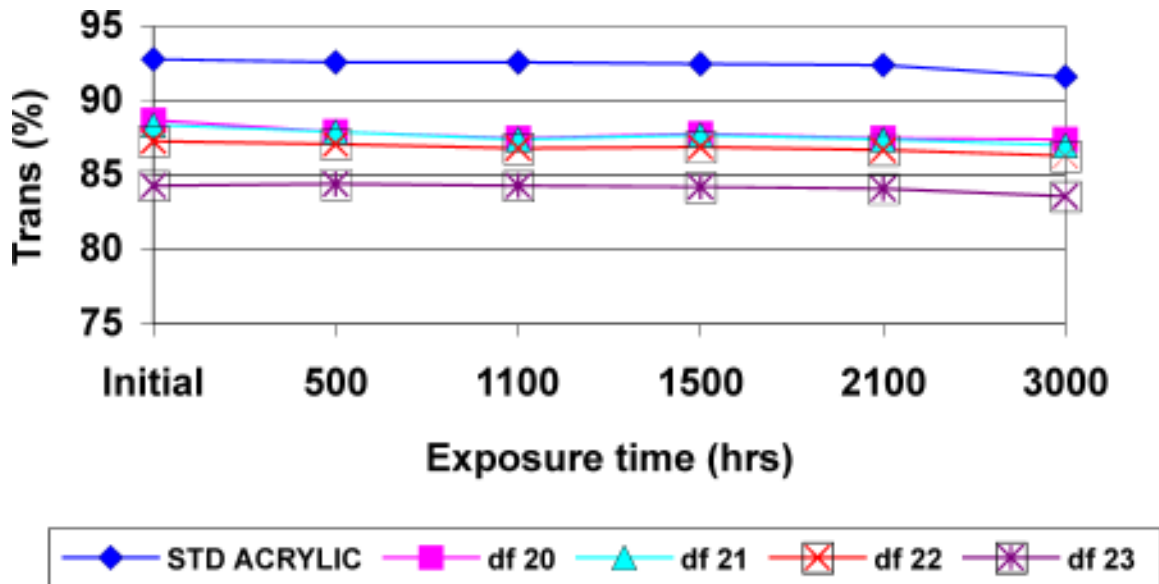
A small amount of transmittance is lost due to internal reflectance. The amount of reflection will vary with the level of diffusion and wall thickness. For a 0.125" thick part, losses ranging from 2.2% (df 20 compound) to 5.9% (df 23 compound) can be expected.



### Weathering/Aging

ACRYLITE df compounds resist the adverse effects of outdoor exposure and will retain both their appearance and physical properties after long periods of exposure. The light stability of articles made from ACRYLITE df compounds is excellent. Light exposure testing shows no yellowing.

### Xenon Arc Weathering of ACRYLITE df Compounds



## Xenon Arc Weathering - Net Change in Haze & Yellowness Indices 3000 hours exposure

Material Tested	Net Change in YI	Net Change in Haze (%)
Standard ACRYLITE	+0.5	< 1
ACRYLITE df 20	+0.3	< 1
ACRYLITE df 21	+0.3	< 1
ACRYLITE df 22	+0.4	< 1
ACRYLITE df 23	+0.5	< 1

The Yellowness Index and the % Haze remain essentially unchanged versus standard PMMA during the exposure period.

### Physical Properties

ACRYLITE df compounds provide similar strength and heat resistance properties to standard ACRYLITE grades.

### Chemical Resistance

ACRYLITE df compounds resist most chemicals found in normal use. A comprehensive listing of chemical resistance can be found in the *ACRYLITE acrylic molding compounds Technical User's Manual (#1066)*.

### Processing

ACRYLITE df compounds can be injection molded or extruded into sheet and thermoformed using conventional plastic processing equipment.

### Drying

ACRYLITE df compounds will absorb moisture from the atmosphere. The presence of moisture in the pellets may present processing difficulties, and it is recommended that the material be dried prior to use. ACRYLITE df compounds should be dried for 3-4 hours in a desiccant-type dryer at 175 °F and a -20 °F dewpoint. For optimum part appearance and performance, maximum moisture levels of 0.03% for extrusion and 0.1% for injection molding are strongly recommended.

Failure to dry the plastic adequately can result in a loss of surface gloss, severe surface streaks, and/or bubbles. If extruded sheet is to be thermoformed later, re-absorption of moisture by the sheet should be prevented.

### Contamination

The processing equipment employed in the injection molding and extrusion processes – i.e., barrel, screw, mold, and die – should be clean to avoid contamination problems. ACRYLITE df compounds are compatible with similar grades of acrylic molding materials manufactured by other companies, but are not compatible with other plastics. Contamination with other plastics can affect the behavior of the melt and the optical and mechanical properties of the compound.

### Purging

Purging of processing equipment is recommended when transitioning from one plastic to another or when starting up after an extended shutdown (>1 hour). Because the ACRYLITE df grade contains high molecular weight diffusion beads, the compounds may act like a scouring agent, expelling build-up inside the processing equipment. It is recommended that commercially available purging compounds or cast acrylic be used to purge the equipment. When transitioning to the ACRYLITE df compound, use wet df material or ACRYLITE compound initially, following the purging compound.

## Regrind

ACRYLITE df compounds can be regrind and reprocessed without adversely affecting physical properties. The primary effect of using regrind material is a shift in color. A maximum of 25% regrind to 75% virgin material is recommended. It is also important to avoid contamination and remove all fines in the regrinding process. Due to the increased surface to volume ratio, the regrind may require additional drying.

## Processing Parameters

Detailed information on equipment considerations can be found in the ACRYLITE acrylic molding compounds *Technical User's Manual*.

### Injection Molding Processing Parameters ACRYLITE 8N df Grades

Condition	Suggested Range	Starting Point
Melt Temperature, (°F)	464-482	470
Mold Temperature, (°F)	100-175	120
Injection Pressure, (psi)	6000-15000	8000
Clamp Pressure	2.5 tons/in <sup>2</sup> of projected area	
Screw Speed, (rpm)		
2:1 compression ratio	75-150	100
3.5:1 compression ratio	60-130	80
Ram Speed, (in/sec)		
Small gates	0.5-1.5	1
Large gates	1-4	2
Back Pressure, psi	0-100	20

### Extrusion Processing Parameters ACRYLITE 8N df Grades

Screw Diameter	3.5 Inch	4.5"	6 inch
Feed Zone (°F)	350-400	340-400	280-320
Rear (°F)	380-420	380-415	320-360
Rear Center (°F)	380-425	380-425	360-420
Center (°F)	390-430	380-425	400-440
Front Center (°F)	420-470	420-460	420-460
Front (°F)	430-475	420-460	420-460
Gate (°F)	450-470	450-470	460
Adapter (°F)	450-470	450-470	460
Die end plates (°F)	450-470	450-470	470
Die left and right (°F)	440-470	445-460	460
Die center (°F)	440-470	445-460	460

**Typical  
Property  
Sheet  
ACRYLITE  
8N df  
Grades**

Property	Test Method	8N df 20	8N df 21	8N df 22	8N df 23
<b>Optical</b>					
Light Trans %	ASTM D-1003	90	90	88	86
Haze, %	ASTM D-1003	50	83	94	96
Refractive Index	ASTM D-542	1.492	1.496	1.498	1.498
<b>Rheological</b>					
Avg. Melt Flow @ 230 °C/3.8 kg	ASTM D-1238	3.2	3.1	3.0	2.9
<b>Mechanical</b>					
Tensile Strength, psi	ASTM D-638	11,350	11,500	11,500	11,500
Tensile Modulus, psi	ASTM D-638	540,000	550,000	550,000	550,000
Tensile Elongation @ Yield, %	ASTM D-638	4	4	4	4
Tensile Elongation @ Break, %	ASTM D-638	4	4	4	4
Flexural Strength, psi	ASTM D-790	19,000	20,000	20,000	19,000
Flexural Modulus, psi	ASTM D-790	500,000	500,000	500,000	500,000
Notched Izod, ft-lb/in @ 23 °C	ASTM D-256	0.3	0.3	0.3	0.3
Gardner Impact, in-lb	ASTM D-3029	2	2	2	2
Rockwell Hardness, M scale	ASTM D-785	95	95	95	95
<b>Physical</b>					
DTL, °C @ 264 psi annealed	ASTM D-648	105	105	105	105
Vicat Softening Point, °C	ASTM D-1525	117	119	119	119
Specific Gravity	ASTM D-792	1.19	1.19	1.19	1.19
Water Absorption, % max	ASTM D-570	0.3	0.3	0.3	0.3
Flammability		UL 94 HB	UL 94 HB	UL 94 HB	UL 94 HB
Mold Shrinkage, in/in:mm/mm	ASTM D-551	0.004-0.006	0.004-0.006	0.004-0.006	0.004-0.006

**Compliance Information:** *(When available)*

746c-suitability for outdoor lighting Building Code

**TO ORDER, CALL: 800-225-0172**

**Sales Offices**

**Eastern Region** - 100 Enterprise Dr., PO Box 5055, Rockaway, NJ 07866 973-442-6123

**Western Region** - 65 E. Elizabeth Ave. Suite 309, Bethlehem, PA 18018 610-317-2570

**International** - 100 Enterprise Dr., PO Box 5055, Rockaway, NJ 07866 Fax 973-442-6083

**CYRO Canada Inc.** - 6285 Northam Drive, Unit 100, Mississauga, Ontario L4V 1X5 905-677-1388, 800-268-4743

**Technical Center** 25 Executive Boulevard, Orange, CT 06477 203-795-6081 Fax 203-795-5800

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