

**ACRYLITE®**

# **ACRYLIC ADVISOR**

Technical reference guide  
for ACRYLITE® & ACRYMID®  
acrylic polymers

**IRÖHM**

# ACRYLIC ADVISOR

We are traditionally innovative. Our company's founder, Dr. Otto Röhm, laid the groundwork for today's methacrylate chemicals in 1907. Since then, we have continuously expanded our technology-based strengths in the Verbund tapping into new application fields with our products. With long-term investments and targeted expansion, we drive our sustainable growth and further boost our leading market positions.



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# INTRODUCTION

Acrylic polymers, referred to as polymethylmethacrylates or PMMA, are amorphous thermoplastic engineering resins known for their:

- high optical properties
- excellent outdoor weathering resistance
- high scratch resistance
- high dimensional stability
- ease of processing

Roehm is a leading North American supplier of acrylic and acrylic-based molding compounds. Our polymers are widely used in lighting, automotive, medical, optics, architectural interiors, point-of-purchase, sanitary ware, and houseware applications that require vastly different end use performance properties. Roehm markets its products under the ACRYLITE® and ACRYMID® trade names in the Americas. The same products are sold under the PLEXIGLAS® and PLEXIMID® trade names throughout the rest of the world.

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## Roehm offers the following product lines:

- ACRYLITE®
- ACRYLITE® Resist
- ACRYLITE® Optical
- ACRYLITE® Heatresist
- ACRYMID®
- ACRYLITE® LED
- ACRYLITE® Satinice
- ACRYLITE® Hi-Gloss



ACRYLITE® is Roehm's standard acrylic product line. ACRYLITE® acrylic polymers are available in grades that vary according to four manufacturing variables:

- Molecular weight
- Co-monomer content
- Lubricant content
- Ultraviolet light transmission

These variations control the physical and rheological properties of each material.

- High molecular weight acrylics generally exhibit higher strength properties and lower melt flow rates
- Low molecular weight acrylic with high co-monomer content will exhibit lower strength and higher melt flow rates.
- Lubricant is added to facilitate ejection of molded parts with low draft angles and aid in processing. The higher the level of lubricant, the more easily parts are ejected and the easier the material will flow.
- Ultraviolet light transmission properties can be adjusted from the maximum UV transmitting to high UV absorbing.

**ACRYLITE® 8H, 8N, and H15 acrylic polymers** are considered high molecular weight acrylics containing the lowest co-monomer content. These two factors contribute to the high rigidity, high heat resistance characteristics, and the lower melt flow rates.

All grades of ACRYLITE® polymers are available in clear and a wide range of transparent, translucent, and opaque colors. Specialty colors can be produced on a made to order basis.



## TYPICAL APPLICATIONS

- Automotive lighting lenses, light pipes and instrument panel lenses
- Solar photovoltaic lenses
- High heat lighting applications for diagnostic and surgical; marine signaling; roads and runways
- Optical lenses
- LCD displays
- High efficiency LED lighting
- Housewares
- P-O-P displays

## DESCRIPTION OF GRADES

<i>Grade</i>	<i>Description</i>
<b>ACRYLITE® 8H</b>	Highest heat resistance/service temperature (DTL/Vicat), optimum mechanical properties, excellent weatherability
<b>ACRYLITE® 8N</b>	Highest heat resistance/service temperature (DTL/Vicat), optimum mechanical properties, excellent weatherability
<b>ACRYLITE® H15</b>	High heat resistance/service temperature (DTL/Vicat), high mechanical properties, excellent weatherability
<b>ACRYLITE® H12</b>	Medium heat resistance/service temperature (DTL/Vicat), high mechanical properties, excellent weatherability, ease of flow
<b>ACRYLITE® M30</b>	Medium heat resistance/service temperature (DTL/Vicat), high mechanical properties, excellent weatherability, ease of flow
<b>ACRYLITE® L40</b>	Medium heat resistance/service temperature (DTL/Vicat), high mechanical properties, excellent weatherability, ease of flow

## MATERIAL PROPERTIES

Property	ASTM Method	ACRYLITE® 8H	ACRYLITE® H15	ACRYLITE® 8N	ACRYLITE® H12	ACRYLITE® M30	ACRYLITE® L40
<b>OPTICAL (3mm path length)</b>							
Light Transmission, %	D-1003	92	92	92	92	92	92
Light Transmission, % at 340 nm	D-1003		NA	NA	min 87.7	NA	min 87.7
Haze, %	D-1003	<1	<1	<1	<1	<1	<1
Refractive Index	D-542	1.49	1.49	1.49	1.49	1.49	1.49
Yellowness Index	D-1925	<1	<1	<1	<1	<1	<1
<b>RHEOLOGICAL</b>							
Melt Flow Rate, g/10 min at 230°C and 3.8 kg	D-1238	0.7	2.2	3.3	7.0	24	26
<b>MECHANICAL</b>							
Tensile Strength, psi (MPa)	D-638	11,300 (779)	9,800 (67.6)	11,300 (779)	9,500 (65.5)	9,200 (63.4)	8,800 (60.7)
Tensile Modulus, x10 <sup>8</sup> psi (GPa)	D-638	0.49 (3.3)	0.47 (3.2)	0.47 (3.2)	0.47 (3.2)	0.47 (3.2)	0.47 (3.2)
Tensile Elongation at Yield, %	D-638	6-8	4 - 6	4 - 6	4 - 6	2 - 4	2 - 4
Tensile Elongation at Break, %	D-638	6-8	4 - 6	4 - 6	4 - 6	2 - 4	2 - 4
Flexural Strength, psi (MPa)	D-790	17,900 (123)	17,000 (117.2)	16,200 (111.7)	17,000 (117.2)	15,500 (106.9)	14,200 (97.9)
Flexural Modulus, x10 <sup>5</sup> psi (GPa)	D-790	0.36 (2.5)	0.49 (3.4)	0.50 (3.5)	0.49 (3.4)	0.46 (3.2)	0.44 (3.0)
Notched Izod, ft-lb/in (J/m) on ¼ bar at 23°C	D-256	0.36 (19)	0.36 (19)	0.36 (19)	0.36 (19)	0.36 (19)	0.36 (19)
Rockwell Hardness, M scale	D-785	98	95	95	94	89	84
<b>PHYSICAL</b>							
DTL, °F (°C) at 264 psi, annealed	D-648	212 (100)	203 (96)	208 (98)	201 (95)	180 (82)	165 (74)
Vicat Softening Point, 50°C/h, 50N °F (°C)	D-1525	226 (108)	221 (105)	226(108)	221 (105)	194 (90)	180 (82)
Specific Gravity (25°C/25°C)	D-792	1.19	1.19	1.19	1.19	1.19	1.19
Water Absorption, % max	D-570	0.3	0.3	0.3	0.3	0.3	0.3
Mold Shrinkage, in/in, mm/mm	D-955	0.004-0.006	0.004-0.007	0.004-0.007	0.004-0.006	0.003-0.006	0.003-0.006
Coefficient of Linear Expansion (in/in/°F, 32-212°F) (mm/mm/°C, 0-100°C)	D-696 D-696	0.00004 -0.000072	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)
UL Flammability Class		50	90	90	90	50	70
UL Relative Thermal Index (RTI) 3 mm / 1.5 mm (°C)		-	- / 3	- / 0	-	-	-
UL HWI PLC 3 mm / 1.5 mm	IEC 60695-2-12	-	-	- / 700	-	-	-
UL Glow Wire Flammability (GWFI) 3 mm / 1.5 mm (°C)	IEC 60695-2-13	-	-	- / 725	-	-	-
UL Glow Wire Ignition (GWIT) 3 mm / 1.5 mm (°C)	D-788	PMMA 0142V1	PMMA 0140V2	PMMA 0140V3	PMMA 0130V4	PMMA 0122V7	PMMA 0112V7
CLASS	D-788	PMMA 0142V1	PMMA 0140V2	PMMA 0140V3	PMMA 0130V4	PMMA 0122V7	PMMA 0112V7

## PROCESSING CONDITIONS – INJECTION MOLDING

Condition	ACRYLITE® 8H	ACRYLITE® 8N	ACRYLITE® H15	ACRYLITE® H12	ACRYLITE® M30	ACRYLITE® vL40
Drying Temperature (3–4 hours) min.	180°F 82°C	180°F 82°C	180°F 82°C	180°F 82°C	175°F 80°C	160°F 71°C
Melt Temperature	450–490°F 230–255°C	450–490°F 230–255°C	450–490°F 230–255°C	450–490°F 230–255°C	450–490°F 230–255°C	430–480°F 220–250°C
Mold Temperature	100–180°F 38–82°C	100–180°F 38–82°C	100–180°F 38–82°C	100–180°F 38–82°C	100–180°F 38–82°C	100–180°F 38–82°C

### Clamp Pressure

25 tons/in<sup>2</sup> of projected area for flow length/wall thickness <100/1

5 tons/in<sup>2</sup> of projected area for flow length/wall thickness >100/1

Screw Speed, rpm 2:1 compression ratio	75–150	75–150	75–150	75–150	75–150	75–150
Screw Speed, rpm 3.5:1 compression ratio	60–130	60–130	60–130	60–130	60–130	60–130
Ram Speed, in/sec	small gates 0.5–1.5 large gates 1–4	small gates 0.5–1.5 large gates 1–4	small gates 0.5–1.5 large gates 1–4	small gates 0.5–1.5 large gates 1–4	small gates 0.5–1.5 large gates 1–4	small gates 0.5–1.5 large gates 1–4
Back Pressure, psi	25–100	25–100	25–100	25–100	25–100	25–100

## PROCESSING CONDITIONS – EXTRUSION

Screw Diameter	3 ½ inch	4 ½ inch	6 inch
Turns of Feed–Constant Depth	4 at 0.400	4 at 0.625	7 at 0.635
Turns of Transition–Constant Taper	3	3	3
Turns of Meter Pump–Constant	5 at 0.165	5 at 0.180	4 at 0.190
Turns of Decompression Constant Taper	1	1	1
Turns of Vent Zone–Constant Depth	4 at 0.650	4 at 0.750	at 0.750
Turns of Recompression–Constant Taper	2.5	2.5	2.0
Turns of 2nd Meter Pump–Constant Taper	5 at 0.280	5 at 0.305	5 at 0.320
Feed Zone	350–400°F	340–400°F	280–320°F
Rear	380–420°F	380–415°F	320–360°F
Rear Center	380–425°F	380–425°F	360–420°F
Center	390–430°F	380–425°F	400–440°F
Front Center	420–470°F	420–460°F	420–460°F
Front	430–475°F	420–460°F	420–460°F
Adapter	450–470°F	450–470°F	460°F
Die End Plates	450–470°F	450–470°F	470°F
Die Left and Right	440–470°F	440–470°F	460°F
Die Center	440–470°F	440–470°F	460°F
Approximate Output (lb/hr)	440–550	800–1,000	1,300–1,800
Drive Horsepower	75–100	125–174	200–300

Typical screw geometries and machine settings for sheet extrusion with ACRYLITE® acrylic polymers (two stage screw with L/D of 30/1 assumed)



## ACRYLITE® Resist acrylic polymers are specially formulated to offer:

- Enhanced impact resistance and toughness
- Clarity similar to standard PMMA
- Resistance to adverse effects of outdoor weathering
- Chemical resistance

ACRYLITE® Resist acrylic polymers will retain both their physical properties and appearance after long periods of outdoor exposure. ACRYLITE® Resist polymers vary according to molecular weight, co-monomer content, rubber modifier and lubricant content. Depending on the application requirements, there is an ACRYLITE® Resist grade that can provide the optimum balance of impact resistance and melt flow properties. A high amount of rubber modifier will correspond to high impact resistance and mechanical properties and lower melt flow rates.

## ACRYLITE® Resist acrylic polymers are available in both global formulations and regionally customized grades;

- ACRYLITE® Resist AG 100, zk6BR, zk5BR, and zk4BR are global recipes which cover applications from maximum impact strength to low impact strength.
- ACRYLITE® Resist zk6 and zkM are customized regionally available formulations.
- All ACRYLITE® Resist grades can be easily blended with ACRYLITE® acrylic molding compounds to further optimize impact strength and processability.



## TYPICAL APPLICATIONS

- Lighting
- Glazing
- Automotive lenses and trim
- Engraving stock
- Surface protection i.e. hoods, golf carts, lawn tractors, snowmobiles
- Housings for consumer products i.e. hot tubs, shower surrounds
- Personal accessories i.e. toothbrushes
- Signs
- Sanitaryware
- Window profiles

## DESCRIPTION OF GRADES

<i>Grade</i>	<i>Description</i>
<b>ACRYLITE® Resist AG 100*</b>	Superior impact strength developed for automotive glazing applications. It has the highest heat deflection temperature of any ACRYLITE® Resist grade. Typical applications include front grilles, center signature lights, fog lamp bezels, emblems, badges and tail light lenses.
<b>ACRYLITE® Resist zk6BR*</b> <b>ACRYLITE® Resist zk6</b>	Maximum impact strength with a balanced property spectrum. The product is found in a wide variety of applications including mirror housings, rear combination lamps, and appliance lenses.
<b>ACRYLITE® Resist zk5BR*</b> <b>ACRYLITE® Resist zkM</b>	Medium impact strength and medium flow. Often used for electronic instrumentation windows, security camera and automotive signal lens applications.
<b>ACRYLITE® Resist zk4BR</b>	Light level of impact strength designed to improve toughness and processability while retaining material hardness, brilliant optical clarity and high heat resistance expected from unmodified acrylic polymer. Typical applications include signal lens, exterior automotive trims, LED lighting, and rear combination lamps.

\*ACRYLITE® Resist AG100, zk6BR, zk5BR, and zk4BR are globally available products.

# ACRYLITE® RESIST

## MATERIAL PROPERTIES

Property	ASTM Method	ACRYLITE® Resist AG 100	ACRYLITE® Resist zk6	ACRYLITE® Resist zkM	ACRYLITE® Resist zk4BR	ACRYLITE® Resist zk5BR	ACRYLITE® Resist zk6BR
<b>OPTICAL (3mm path length)</b>							
Light Transmission, %	D-1003	91	91	91	92	92	91
Haze, %	D-1003	<1	1	1	<1.5	<2	<2
Refractive Index	D-542	1.49	1.49	1.49	1.49	1.49	1.49
Yellowness Index	D-1925	0.3	0.3	0.3	0.3	0.3	0.3
<b>RHEOLOGICAL</b>							
Melt Flow Rate, g/10 min at 230°C and 3.8 kg	D-1238	1.3	1.7	3.5	4.5	3.4	1.5
<b>MECHANICAL</b>							
Tensile Strength, psi (MPa)	D-638	6,800 (47.1)	6,300 (43.4)	8,500 (58.6)	11000 (75.8)	9000 (62)	7000 (48)
Tensile Modulus, x10 <sup>6</sup> psi (GPa)	D-638	0.22 (1.5)	0.22 (1.5)	0.32 (2.2)	0.43 (3.0)	0.36 (2.5)	0.25 (1.7)
Tensile Elongation at Yield, %	D-638	6.6	5	5	5	5	6
Tensile Elongation at Break, %	D-638	42.2	55	30	19	30	50
Flexural Strength, psi (MPa)	D-790	8,900 (61.6)	8,600 (59.3)	13,000 (89.6)	14,800 (102)	12,900 (88.7)	9100 (62.8)
Flexural Modulus, x10 <sup>4</sup> psi (GPa)	D-790	0.22 (1.5)	0.22 (1.5)	0.32 (2.2)	0.40 (2.7)	0.33 (2.3)	0.24 (1.7)
Notched Izod, ft-lb/in (J/m) on ¼ bar at 23°C on ¼ bar at 0°C	D-256 D-256	0.85 (44.9) 0.35 (18.5)	1.1 (58.1) 0.70 (36.8)	0.85 (44.9) 0.50 (26.3)	0.47 (24.6) –	0.80 (41.6) –	1.09 (57.1) –
Charpy Impact Strength 23°C, kJ/m <sup>2</sup>	ISO 179/1eU	120	80	50	25	50	80
Rockwell Hardness, M scale	D-785	–	40	68	83	70	49
<b>PHYSICAL</b>							
DTL, °F (°C) at 264 psi, annealed	D-648	208 (98)	194 (90)	196 (91)	203 (95)	199 (93)	191 (88)
Vicat Softening Point, 50°C/h, 50N °F (°C)	D-1525	220 (104)	201 (94)	210 (99)	216 (102)	212 (100)	203 (95)
Specific Gravity (25°C/25°C)	D-792	1.17	1.16	1.18	1.18	1.18	1.16
Water Absorption, % max	D-570	0.3	0.3	0.3	0.3	0.3	0.3
Mold Shrinkage, in/in, mm/mm	D-955	0.003 - 0.006	0.004 - 0.007	0.003 - 0.006	0.004 - 0.007	0.004 - 0.007	0.004 - 0.007
Coefficient of Linear Expansion in/in/°F, 32-212°F mm/mm/°C, 0-100°C	D-696 D-696	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00005 (0.00009)
UL Flammability Class		UL 94 HB (f1)	UL 94 HB (f1)	UL 94 HB (f1)	UL 94 HB (f1)	UL 94 HB (f1)	UL 94 HB (f1)
UL Relative Thermal Index (RTI) - 3 mm / 1.5 mm (°C)		50	90	90	50	50	50
UL HWI PLC - 3 mm / 1.5 mm		–	2 / 3	2 / 3	–	–	–
CLASS	D-788	PMMA 0231V1	PMMA 0241V3	PMMA 0221V3	PMMA 0221V3	PMMA 0221V3	PMMA 0241V1

## PROCESSING CONDITIONS – INJECTION MOLDING

Condition	Suggested	Starting Point
Drying Temperature, (3-4 hours)	180°F (82°C)	160°F (71°C)
Melt Temperature	450-480°F (232-250°C)	460°F (238°C)
Mold Temperature	110-180°F (38-82°C)	140°F (60°C)
Injection Pressure, psi	6,000-15,000 (40-100)	10,000 (69)
Clamp Pressure, psi	2.5 tons/in <sup>2</sup> of projected area for flow length/wall thickness <100/1 5 tons/in <sup>2</sup> of projected area for flow length/wall thickness >100/1	
Screw Speed, rpm 2:1 compression ratio	75-150	100
Screw Speed, rpm 3.5:1 compression ratio	60-120	80
Ram Speed, in/sec	small gates 0.5-1.5 large gates 1-4	small gates 0.5-1.5 large gates 1-4
Back Pressure, psi (MPa)	50-150 (0.14-0.70)	25-100

## PROCESSING CONDITIONS – EXTRUSION

Screw Diameter	°F	°C
Feed Zone	390-410°F	199-210°C
Rear Center	410-430°F	210-221°C
Center	440-470°F	226-243°C
Front	440-470°F	226-243°C
Adapter	450-470°F	232-243°C
Die	420-450°F	216-232°C
Polishing Roll Temperature	180-220°F	82-104°C

ACRYLITE® Resist Compounds can be extruded with conventional general purpose screws (typical heat settings)



ACRYLITE® Optical grades use propriety purification processes that ensure the polymers are free of any visible dust, fines and contaminates.

These specialty polymers provide the high optical purity needed for applications that require high transmission efficiency in long light paths. The low absorption coefficient characteristics provide the best possible outcomes for sophisticated light pipes and interior lighting lenses.

**ACRYLITE® Optical POQ polymers** have formulation refinements that further ensure high optical purity. The POQ polymers are excellent for long path light guide applications, but should not be used for outdoor applications and should only be used with LED lighting sources.

**ACRYLITE® 8N SuPure** acrylic polymers are designed to deliver an end product of extreme purity and clarity with no visible defects. Typical applications in automotive include instrument cluster lenses, interior lighting lenses and telematic covers. In lighting applications it is used for light pipes and covers. In optical products for eye wear, cameras, binoculars, telescopes, scientific instruments and testing equipment.



## DESCRIPTION OF GRADES

<i>Material</i>	<i>Performance Characteristics</i>
<b>ACRYLITE® Optical POQ66</b>	<ul style="list-style-type: none"> <li>• Suitable for extrusion</li> <li>• Balanced combination of melt elasticity and flow properties</li> <li>• High heat deflection temperature under load</li> <li>• Good mechanical properties for post treatment (sheet)</li> </ul>
Melt Volume Rate (ISO 1133)	2.3 mL/10min
Vicat Softening Temperature (ISO 306)	104°C
Deflection Temperature Under Load (ISO 75)	94.5°C
<b>ACRYLITE® Optical POQ64</b>	<ul style="list-style-type: none"> <li>• Suitable for injection molding</li> <li>• Excellent flow properties</li> <li>• Optimized demolding behavior</li> <li>• Accurate reproduction of mold surfaces</li> </ul>
Melt Volume Rate (ISO 1133)	9.0 mL/10min
Vicat Softening Temperature (ISO 306)	104°C
Deflection Temperature Under Load (ISO 75)	97°C
<b>ACRYLITE® Optical POQ62</b>	<ul style="list-style-type: none"> <li>• Suitable for injection molding and co-extrusion</li> <li>• Outstanding flow properties</li> <li>• Highly accurate reproduction of microstructures</li> </ul>
Melt Volume Rate (ISO 1133)	21.0 mL/10min
Vicat Softening Temperature (ISO 306)	97°C
Deflection Temperature Under Load (ISO 75)	91°C

## MATERIAL PROPERTIES

Property	ASTM Method	ACRYLITE® Optical POQ66	ACRYLITE® Optical POQ64	ACRYLITE® Optical POQ62	ACRYLITE® 8N SuPure
<b>OPTICAL (3mm path length)</b>					
Light Transmission, %	D-1003	92	92	92	92
Light Transmission, % at 150 mm	D-1003	91	91	91	87
Haze, %	D-1003	<1	<1	<1	<1
Refractive Index	D-542	1.49	1.49	1.49	1.49
Yellowness Index	D-1925	<1	<1	<1	<1
<b>RHEOLOGICAL</b>					
Melt Flow Rate, g/10 min at 230°C and 3.8 kg	D-1238	2.5	11	25	3.3
<b>MECHANICAL</b>					
Tensile Strength, psi (MPa)	D-638	10,800 (74.6)	–	9,150 (63)	11,300 (779)
Tensile Modulus, x10 <sup>6</sup> psi (GPa)	D-638	0.47 (3.2)	0.48 (3.3)	0.48 (3.3)	0.47 (3.2)
Tensile Elongation at Yield, %	D-638	4-6	4-6	4-6	4-6
Tensile Elongation at Break, %	D-638	4-6	4-6	4-6	4-6
Flexural Strength, psi (MPa)	D-790	14,300 (98.6)	–	–	16,200 (111.7)
Flexural Modulus, x10 <sup>6</sup> psi (GPa)	D-790	–	–	–	0.50 (3.5)
Notched Izod, ft-lb/in (J/m) on ¼ bar at 23°C	D-256	0.36	0.36	0.36	0.36
Rockwell Hardness, M scale	D-785	96	95	94	95
<b>PHYSICAL</b>					
DTL, °F (°C) at 264 psi, annealed	D-648	208 (98)	207 (97)	196 (91)	208 (98)
Vicat Softening Point, 50°C/h, 50N °F (°C)	D-1525	219 (104)	219 (104)	207 (97)	226 (108)
Specific Gravity (25°C/25°C)	D-792	1.19	1.19	1.19	1.19
Water Absorption, % max	D-570	0.6	0.6	0.6	0.6
Mold Shrinkage, in/in, mm/mm	D-955	0.004-0.007	0.004-0.007	0.004-0.007	0.004-0.007
Coefficient of Linear Expansion in/in/°F, 32-212°F (mm/mm/°C, 0-100°C)	D-696 D-696	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)
UL Flammability Class		UL 94 HB (f1)	UL 94 HB (f1)	UL 94 HB (f1)	UL 94 HB (f1)
UL Relative Thermal Index (RTI) - 3 mm / 1.5 mm (°C)		90	90	90	90
UL HWI PLC - 3 mm / 1.5 mm		- / 3	–	–	–
UL Glow Wire Flammability (GWFI) - 3 mm / 1.5 mm (°C)	IEC 60695-2-12	–	–	–	–
UL Glow Wire Ignition (GWIT) - 3 mm / 1.5 mm (°C)	IEC 60695-2-13	–	–	–	–
CLASS	D-788	PMMA 0140V2	PMMA 0130V4	PMMA 0122V7	PMMA 0122V7

## PROCESSING CONDITIONS – INJECTION MOLDING

Condition	ACRYLITE® Optical POQ66	ACRYLITE® Optical POQ64	ACRYLITE® Optical POQ62	ACRYLITE® 8N SuPure
Drying Temperature, (3-4 hours)	180°F (82°C)	180°F (82°C)	160°F (71°C)	180°F (82°C)
Mold Temperature	450-490°F (230-255°C)	430-480°F (220-250°C)	430-480°F (220-250°C)	450-490°F (230-255°C)
Injection Pressure, psi	100-180 (38-82)	100-180 (38-82)	100-180 (38-82)	100-180 (38-82)
Clamp Pressure, psi	2.5 tons/in <sup>2</sup> of projected area for flow length/wall thickness <100/1 5 tons/in <sup>2</sup> of projected area for flow length/wall thickness >100/1			
Screw Speed, rpm 2:1 compression ratio	75-150	75-150	75-150	75-150
Screw Speed, rpm 3.5:1 compression ratio	60-130	60-130	60-130	60-130
Ram Speed, in/sec	small gates 0.5-1.5 large gates 1-4	small gates 0.5-1.5 large gates 1-4	small gates 0.5-1.5 large gates 1-4	small gates 0.5-1.5 large gates 1-4
Back Pressure, psi	25-100	25-100	25-100	25-100



# [ ACRYLITE® HEATRESIST ACRYMID®



ACRYLITE® offers the widest range of acrylic polymers for optical, thermal, and outdoor LED lighting applications. Our polymers offer excellent optics which yield high efficiencies in all types of demanding lighting applications. Products can be colored to various levels of transparency or to fully opaque, including brilliant white to high gloss piano black. Special UV blocking and HID grades are available.

## ACRYMID® high heat weatherable acrylic polymers features and benefits:

- High heat distortion resistance
- Excellent transmission and clarity
- High vicat softening temperature
- High strength and rigidity
- Good weather resistance
- High surface hardness
- High chemical resistance
- AMECA listed (ACRYLITE® Heatresist FT15 and hw55, ACRYMID® TT50)

# ACRYLITE® HEATRESIST ACRYMID®



## DESCRIPTION OF GRADES

<i>Grade</i>	<i>Description</i>
<b>ACRYLITE® Heatresist hw55</b>	119°C Vicat temperature resistance
<b>ACRYLITE® Heatresist FT15</b>	115°C Vicat temperature resistance
<b>ACRYMID® TT70</b>	170°C Vicat temperature resistance
<b>ACRYMID® TT50</b>	150°C Vicat temperature resistance

## TYPICAL APPLICATIONS

- High heat distortion resistance
- Excellent transmission and clarity
- High vicat softening temperature
- High strength and rigidity
- Good weather resistance
- High surface hardness
- High chemical resistance
- AMECA listed (ACRYLITE® Heatresist FT15 and hw55, ACRYMID® TT50)



# ACRYLITE® HEATRESIST ACRYMID®

## MATERIAL PROPERTIES

Property	ISO Method	ACRYLITE® Heatresist hw55	ACRYLITE® Heatresist FT15	ACRYMID® TT70	ACRYMID® TT50
<b>OPTICAL (3mm path length)</b>					
Luminous transmittance D65, %	ISO 13468-2	91	91	91	91
Refractive Index	ISO 489	1.5	1.5	1.5	1.5
<b>RHEOLOGICAL</b>					
Melt Volume Rate, 230°C and 3.8kg, cm <sup>3</sup> /10min	ISO 1133	1.2	4.5	–	–
Melt Volume Rate, 260°C and 10kg, cm <sup>3</sup> /10min		–	–	1.7	5
<b>MECHANICAL</b>					
Tensile Modulus at 1 mm/min, GPa	ISO 527	3.6	3.5	4	4
Stress at Break at 5 mm/min, MPa	ISO 527	80	50	80	80
Strain at Break at 5 mm/min, %	ISO 527	3.5	3.1	3	3
Charpy Impact Strength 23°C, kJ/m <sup>2</sup>	ISO 179/1eU	20	18	20	20
<b>PHYSICAL</b>					
Deflection Temperature Under Load at 0.45 MPa, °C	ISO 75	109	107	158	140
Deflection Temperature Under Load at 1.8 MPa, °C	ISO 75	106	105	149	132
Vicat Softening Point, B/50, °C	ISO 306	119	115	170	150
Glass Transition Temperature, °C	IEC 10006	122	121	–	151
Density, g/cm <sup>3</sup>	ISO 1183	1.19	1.19	1.21	1.21
Water Absorption, 23°C/50% RH	ISO 62	0.6	0.46	0.54	0.63
Water Absorption, Sat/23°C, %	ISO 62	2.2	2	6	4
Mold Shrinkage, mm/mm	ISO 294	0.002 - 0.006	0.002 - 0.005	0.001 - 0.004	0.002 - 0.005
Coeff. Of Linear Therm. Expansion (0 - 50°C), E-5/°K	ISO 11359	7	6.6	5.7	5.3
Fire Rating	DIN 4102	B2	B2	B2	B2
Flammability (1.6mm), Class	IEC 707	UL 94 HB	UL 94 HB	UL 94 HB	UL 94 HB
RTI, °C		105	95	50	130

# ACRYLITE® HEATRESIST ACRYMID®

## PROCESSING CONDITIONS – INJECTION MOLDING

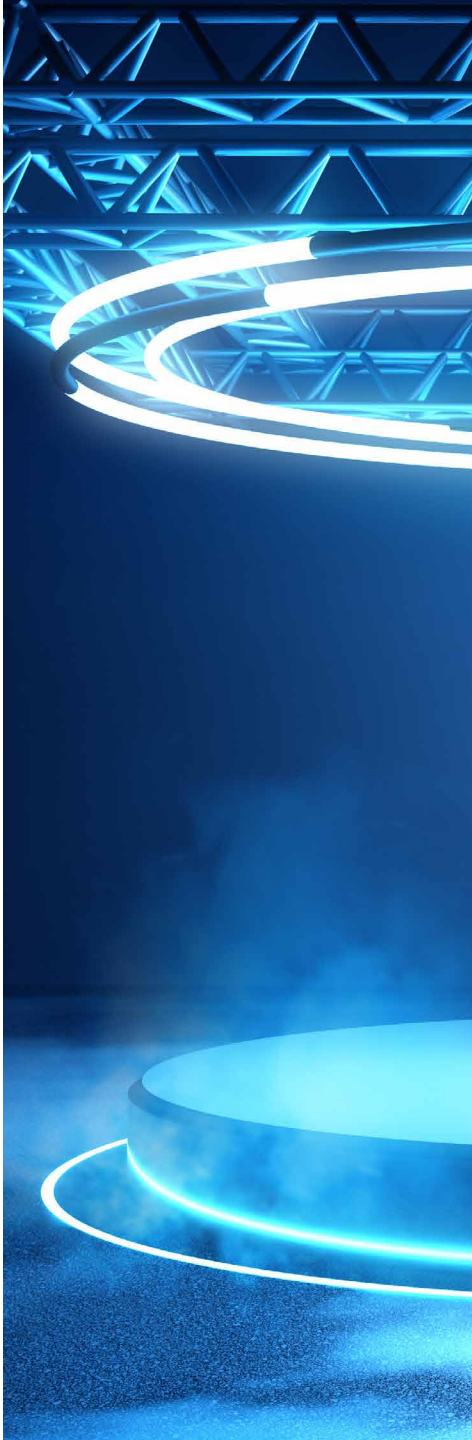
Condition	ACRYLITE® Heatresist hw55	ACRYLITE® Heatresist FT15	ACRYMID® TT70	ACRYMID® TT50
Drying Temperature	228°F	228°F	248°F	212°F
Melt Temperature	428-482°F	428-482°F	500-555°F	482-536°F
Mold Temperature	140-194°F	120-180°F	265°F	230°F
Injection Pressure, psi	6,000-15,000	6,000-15,000	6,000-15,000	6,000-15,000
Clamp Pressure, psi	2.5 tons/in <sup>2</sup> of projected area for flow length/wall thickness <100/1 5 tons/in <sup>2</sup> of projected area for flow length/wall thickness >100/1			
Screw Speed, rpm 2:1 compression ratio	75-150	75-150	75-150	75-150
Screw Speed, rpm 3.5:1 compression ratio	60-130	60-130	60-130	60-130
Ram Speed, in/sec	small gates 0.5-1.5 large gates 1-4	small gates 0.5-1.5 large gates 1-4	small gates 0.5-1.5 large gates 1-4	small gates 0.5-1.5 large gates 1-4
Back Pressure, psi	50-150	25-100	25-100	25-100

## PROCESSING CONDITIONS – EXTRUSION

Screw Diameter	3 ½ inch	4 ½ inch	6 inch
Turns of Feed-Constant Depth	4 at 0.400	4 at 0.625	7 at 0.635
Turns of Transition-Constant Taper	3	3	3
Turns of Meter Pump-Constant	5 at 0.165	5 at 0.180	4 at 0.190
Turns of Decompression-Constant Taper	1	1	1
Turns of Vent Zone-Constant Depth	4 at 0.650	4 at 0.750	at 0.750
Turns of Recompression-			
Constant Taper	2.5	2.5	2.0
Turns of 2nd Meter Pump-Constant Taper	5 at 0.280	5 at 0.305	5 at 0.320
Feed Zone	350-400°F	340-400°F	280-320°F
Rear	380-420°F	380-415°F	320-360°F
Rear Center	380-425°F	380-425°F	360-420°F
Center	390-430°F	380-425°F	400-440°F
Front Center	420-470°F	420-460°F	420-460°F
Front	430-475°F	420-460°F	420-460°F
Gate	450-470°F	450-470°F	460°F
Adapter	450-470°F	450-470°F	460°F
Die End Plates	450-470°F	450-470°F	470°F
Die Left and Right	440-470°F	440-470°F	460°F
Die Center	440-470°F	440-470°F	460°F
Approximate Output (lb/hr)	440-550	800-1000	1300-1800
Drive Horsepower	75-100	125-174	200-300

ACRYLITE® Heatresist and ACRYMID® acrylic polymers  
Typical Screw Geometries and Machine Settings for Sheet Extrusion with ACRYLITE®  
Acrylic Molding Compounds (two stage screw with L/D of 30/1 assumed)

# [ ACRYLITE® LED



ACRYLITE® polymers are well known for premium weatherability, superior optics and ease of processing. ACRYLITE® LED molding and extrusion acrylic polymers provide the best-in-class products for automotive applications, decorative lighting, signage, displays and lighting profiles. A specialty portfolio is available for edgelit and backlit applications.

# ACRYLITE® LED

## For Back Lit Applications

ACRYLITE® LED is available in two specialty whites developed specifically for backlit applications using high brightness LED lights. They provide uniform light distribution, high transmission values when backlit with intense LED's and excellent hiding power of disturbing hotspots. These properties make it possible to reduce the spacing required to cover the LED light source and to minimize the wall thickness of the fixtures.

### ACRYLITE® LED – Color Selection for Back Lit Applications

#### ACRYLITE® LED White OV606

- Components that are manufactured with this color appear optically white in reflected light
- Textured surface finish when material is extruded

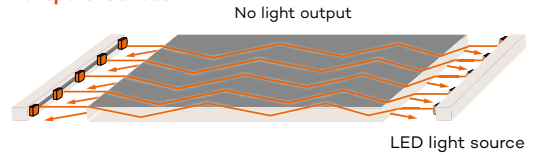
#### ACRYLITE® LED White OV200

- Slightly higher light transmission values, while retaining light diffusing properties
- Smooth surface finish whether material is extruded or injection molded

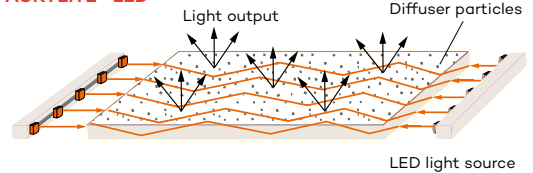
## For Edge Lit Applications

Components made from ACRYLITE® LED LD grades appear crystal clear and are completely transparent when unlit. They are optimized for edge lighting so as to guide light across different linear lengths. Each ACRYLITE® LED LD grade provides an optimized light panel at the recommended size. No additional diffusion films or micro-structures are needed to achieve uniform light distribution across its entire surface.

### Transparent sheet



### ACRYLITE® LED



ACRYLITE® LED pushes LED light out the surface instead of piping it to the edges and out.

## ACRYLITE® LED LD Light Path Distance

### LED double sided



Up to 12 cm (4.7")



12 to 24 cm (4.7 – 9.5")



24 to 48 cm (9.5 – 19")



48 to 96 cm (19 – 37.8")

### LED single sided



Up to 6 cm (2.4")



6 to 12 cm (2.4 – 4.7")



12 to 24 cm (4.7 – 9.5")



24 to 48 cm (9.5 – 19")

## Recommended Product for Edge Lit Applications

ACRYLITE® LED LD12

ACRYLITE® LED LD24

ACRYLITE® LED LD48

ACRYLITE® LED LD96

## MATERIAL PROPERTIES

Property	ASTM Method	ACRYLITE® LED LD12	ACRYLITE® LED LD 24	ACRYLITE® LED LD48	ACRYLITE® LED LD96
<b>OPTICAL (3mm path length)</b>					
Light Transmission, %	D-1003	90	91	91	92
Haze, %	D-1003	<8	<4	<2	<1
Refractive Index	D-542	1.49	1.49	1.49	1.49
Yellowness Index	D-1925	<1	<1	<1	<1
<b>RHEOLOGICAL</b>					
Melt Flow Rate, g/10 min at 230°C and 3.8 kg	D-1238	3.3	3.3	3.3	3.3
<b>MECHANICAL</b>					
Tensile Strength, psi (MPa)	D-638	11,600 (80)	11,600 (80)	11,600 (80)	11,600 (80)
Tensile Modulus, x10 <sup>6</sup> psi (GPa)	D-638	0.47 (3.2)	0.47 (3.2)	0.47 (3.2)	0.47 (3.2)
Tensile Elongation at Yield, %	D-638	4-6	4-6	4-6	4-6
Tensile Elongation at Break, %	D-638	4-6	4-6	4-6	4-6
Flexural Strength, psi (MPa)	D-790	18,700 (128.9)	18,700 (128.9)	18,700 (128.9)	18,700 (128.9)
Flexural Modulus, x10 <sup>6</sup> psi (GPa)	D-790	0.42 (2.9)	0.42 (2.9)	0.42 (2.9)	0.42 (2.9)
Notched Izod, ft-lb/in (J/m) on ¼ bar at 23°C	D-256	0.33 (17.3)	0.33 (17.3)	0.33 (17.3)	0.33 (17.3)
Rockwell Hardness, M scale	D-785	101	101	101	101
<b>PHYSICAL</b>					
DTL, °F (°C) at 264 psi, annealed	D-648	208 (98)	208 (98)	208 (98)	208 (98)
Vicat Softening Point, 50°C/h, 50N °F (°C)	D-1525	226 (108)	226 (108)	226 (108)	226 (108)
Specific Gravity (25°C/25°C)	D-792	1.18	1.18	1.18	1.18
Water Absorption, % max	D-570	0.3	0.3	0.3	0.3
Mold Shrinkage, in/in, mm/mm	D-955	0.004-0.007	0.004-0.007	0.004-0.007	0.004-0.007
Coefficient of Linear Expansion in/in/°F, 32-212°F (mm/mm/°C, 0-100°C)	D-696	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)
UL Flammability Class		UL 94 HB (f1)	UL 94 HB (f1)	UL 94 HB (f1)	UL 94 HB (f1)
<b>CLASS</b>	D-788	PMMA 0140V3	PMMA 0140V3	PMMA 0140V3	PMMA 0140V3

Refer to ACRYLITE® polymers processing conditions for LED materials

# [ ACRYLITE® SATINICE



ACRYLITE® Satinice light diffusing acrylic polymers meet the demanding requirements for the injection molding or extrusion of general lighting products in light fixtures and automotive interior applications.

**ACRYLITE® Satinice provides the following outstanding properties:**

- High light transmission with outstanding diffusion to eliminate LED hot spots
- Provides wide range of diffusion
- Polymer can be “blended” to create even more tailored precision for the specific application
- Scattering particles within the acrylic
- Matte surface (when extruded) provides better light scattering, glare reduction and scratch resistance

## DESCRIPTION OF GRADES

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### ACRYLITE® Satinice df

Where high lighting efficiency and excellent hiding power are desired, ACRYLITE® Satinice df polymers provide added-value in performance and reduced lighting costs. These light-diffusing acrylic polymers are available in four ACRYLITE® grades. Compared to traditional pigmented white diffusers, they allow higher lighting capacity at the same energy level or equivalent lighting capacity at lower energy levels. They are frequently used in backlit LED lighting applications to hide hot spots. ACRYLITE® Satinice df polymers offer increased lighting efficiency with a 20 to 40 percent increase in light transmittance versus pigmented acrylic products. All ACRYLITE® Satinice df products are extremely weather resistant. They can be further customized with the addition of UV absorbers, lubricants and colorants.

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### ACRYLITE® Satinice zd

ACRYLITE® Satinice zd is similar to ACRYLITE® Satinice df providing weatherability, outstanding light diffusion characteristics while maintaining excellent light transmission properties. It is available in three grades, Satinice zd22, zd23 and zd24, that provide the additional characteristic of excellent impact resistance. Lighting, automotive, appliance, and device designers now have more freedom to create special effects in their product designs.

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### ACRYLITE® Satinice zd22 OV440

ACRYLITE® Satinice zd22 OV440 is designed for extrusion applications including profiles and sheet. ACRYLITE® Satinice zd22 produces a rougher surface texture. It offers maximum impact resistance and excellent light diffusion capability which maximizes hiding power.

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### ACRYLITE® Satinice zd23

ACRYLITE® Satinice zd23 is specially formulated for maximum impact strength offering superior light diffusion characteristics. It is designed for injection molding and is used in lighting as well as in automotive interior applications.

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### ACRYLITE® Satinice zd24

Designed for extrusion applications including profiles and sheet, ACRYLITE® Satinice zd24 produces a rougher surface texture. It offers maximum impact resistance and excellent light diffusion capability.

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### ACRYLITE® Satinice OV45x

ACRYLITE® Satinice OV45x series optimizes light diffusion at higher light transmission. The products are offered in both impact modified and non impact modified resins at four different diffusion levels. Designed for architectural and linear LED lighting applications, these superior ACRYLITE® Satinice specialty acrylic grades are offered in sheet and molding compounds. Injection molded, blow molded or custom extruded profile lenses are available through your preferred convertor partner using ACRYLITE® Satinice molding compounds.

# ACRYLITE® SATINICE

## MATERIAL PROPERTIES

Property	ASTM Method	ACRYLITE® Satinice df 20 8N	ACRYLITE® Satinice df 21 8N	ACRYLITE® Satinice df 22 8N	ACRYLITE® Satinice df 23 8N	ACRYLITE® Satinice df 21 0V452	ACRYLITE® Satinice df 21 0V453	ACRYLITE® Satinice df 21 0V454	ACRYLITE® Satinice df 21 0V455
<b>OPTICAL (2mm path length)</b>									
*Light Transmission, %	D-1003	90	90	88	86	92	85	79	72
**Half Angle	D-1003	2.5	4	8	12	20	30	40	50
Refractive Index	D-542	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49
Yellowness Index	D-1925	<1	<2	<2	<2	2.2	2.8	3.4	3.6
<b>RHEOLOGICAL</b>									
Melt Flow Rate, g/10 min at 230°C and 3.8 kg	D-1238	3.2	3.1	3	2.9	3.1	3.1	3.1	3.1
<b>MECHANICAL</b>									
Tensile Strength, psi (MPa)	D-638	11,350 (78.3)	11,500 (79.3)	11,500 (79.3)	11,500 (79.3)	11,500 (79.3)	11,500 (79.3)	11,500 (79.3)	11,500 (79.3)
Tensile Modulus, x10 <sup>3</sup> psi (GPa)	D-638	0.54 (3.7)	0.55 (3.8)	0.55 (3.8)	0.55 (3.8)	0.55 (3.8)	0.55 (3.8)	0.55 (3.8)	0.55 (3.8)
Tensile Elongation at Yield, %	D-638	4	4	4	4	4	4	4	4
Tensile Elongation at Break, %	D-638	4	4	4	4	4	4	4	4
Flexural Strength, psi (MPa)	D-790	19,000 (131)	20,000 (138)	20,000 (138)	19,000 (131)	20,000 (138)	20,000 (138)	20,000 (138)	20,000 (138)
Flexural Modulus, x10 <sup>3</sup> psi (GPa)	D-790	0.50 (3.5)	0.50 (3.5)	0.50 (3.5)	0.50 (3.5)	0.50 (3.5)	0.50 (3.5)	0.50 (3.5)	0.50 (3.5)
Notched Izod, ft-lb/in (J/m) on ¼ bar at 23°C	D-256	0.3 (16)	0.3 (16)	0.3 (16)	0.3 (16)	0.3 (16)	0.3 (16)	0.3 (16)	0.3 (16)
on ¼ bar at 0°C	D-256	NA	NA	NA	NA	NA	NA	NA	NA
Rockwell Hardness, M scale	D-785	95	95	95	95	95	95	95	95
<b>PHYSICAL</b>									
DTL, °F (°C) at 264 psi, annealed	D-648	208 (98)	208 (98)	208 (98)	208 (98)	208 (98)	208 (98)	208 (98)	208 (98)
Vicat Softening Point, 50°C/h, SON °F (°C)	D-1525	226 (108)	226 (108)	226 (108)	226 (108)	226 (108)	226 (108)	226 (108)	226 (108)
Specific Gravity (25°C/25°C)	D-792	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19
Water Absorption, % max	D-570	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Mold Shrinkage, in/in, mm/mm	D-955	0.003-0.006	0.003-0.006	0.003-0.006	0.003-0.006	0.003-0.006	0.003-0.006	0.003-0.006	0.003-0.006
Coefficient of Linear Expansion in/in/°F, 32-212°F (mm/mm/°C, 0-100°C)	D-696 D-696	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)
UL Flammability Class (f1)	UL 94 HB	UL 94 HB	UL 94 HB	UL 94 HB	UL 94 HB	UL 94 HB	UL 94 HB	UL 94 HB	UL 94 HB
UL Relative Thermal Index (RTI) – 3 mm / 1.5 mm (°C)		90	90	90	90	90	90	90	90
UL HWI PLC – 3 mm / 1.5 mm		3 / 0	3 / 0	3 / 0	3 / 0	3 / 0	3 / 0	3 / 0	3 / 0
UL Glow Wire Flammability (GWFI) – 3 mm / 1.5 mm (°C)	IEC 60695-2-12	725 / 700	725 / 700	725 / 700	725 / 700	725 / 700	725 / 700	725 / 700	725 / 700
UL Glow Wire Ignition (GWIT) – 3 mm / 1.5 mm (°C)	IEC 60695-2-13	750 / 725	750 / 725	750 / 725	750 / 725	750 / 725	750 / 725	750 / 725	750 / 725
CLASS (PMMA)	D-788	0143V3	0143V3	0143V3	0143V3	0143V3	0143V3	0143V3	0143V3

\* Measurement recorded with BYK Gardner Haze Guard Plus machine

\*\* The angle having half the light intensity of a collimated beam shone through a sample perpendicular to the light source. Twice the half angle is defined as the FWHM (Full Width Half Maximum).

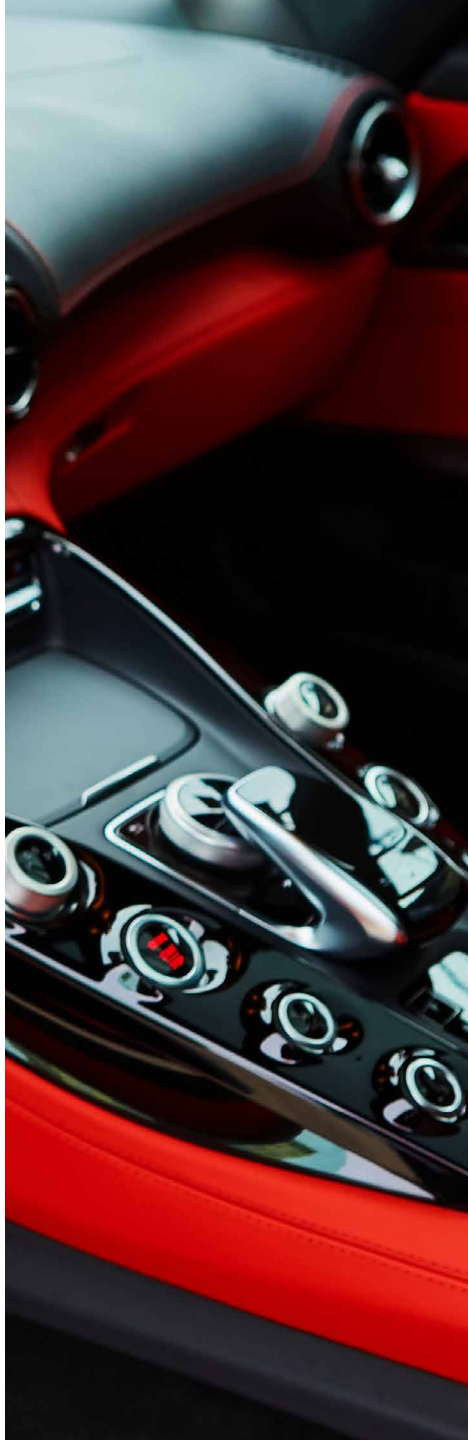
## MATERIAL PROPERTIES

Property	ASTM Method	ACRYLITE® Satinice zd22 OV440	ACRYLITE® Satinice zd23	ACRYLITE® Satinice zd24	ACRYLITE® Satinice zx 21 OV452	ACRYLITE® Satinice zx 21 OV453	ACRYLITE® Satinice zx 21 OV454	ACRYLITE® Satinice zx 21 OV455
<b>OPTICAL (2mm path length)</b>								
*Light Transmission, %	D-1003	84	84	84	91	84	77	71
**Half Angle	D-1003	48	14	14	20	30	40	50
Refractive Index	D-542	1.49	1.49	1.49	1.49	1.49	1.49	1.49
Yellowness Index	D-1925	6	5	5	2.2	2.8	3.4	3.6
<b>RHEOLOGICAL</b>								
Melt Flow Rate, g/10 min at 230°C and 3.8 kg	D-1238	0.9	3.1	0.8	1	1	1	1
<b>MECHANICAL</b>								
Tensile Strength, psi (MPa)	D-638	7350 (507)	6400 (44.1)	7330 (51)	8,550 (59)	8,550 (59)	8,550 (59)	8,550 (59)
Tensile Modulus, x10 <sup>6</sup> psi (GPa)	D-638	.31 (2.1)	0.25 (1.7)	0.33 (2.3)	.41 (2.8)	.41 (2.8)	.41 (2.8)	.41 (2.8)
Tensile Elongation at Yield, %	D-638	5.2	4	4-6	4	4	4	4
Tensile Elongation at Break, %	D-638	42	20	43	30	30	30	30
Flexural Strength, psi (MPa)	D-790	11,900 (82.1)	10,000 (69.0)	18,700 (128.9)	18,700 (128.9)	18,700 (128.9)	18,700 (128.9)	18,700 (128.9)
Flexural Modulus, x10 <sup>6</sup> psi (GPa)	D-790	.29 (2.0)	0.26 (1.8)	0.30 (2.1)	0.30 (2.1)	0.30 (2.1)	0.30 (2.1)	0.30 (2.1)
Notched Izod, ft-lb/in (J/m) on ¼ bar at 23°C	D-256	0.7 (37.4)	1.0 (52.5)	0.7 (37.4)	0.62 (32)	0.62 (32)	0.62 (32)	0.62 (32)
on ¼ bar at 0°C	D-256	NA	0.5 (26.3)	NA	NA	NA	NA	NA
Rockwell Hardness, M scale	D-785	59	44	63	63	63	63	63
<b>PHYSICAL</b>								
DTL, °F (°C) at 264 psi, annealed	D-648	200 (93)	190 (88)	200 (93)	185 (85)	185 (85)	185 (85)	185 (85)
Vicat Softening Point, 50°C/h, SON °F (°C)	D-1525	217 (103)	201 (94)	217 (103)	203 (95)	203 (95)	203 (95)	203 (95)
Specific Gravity (25°C/25°C)	D-792	1.16	1.15	1.15	1.15	1.15	1.15	1.15
Water Absorption, % max	D-570	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Mold Shrinkage, in/in, mm/mm	D-955	0.003 - 0.006	0.003 - 0.006	0.003-0.006	0.003-0.006	0.003-0.006	0.003-0.006	0.003-0.006
Coefficient of Linear Expansion in/in/°F, 32-212°F (mm/mm/°C, 0-100°C)		0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)	0.00004 (0.000072)
UL Flammability Class (f1)		UL 94 HB	UL 94 HB	UL 94 HB	UL 94 HB	UL 94 HB	UL 94 HB	UL 94 HB
UL Relative Thermal Index (RTI) - 3 mm / 1.5 mm (°C)		50	50	90	90	90	90	90
UL HWI PLC - 3 mm / 1.5 mm		2 / 4	-	-	-	-	-	-
UL Glow Wire Flammability (GWFI) - 3 mm / 1.5 mm (°C)	IEC 60695-2-12	-	-	- / 725	725 / 700	725 / 700	725 / 700	725 / 700
UL Glow Wire Ignition (GWIT) - 3 mm / 1.5 mm (°C)	IEC 60695-2-13	-	-	- / 725	-	-	-	-
CLASS (PMMA)	D-788	PMMA Q143V3	PMMA Q143V3	PMMA Q143V3	PMMA Q143V3	PMMA Q143V3	PMMA Q143V3	PMMA Q221V1

\* Measurement recorded with BYK Gardner Haze Guard Plus machine

\*\* The angle having half the light intensity of a collimated beam shone through a sample perpendicular to the light source. Twice the half angle is defined as the FWHM (Full Width Half Maximum).

# [ ACRYLITE® HI-GLOSS



ACRYLITE® polymers have long been the preferred materials for manufacturing highly weatherable exterior automotive components. Roehm has set the standard in the use of specialty acrylics for non-transparent trim applications for the automotive and electronics markets with ACRYLITE® Hi-Gloss acrylic polymers.

#### **ACRYLITE® Hi-Gloss polymers offer outstanding features and benefits:**

- Excellent weather resistance for lifetime durability
- Depth of color for outstanding appearance
- High-gloss surface (Class A) for lasting appeal
- Superior surface hardness delivers abrasion resistance
- High rigidity for good dimensional stability
- Good chemical resistance offers protection from environmental damage
- Polishable to remove small surface scratches
- 100% recyclable – environmentally friendly (meets ELV mandates)

#### **For enhanced bottom-line results, including:**

- Ease of processing for efficient molding and stable part production
- Cost effective, durable solution compared to paint and hardcoat solutions.
- Reliable technical assistance worldwide



## TYPICAL APPLICATIONS

- Automotive trim parts
- Decorative appliques
- Mirror housings
- Roof elements
- Bezel surroundings

## DESCRIPTION OF GRADES

<i>Grade</i>	<i>Description</i>				
<b>ACRYLITE® Hi-Gloss FT15</b>	<ul style="list-style-type: none"> <li>• High heat resistance (115°C)</li> <li>• Scratch resistance</li> </ul>				
	<table border="1"> <tr> <td>Melt Volume Rate (cm<sup>3</sup>/10 min)</td> <td>4.5</td> </tr> <tr> <td>Charpy Impact unnotched (kJ/m<sup>2</sup>)</td> <td>18</td> </tr> </table>	Melt Volume Rate (cm <sup>3</sup> /10 min)	4.5	Charpy Impact unnotched (kJ/m <sup>2</sup> )	18
Melt Volume Rate (cm <sup>3</sup> /10 min)	4.5				
Charpy Impact unnotched (kJ/m <sup>2</sup> )	18				
<b>ACRYLITE® Hi-Gloss 8N</b>	<ul style="list-style-type: none"> <li>• Excellence balance of properties with good flow</li> </ul>				
	<table border="1"> <tr> <td>Melt Volume Rate (cm<sup>3</sup>/10 min)</td> <td>3.0</td> </tr> <tr> <td>Charpy Impact unnotched (kJ/m<sup>2</sup>)</td> <td>20</td> </tr> </table>	Melt Volume Rate (cm <sup>3</sup> /10 min)	3.0	Charpy Impact unnotched (kJ/m <sup>2</sup> )	20
Melt Volume Rate (cm <sup>3</sup> /10 min)	3.0				
Charpy Impact unnotched (kJ/m <sup>2</sup> )	20				
<b>ACRYLITE® Hi-Gloss NTA-1</b>	<ul style="list-style-type: none"> <li>• High heat resistance (110°C)</li> </ul>				
	<table border="1"> <tr> <td>Melt Volume Rate (cm<sup>3</sup>/10 min)</td> <td>3.0</td> </tr> <tr> <td>Charpy Impact unnotched (kJ/m<sup>2</sup>)</td> <td>33</td> </tr> </table>	Melt Volume Rate (cm <sup>3</sup> /10 min)	3.0	Charpy Impact unnotched (kJ/m <sup>2</sup> )	33
Melt Volume Rate (cm <sup>3</sup> /10 min)	3.0				
Charpy Impact unnotched (kJ/m <sup>2</sup> )	33				
<b>ACRYLITE® Hi-Gloss NTA-3</b>	<ul style="list-style-type: none"> <li>• High heat resistance (116°C)</li> </ul>				
	<table border="1"> <tr> <td>Melt Volume Rate (cm<sup>3</sup>/10 min)</td> <td>2.0</td> </tr> <tr> <td>Charpy Impact unnotched (kJ/m<sup>2</sup>)</td> <td>16</td> </tr> </table>	Melt Volume Rate (cm <sup>3</sup> /10 min)	2.0	Charpy Impact unnotched (kJ/m <sup>2</sup> )	16
Melt Volume Rate (cm <sup>3</sup> /10 min)	2.0				
Charpy Impact unnotched (kJ/m <sup>2</sup> )	16				
<b>ACRYLITE® Hi-Gloss NTA-5</b>	<ul style="list-style-type: none"> <li>• Superior impact resistance, medium heat resistance (103°C)</li> </ul>				
	<table border="1"> <tr> <td>Melt Volume Rate (cm<sup>3</sup>/10 min)</td> <td>1.3</td> </tr> <tr> <td>Charpy Impact unnotched (kJ/m<sup>2</sup>)</td> <td>110</td> </tr> </table>	Melt Volume Rate (cm <sup>3</sup> /10 min)	1.3	Charpy Impact unnotched (kJ/m <sup>2</sup> )	110
Melt Volume Rate (cm <sup>3</sup> /10 min)	1.3				
Charpy Impact unnotched (kJ/m <sup>2</sup> )	110				

# ACRYLITE® HI-GLOSS

## MATERIAL PROPERTIES

Property	ISO Method	ACRYLITE® Hi-Gloss FT15 9V022	ACRYLITE® Hi-Gloss 8N 9V022	ACRYLITE® Hi-Gloss NTX8 9V022	ACRYLITE® Hi-Gloss NTX15 9V022	ACRYLITE® Hi-Gloss NTA-1 9V022	ACRYLITE® Hi-Gloss NTA-3 9V022	ACRYLITE® Hi-Gloss NTA-5 9V022
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### RHEOLOGICAL

Melt Volume Rate (cm <sup>3</sup> /10 min)	ISO 1133	4.5	3.0	5	6	3.0	2.0	1.3
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### MECHANICAL

Stress @ Break – 5 mm/min, MPa	ISO 527	50	77	67	63	68 (1)	60	54 (1)
Tensile Modulus – 1 mm/min, GPa	ISO 527	3.5	3.3	3.3	3.4	2.7	2.9	2.1
Strain @ Break – 5 mm/min, %	ISO 527	3.1	5.5	3.9	1.9	10 (1)	2.6	48 (1)
Charpy Impact Strength 23°C, kJ/m <sup>2</sup>	ISO 179/1eU	18	20	18	15	33	16	110

### PHYSICAL

Vicat Softening Temperature - B/50	ISO 306	115°C (239°F)	108°C (226°F)	104°C (219°F)	109°C (228°F)	110°C (230°F)	116°C (241°F)	103°C (217°F)
Glass Transition Temperature	ISO 11357	121°C (250°F)	117°C (243°F)	115°C (239°F)	117°C (243°F)	120°C (248°F)	126°C (259°F)	113°C (235°F)
Deflection Temperature Under Load - 0.45 MPa, °C	ISO 75	107	103	100	104	103	106	102
Deflection Temperature Under Load - 1.80 MPa, °C	ISO 75	105	98	98	102	102	106	96
Coefficient of Linear Thermal Expansion - 0-50°C, E-5/°K	ISO 11359	8	8	8	8	9	9	11

### MECHANICAL

Density, g/cm <sup>3</sup>	ISO 1183	1.19	1.19	1.19	1.19	1.18	1.18	1.16
Water absorption in water, %	ISO 62	>3	>3	>3	>3	>3	>3	1.5

<sup>1</sup> Stress at Break and Strain at Break at 50 mm/min



# ACRYLITE® HI-GLOSS

## PROCESSING CONDITIONS – INJECTION MOLDING

Condition	ACRYLITE® Hi-Gloss FT15 9V022	ACRYLITE® Hi-Gloss 8N 9V022	ACRYLITE® Hi-Gloss NTA-1 9V022	ACRYLITE® Hi-Gloss NTA-3 9V022	ACRYLITE® Hi-Gloss NTA-5 9V022
Drying Temperature, 3-4 hours	212°F (100°C)	208°F (98°C)	212°F (100°C)	212°F (100°C)	176°F (80°C)
Melt Temperature, 3-4 hours	428-500°F (220-260°C)	428-500°F (220-260°C)	428-500°F (220-260°C)	428-500°F (220-260°C)	428-500°F (220-260°C)
Mold Temperature, 3-4 hours	158-203°F (70-95°C)	140-194°F (60-90°C)	122-185°F (50-85°C)	122-185°F (50-85°C)	122-185°F (50-85°C)
Clamp Pressure	2.5 tons/in <sup>2</sup> of projected area for flow length/wall thickness <100/1 5 tons/in <sup>2</sup> of projected area for flow length/wall thickness >100/1				
Screw Speed, rpm 2:1 compression ratio	75-150	75-150	75-150		75-150
Screw Speed, rpm 3.5:1 compression ratio	60-130	60-130	60-130		60-130
Ram Speed, in/sec (mm/sec) small gates large gates	0.5-1.5 (12.7 - 38) 1-4 (25.4-101)	0.5-1.5 (12.7 - 38) 1-4 (25.4-101)	0.5-1.5 (12.7 - 38) 1-4 (25.4-101)	0.5-1.5 (12.7 - 38) 1-4 (25.4-101)	0.5-1.5 (12.7 - 38) 1-4 (25.4-101)
Back Pressure, psi	50-150 (0.34-1)	50-150 (0.34-1)	50-150 (0.34-1)	50-150 (0.34-1)	50-150 (0.34-1)



# MATERIAL CONSIDERATIONS

## Material Selection

- Selecting the right acrylic polymer for a particular application is an extremely important part of the design process.
- The first step is to clearly define the application and the end-use performance requirements for the molded part.
- Performance requirements include: weather resistance, heat resistance, toughness, and chemical resistance.
- Match the end-use performance requirements with the properties/attributes of potential materials. A grade with the highest strength and dimensional stability under heat will result in the most durable parts, although it may be more difficult to mold.

## Chemical Resistance

- In practice, chemical resistance is dependent on:
  - Molecular weight
  - Internal and external stresses
  - Degree of molecular orientation in the molded part
  - The specific chemical
  - Presence and amount of impact modifier
- Acrylic polymers resist many chemicals found in normal use such as:
  - Ink
  - Alkaline solutions
  - Weak acids
  - Aliphatic hydrocarbons
  - Water and perspiration
  - Salt water

## Chemical Resistance (continued)

- Acrylic polymers are not resistant to most aromatic hydrocarbons.
- Plasticizers can attack ACRYLITE® and ACRYLITE® Resist acrylic polymers.
- Temperature can also affect the chemical resistance of acrylic polymers.
- As a result, we recommend that appropriate tests should be carried out in doubtful cases and technical advice be requested from us.

## Outdoor Use

- A distinct advantage of ACRYLITE® and ACRYLITE® Resist polymers is their resistance to the adverse effects of weathering.
- ACRYLITE® acrylic polymers maintain physical properties and optical properties for many years.
- ACRYLITE® Resist polymers are also weather resistant and will retain both their physical properties and appearance after long periods of outdoor exposure.

## Drying

- Acrylic polymers are slightly hygroscopic and require pre-drying.
- Recommended moisture levels:
  - Injection molding: 0.08% max
  - Extrusion: 0.03% max
- Use a desiccant type dryer:
  - Drying time: 3 to 4 hrs
  - Effluent air: dew point of -20°F or lower
  - Small desiccant beads: 1/8" for more effective drying
  - Change desiccant periodically

# MATERIAL CONSIDERATIONS

(continued)

## Drying (continued)

- Acrylic polymers openly exposed to humid conditions can absorb up to 1.8% moisture
- Increase the drying time for high moisture containing polymer to 4 to 6 hours. Do not raise drying temperature.
- Insufficient drying can cause:
  - reduced transparency and increased haze
  - the appearance of surface streaks
  - bubbles throughout the part

## Regrind

- Roehm's materials can all be reground and reprocessed without adversely affecting physical properties.
- The primary effect from using reground material is a shift in color.
- Use 25% regrind to 75% virgin material to minimize significant color change.
- Avoid contamination and remove all fines in the regrinding process.
- Regrind may require additional drying due to the increased surface to volume ratio.

## Purging

- In most cases the acrylic polymer in an undried state is a sufficient purging material.
- Commercial materials that do not contain styrene or detergents such as ASA Clean, Dyna-Purge, and Ultimax are recommended.

## Purging (continued)

- Acrylic polymers will discolor if left in the barrel too long (5 - 10 minutes).
- Material exposed to high temperatures for longer periods of time (i.e., overnight) will decompose and develop a skin on the screw barrel and nozzle.
- Decomposition will not cause any permanent machine damage and can be removed by purging with ground cast acrylic sheet.
- Prolonged interruptions, or when temperatures are unusually high (above 500°F), may lead to yellowing of material in the cylinder. If yellowing occurs, purging may be required

## Material Handling

- Molding of high quality transparent parts requires high quality handling processes to prevent contamination from external sources.
- The high surface hardness of acrylic also means it is abrasive in conveying systems.
- Stainless steel should be used for fixed conveying lines.
- Polyurethane hoses can be used for short, flexible hose runs.
- PVC should never be used as it softens and feeds particles of PVC into the conveying stream as it is abraded.
- Separators should be used to remove fines that are generated during the conveying process.

# INJECTION MOLD DESIGN GUIDELINES

## Basic Design

- The mold plates should be thick enough to prevent mold deformation that can occur from high melt pressures in the cavity.
- Slide molds can be used because the relatively viscous melt scarcely penetrates the gap between the sliding members.
- Acrylic polymers require 2.5 tons/in<sup>2</sup> (352 kg/cm<sup>2</sup>) of projected area for flow length/wall thickness (L/t) <100/1 and 5 tons/in<sup>2</sup> (703 kg/cm<sup>2</sup>) for L/t >100.
- Undercuts are not recommended.
- The mold cavity should have a smooth and nonporous surface, especially important when using crystal clear polymers.
- Chrome plating is preferred for a high gloss finish and to protect against penetration of lubricants into the mold surface.
- Molds for long runs should be case hardened and highly polished.
- To maintain reasonable residence times and minimize shear degradation, the shot size should range from 40 to 60% of the barrel capacity.
- If the cylinder is too large, difficulties in processing may occur because of long residence times or because of excessive stress on the machine drive.
- The choice of using a single-cavity versus a multi-cavity mold is dependent upon the capacity of the machine and the overall production economics.

## Wall Thickness

- As a general rule, it is best to work with walls that are not excessively thin (< 0.039 in, 1 mm).
- Thin wall parts are more difficult to process and often deform at lower than expected temperatures due to increased molecular orientation.
- In order to adequately fill a thin wall part, a lower molecular weight material with a higher melt flow rate should be used.
- Roehm offers grades of materials that are specifically suited for thin wall applications.

## Mold Temperature

- The mold temperature has a significant influence on both the processing and properties of acrylics.
- A mold temperature control device is recommended.
- A cold mold is more difficult to fill and can lead to high cooling stresses, warping, strong orientation, and sink marks.
- A cold mold may also lead to a hazy surface appearance for parts molded from impact modified materials.

## Venting

- Acrylic polymers tend to generate gases during processing requiring the mold to be vented.
- Venting serves two main purposes:
  1. Allows for displacement of the air in the mold so the polymer can fill the mold.
  2. Releases gases from the process resulting in a quality part free of dullness and poor finish.
- Use 0.0015" to 0.002" (0.040mm to 0.051mm) deep vents relieved to 0.005" for a length of 0.25 inches.
- For complex molds, vacuum venting should be considered.

# INJECTION MOLD DESIGN GUIDELINES

(continued)

## Shrinkage

- Acrylic parts will shrink upon cooling.
- The amount of shrinkage is dependent upon the grade of acrylic, the processing conditions used, and the size and thickness of the part.
- Roehm's acrylics have a relatively low and predictable shrinkage in the range of 0.003 in/in to 0.008 in/in, depending on the particular grade.
- Mold design and process conditions should be taken into consideration when estimating the shrinkage.

## Sprue

- The sprue must allow good filling of the mold cavity with a low pressure drop.
- The sprue should be as short as possible as flow resistance increases with sprue length.
- If the sprue is not seated directly on the mold, a cold slug well should be used opposite the sprue.
- The cold well will collect the cooler material that emerges first from the nozzle.

## Runners

- The best cross-section for a runner is full-round or trapezoid.
- Oval and rectangular cross-sections are not recommended.
- The runners should be kept as short as possible to facilitate complete and uniform filling.

## Gating

- All types of gating designs have been used successfully with Roehm's line of acrylic polymer products.
- If the gate is too small it will restrict the filling speed which in turn prevents the adequate filling of the mold.
- When using a restricted gate, the diameter should not be less than 0.036 inch (0.9 mm) for articles of average weight and 0.028 inch (0.7 mm) for smaller articles with a uniform wall thickness.
- The tab gate is used in situations where the weak area around a restricted gate must be avoided. The wall of the tab should not be thicker than the wall of the part to avoid excessive cooling time.
- The fan gate is used for flat, thin moldings such as scales, covers, or rulers where one does not wish to inject on the large, flat faces.
- The umbrella gate is recommended for tubular articles.
- Submarine gating allows the molding to be automatically separated from the runner upon removal from the mold.
- Center gating was one of the first types of gates used in injection molding and is considered to be one of the best. It provides a balanced fill for the molded part which reduces stress and minimizes weld lines. Center gating requires adequate cooling around the gate area for hot runner molds.
- The gate should be located in a position of minimum mechanical stress as the gate has a notch effect and can induce failure.
- Refer to the ACRYLITE® Technical User's Manual for a more detailed discussion regarding gating.

# EXTRUSION

- There are many steps to follow in extrusion to ensure high quality product:
  - A clean dryer, conveying line, hopper, screw, barrel, and die
  - Maintain the proper melt temperature
  - Use microfinished, chromed, hardened dies and polishing rolls
  - Dry the material adequately
- A clean screw, barrel and die will tend to avoid contamination problems.
- It is very important to avoid contamination with other plastics as the extrusion behavior of the melt and the optical and mechanical properties of the finished extrudate can be seriously jeopardized.
- When the die temperatures are too high, a buildup will form on the die lips. This has been experienced with ACRYLITE® Resist polymers.
- A die lip buildup can cause lines to form on the extrudate in the machine direction. On the other hand, if the die lip is too cool, the surface will be dull. Die lip edges must be very sharp to eliminate buildup.
- High quality polishing rolls are necessary to produce an excellent surface finish that is smooth and glossy.
- We recommend using microfinished, chromed, and hardened rolls to Rockwell C 50-60.
- The rolls should be equipped with accurate and independent temperature and speed controls, coupled to rubber pull rolls.
- Drying of the material is critical in extrusion. A moisture level at or below 0.03% is recommended to ensure that quality parts will be produced. Failure to adequately dry the material can result in a slight reduction in transparency and surface gloss, to severe surface streaks and/or bubbles.
- When using regrind, it is important to separate fines from the regrind. Failure to do this will result in black specs as the fines degrade and form char in the barrel which will slough off into the melt stream during processing.

# FINISHING AND POST TREATMENT OPTIONS

## Separation of the Sprue

- It is best to remove the sprue immediately after removal from the mold.
- Thin gates are cut with scissors, heated diagonal cutting pliers, or are broken off.
- Tab gates are usually removed with a small circular saw.
- Sprues are removed with cutters. The short, residual stump is sometimes faced on a milling machine.
- Umbrella-type gates and annular gates are usually trimmed off on a lathe.

## Annealing

- Annealing minimizes the effects of internal stresses caused by the molding process.
- Annealing is recommended to avoid stress crazing if the molding may contact solvents or if the part will be solvent bonded or painted.
- The optimum annealing temperature is approximately 5°C below the distortion temperature under load (DTL).
- The annealing time is dictated by the thickness of the part.
- A rough guideline is one hour of heating per millimeter of material thickness and most importantly, one hour of cooling per millimeter of material thickness.
- The cooling time and rate are very important to the annealing process. If the molded parts are cooled too quickly, stresses may actually increase.

## Antistatic Treatment

- The attraction of dust can be reduced by surface treatment with ionized air or liquid antistatic agents.
- Moldings can be immersed in this liquid immediately after removal from the mold.

## Ethyl Acetate Test

- The ethyl acetate test aids in identifying internal stresses.
- The molding is immersed in ethyl acetate for two to three minutes. It is subsequently dried and examined for cracks and crazing.
- A properly molded part or annealed part will craze very little, and will, as a matter of experience, meet all practical requirements.
- Roehm's Technical Center can be contacted for a complete procedure.

## Bonding

- There are a number of methods for bonding Roehm's line of acrylic polymer products.
  - Solvent bonding uses a solvent to soften the bonding area to the point where molecular entanglement between the two surfaces will occur.
  - When the solvent dissipates, the entanglement is frozen in place.
  - The bond strength is often as strong as the parent material.
  - Common solvents used for acrylics are methylene chloride, toluene, tetrahydrofuran, cellusolve, and methyl ethyl ketone.
- Adhesive bonding differs from solvent bonding in that the adhesive itself forms the bond.
  - Here, the bond is only as strong as the adhesive to the plastic substrate.
- Two-part epoxies, 100% solids UV curable, and cyanoacrylate adhesives are often used for acrylics.
- It is important to minimize molded-in stresses when any type of bonding will be performed on a part.
  - This can be achieved by following recommended processing conditions and/or annealing the part prior to bonding.
  - The Tech Brief entitled "Solvent and Adhesive Bonding" gives further recommendations for this process.

# TECHNICAL SUPPORT

At [acrylite-polymers.com](http://acrylite-polymers.com) we offer access to frequently asked questions, physical properties, processing conditions, regulatory compliance information, tips for trouble shooting and more. Roehm's Technical Service Center utilizes a broad range of extrusion, thermoforming, injection molding, and testing equipment for product and process evaluations. Our Technical Service Engineers are also available for on-site assistance in customer plants as needed. For technical information, please Free Call +1 800 225 0172, Opt 2.

## Important Notice

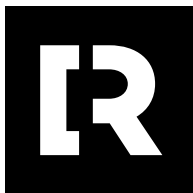
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