

High-Performance Transparent Polymers

SIM 2003 Advantages

- Excellent impact resistance
- Flexibility in processing
- Excellent chemical resistance

SIM 1802 Advantages

- Excellent chemical resistance
- High hardness
- High heat deflection temperature

Simula Technologies, Inc., has developed a family of transparent polymers with unique properties providing performance advantages in a variety of applications. Two materials within this family, SIM 2003 and SIM 1802, are characterized by:

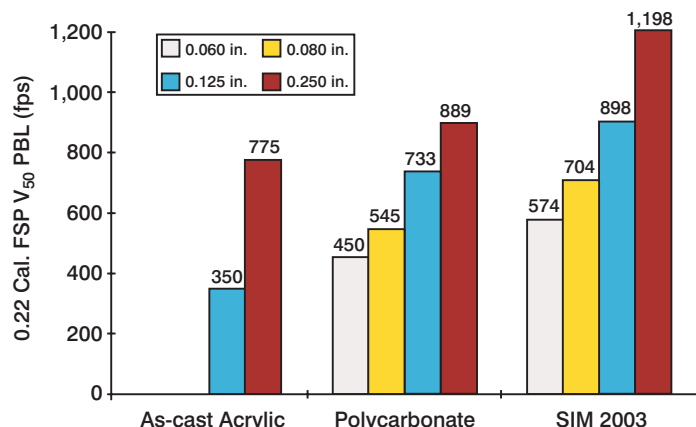
- ✓ **Minimal color**
- ✓ **Excellent optical clarity**
- ✓ **High levels of chemical resistance**
- ✓ **High thermal resistance**
- ✓ **Compatible with a variety of dye packages and coatings**
- ✓ **Easily liquid cast to shape or sheet form**
- ✓ **Superior abrasion resistance as compared to acrylic and polycarbonate**
- ✓ **Lighter weight than acrylic, polycarbonate, and CR-39 (ally diglycol carbonate)**

These innovative materials are useful in numerous applications, including protective face shields and eyewear; transparent armor; high-performance aircraft, rail, and automotive glazing; high-performance optical components; and electronic display screens.

SIM 2003 Impact-resistant Material

SIM 2003 is Simula Technologies' highest-performing impact- and ballistic-resistant material. When tested at a 0.64-cm (0.25-in.) thickness against MIL-P-46593, using 0.22-cal., 17-gr fragment-simulating projectiles (FSPs), SIM 2003 outperformed polycarbonate by 34.8 percent. This performance advantage can be exploited to increase eye protection against higher-velocity fragments, to reduce the thickness and weight of the protective lens or visor, or to provide a combination of both improvements.

Comparative Polymer Ballistic Test Data



- Notes:
1. All V_{50} data is linearly adjusted to common areal density of acrylic and polycarbonate materials
 2. All V_{50} PBL velocities shown are corrected for FSP drag loss from chronograph screens to target



SIM 1802

The highly cross-linked SIM 1802 thermoset material provides high levels of hardness, chemical resistance, and heat resistance. Its heat deflection temperature of 402 °F (205 °C) make this material suitable for use in harsh environments. Applications include: high-performance aircraft canopy face plies, welding lenses and shields, medical components, electronics, and automotive and aircraft lighting lens covers.

Materials Comparison Chart

Property	Units	ADC CR-39®	Acrylic As-Cast	Polycarbonate	SIM 1802	SIM 2003
Color	-	Water clear	Water clear	Water clear, light gray or light straw	Very light straw	Very light straw
Yellowness Index	-	.6-1.4	-	1.00	2.00	2.00
Specific Gravity	-	1.31	1.2	1.2	1.13	1.14
Hardness	D scale	88-89	92-93	84-86	89-90	80-81
Fischer Microhardness	N/mm ²	-	184	116	151	63
Bayer Abrasion, 200 cycles	Δ% haze	5-7	43.2	47.9	10.7	14.6
Luminous Transmittance	Pct.	89-91	91	89	94	93
Haze	Pct.	.3-.9	1.0	.8	.5	.5
Refractive Index	-	1.490	1.490	1.586	1.514	1.538
Abbe No.	-	60	-	27	50	40
Heat Deflection Temperature (264 psi)	°F °C	149 65	212 100	276 136	402 205	320 160
Stress Craze Resistance (isopropyl alcohol)	psi	-	3,800	4,000	>9,800	>7,000

Tailorability and Flexibility

SIM 2003 and SIM 1802 are only two examples of materials within a family of Simula Technologies' polyurethanes. The unique chemistry of this family allows new variations to be formulated to meet specific needs. Whether it is improved ballistics, dye compatibility, heat deflection temperature, optics, hardness, or some other property, Simula Technologies looks forward to developing a material for your application.

For more information about SIM 2003, SIM 1802, and other innovative polymer products, please contact Simula Technologies, Inc., at 480-753-2101.

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