

Cleargard® Transparent Polymer

BAE Systems developed, patented, and is producing a castable transparent polyurethane, Cleargard®, that provides superior ballistic performance compared to conventional transparent polymers like acrylic and polycarbonate. Cleargard® is used in monolithic or laminated form to stop fragments and hand gun-fired projectiles. Laminated behind glass, Cleargard® defeats an array of rifle threats.

Standard Features

- Lower density than acrylic or polycarbonate
- High impact resistance
- High ductility
- Excellent optical clarity
- High thermal and chemical resistance
- Superior abrasion resistance compared to acrylic and polycarbonate
- Liquid castable to complex shapes or sheet form
- Compatible with a variety of dye packages and coatings

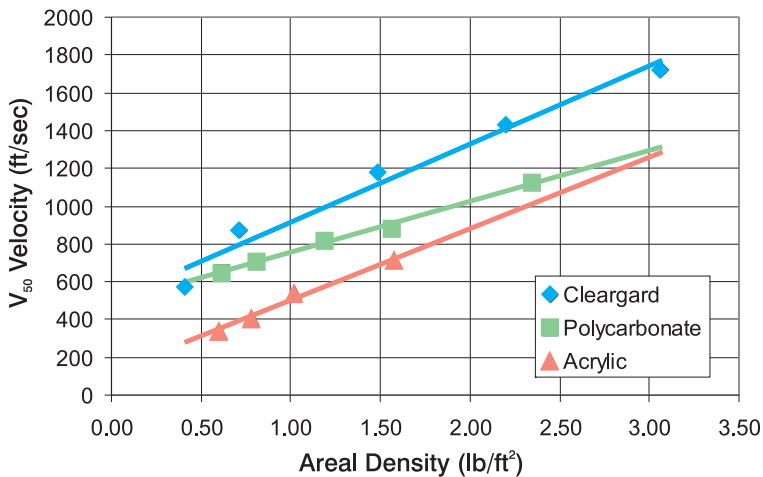
KEY FEATURES

- Excellent impact resistance
- Excellent chemical resistance
- Castable to any shape

Potential Applications

- Transparent armor products
- Aircraft transparencies
- Protective face shields and masks
- Ground vehicle and aircraft lighting lens covers
- Electronics and display screens
- Architectural and automotive glazing

Cleargard Ballistic Performance vs. 0.22-cal FSP



Cleargard® is a registered trademark of BAE Systems.

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Fragment Armor

In monolithic sheet form, Cleargard demonstrates superior ballistic performance against fragment simulating projectiles (FSPs) conforming to MIL-P-46593. For example, Cleargard provides equivalent performance to polycarbonate with a 42% weight savings against the 0.22 cal, 17 gr FSP at 1,180 ft/sec (360 m/sec).

Handgun Armor

In monolithic sheet form, Cleargard demonstrates superior ballistic performance against hand gun projectiles such as those specified in National Institute of Justice Standard 0108.01. For example, Cleargard meets Level III-A protection, defeating the 9-mm FMJ and .44 MAG, 240 gr projectiles at an areal density of 7.0 lb/ft² (3.2 kg/m²) and a thickness of 1.25 in (3.2 cm). This compares to 8.1 lb/ft² (3.7 kg/m²) and 1.30 in (3.3 cm) thickness for the leading transparent polycarbonate laminate.

Rifle Armor

When used as a backing layer behind high performance glass, Cleargard provides superior performance against lead core rifle projectiles. For example, a glass/Cleargard laminate meets NIJ Standard 0108.01 Level III defeating a .308 Winchester, 150 gr projectile at an areal density of 10.5 lb/ft² (4.76 kg/m²) and a thickness of 1.05 in (2.67 cm). This compares to 11.7 lb/ft² (5.3 kg/m²) and 1.09 in (2.8 cm) thickness for a conventional transparent glass/polycarbonate armor. Similar comparative weight savings exist when tested against military ball-type projectiles.

CLEARGARD® VS. POLYCARBONATE

Threat Type	Projectile	Velocity ft/sec (m/sec)	Cleargard®		Polycarbonate	
			lb/ft ² (kg/m ²) monolithic	in (cm)	lb/ft ² (kg/m ²) monolithic	in (cm)
Fragment	0.22 cal, 17 gr FSP MIL-P-46593	1,180 (360)	1.48 (7.1) monolithic	0.25 (0.64)	2.57 (12.3) monolithic	0.41 (1.04)
Handgun	.44 MAG, 240 gr NIJ STD 0108.01 Level III-A	1,400 (427)	7.0 (33.6) monolithic	1.25 (3.2)	8.1 (39.0) laminated	1.30 (3.3)
Rifle	7.62 mm M80 Ball NIJ STD 0108.01 Level III	2,750 (838)	10.5 (50.4) glass/Cleargard	1.05 (2.7)	11.7 (56.0) glass/polycarbonate	1.09 (2.8)

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