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Attenuation of Blast Waves through Transparent Armor Materials

Face shields and goggles used by explosive ordinance (EOD) personnel and others at risk of exposure to explosions are designed to protect from projectiles. In recent years, it has been shown that exposure to the primary blast wave itself can lead to eye and brain injuries, yet very little information is available about the ability of transparent armor materials to attenuate a blast wave.

In this study, a 79 mm diameter, oxygen-acetylene driven shock tube was used to generate a blast-like wave with a peak pressure of 1173 kPa, and a high speed pressure sensor was used to measure the pressure wave transmitted through six transparent armor materials. Five trials were performed on each material.

With the exception of window glass (which shattered), the peak pressure was reduced by 20 dB or more by a 6.35 mm thickness of each material: cast acrylic, -22.63 dB; polycarbonate, -23.13 dB; tempered glass, -29.98 dB; laminated glass, -30.14; and aluminum oxynitride (ALON), -30.99 dB.

The results show that different transparent armor materials have different abilities to attenuate a blast wave and that measurements like those made in this study would be a useful part of the product design process. Though ALON, a transparent ceramic, attenuated the blast wave the most, its current high cost may make tempered glass or laminated glass a better value for many applications, since they performed similarly.