

Honeywell Spectra® fiber



Protective Armor Materials

Honeywell

The Honeywell commitment to keeping people safe

Honeywell Spectra® fiber has been protecting people exposed to the most challenging and critical work situations for over 20 years. Spectra® fiber, one of the world's strongest and lightest materials, can be crafted into composite structures such as Spectra Shield® ballistic material, an ideal product for military applications.

Honeywell engineering is behind some of the most advanced personal protection systems in the world revolutionizing how both hard and soft armor are constructed. We continue to work with customers and partners all over the globe to maximize the strength of advanced armor products while maintaining a light weight critical to many applications.

Honeywell's commitment to the armor business is demonstrated through the number of fibers and materials in our product family. As a multiple materials resource, we are able to supply our customers with solutions that fit their individual needs.

We continue to innovate and create products that can add value to your military applications. Working alongside our customers to evaluate and build new armor systems is essential to our continued success. Contact Honeywell to see how we can help you remain safer, stronger, and more confident in your important line of work.



Honeywell Spectra® fiber: Reporting for duty

Honeywell Spectra® fiber is made from ultra high molecular weight polyethylene (UHMWPE), a remarkably durable and rugged material. By putting this material through our patented gel-spinning and drawing process, Honeywell engineers have created Spectra® fiber, one of the most advanced fibers available today.

- Pound for pound, ten times stronger than steel
- More durable than polyester
- Up to forty percent greater specific strength than aramid fiber
- Higher melting temperature than standard polyethylene (150°C/300°F)

Due to its unique viscoelastic properties, the strength and stiffness of Spectra® fiber is strain-rate dependent. This enables Spectra® fiber, as well as Spectra® fiber-based composites, to perform exceptionally well against high velocity impact such as rifle rounds and shockwaves. Our advanced fiber reacts to impact by rapidly moving the kinetic energy away from the impact area, protecting those placed in harm's way.

This battle-tested fiber is proven to provide high levels of performance for vibration damping, flex fatigue, and internal fiber-friction characteristics at a reduced weight. Spectra® fiber also has been proven to have extraordinary durability as it exhibits superior resistance to chemicals, water, and ultraviolet light.

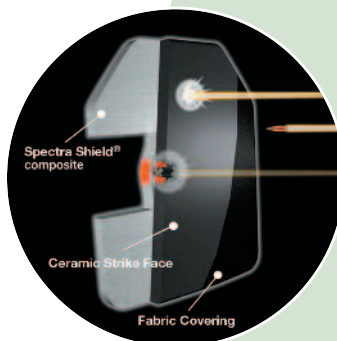


Spectra Shield® composite material: Protecting the Protectors

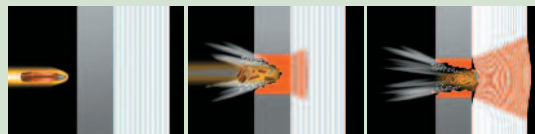
Since the early nineteen nineties, soldiers, police personnel and others in the line of fire have been protected by armor made with Spectra Shield® composite. This patented technology was designed to optimize the remarkable properties of Spectra® fiber. Parallel strands of fiber are bonded in place with an advanced resin system. This unidirectional tape is then layered with other identically constructed tapes at right angles (0°/90°) and fused into a synthesized structure under heat



and pressure. The resulting material, Spectra Shield® composite, demonstrates exceptional multi-hit performance in ballistic tests with substantially reduced back face deformation. By keeping the fibers in a straight and parallel configuration, the energy of the projectile rapidly dissipates along the length of the fiber. The alignment of the long molecular chains in the fiber combined with the patented Honeywell processes achieves the most advanced structure for efficient energy displacement.



Ceramic-faced Spectra Shield® material is designed to protect against high velocity rifle rounds, some of which are armor-piercing bullets. This is best exemplified by Small Arms Protect Insert (SAPI) armor plates used by the Army and US Marine Corps. The plates are made by bonding a ceramic strike face to a hard panel that contains multiple layers of Spectra Shield® material and wrapping the entire unit in a fabric covering.





Standing Strong in Hostile Environments

Protective Gear

Honeywell's dedication to materials research and innovation has produced dramatic results in the protective gear market.

Breastplates

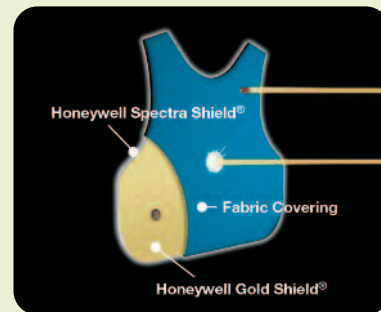
When used in body armor, Spectra Shield® composite can defeat hard, high velocity rounds and manage the blunt trauma effects of automatic and semiautomatic fire. Rigid armor plates, breastplates, collars and other inserts made with Spectra Shield® products offer strong protection in a remarkably lightweight material. Both trauma inserts and new generation breastplate inserts rely on Spectra Shield® materials to halt semi-armor piercing rifle rounds.

Helmets

State of the art helmets have been developed using Honeywell's proprietary resin systems. A number of innovative, lightweight constructions using Spectra Shield® composite materials have been designed for ballistic and fragmentation protection.

The high modulus and energy absorption characteristics of Spectra® fiber are maximized during a ballistic event, reducing the knockdown effect of the projectile. This level of performance allows body armor manufacturers to satisfy new and more demanding standards from the National Institute of Justice.

Over time, Honeywell has adapted Spectra Shield® technology to include different types of fibers in the base material, improve the properties of a wide range of fiber types and optimize the performance parameters of many different armor systems. As a result of this innovative spirit, Spectra Shield® products have become premier ballistic materials in many of the world's most advanced armor systems.



Hybrid soft armor vests containing Honeywell Spectra Shield® and Honeywell Gold Shield® products are designed to protect against handgun rounds such as those from a 9mm full metal jacket.

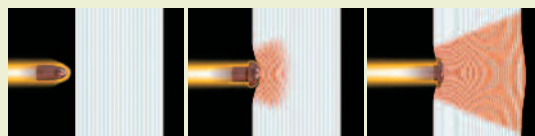
Vests

Concealed ballistic vests and tactical body armor made with Spectra Shield® material provide protection with comfort and maneuverability. Spectra Shield® material provides superior stopping power and exceptional multi-hit, angle shot and trauma reduction benefits.

To provide additional design flexibility Honeywell also manufactures Gold Shield® products that apply the benefits of Spectra Shield® technology to aramid fibers.



A helmet made with Spectra Shield® material is shown stopping a 9mm round and defeating a fragmentation simulator—both tests showing the Spectra Shield® material energy dispersion pattern.



Vehicular Armor

When armoring air, land, and sea vehicles for civilian security, law enforcement, diplomatic, and military needs, trust Spectra® fiber products. Spectra Shield® material is ideal in aircraft and helicopter applications, delivering protection against small arms fire and adding outstanding spall protection in hybrid ceramic/steel systems for tanks and APCs. This patented technology is also used in blast containment applications as well as in reinforced cockpit doors on commercial airliners. Spectra® fiber is light enough to float, making it ideal for water craft applications, and the low dielectric constant of the fiber makes it virtually transparent to radar.

Spectra® fiber based materials have negligible moisture absorption and are chemically inert. They provide outstanding impact resistance and can be combined with other ballistic materials to conform to the irregular contours of large and small vehicles. And since lightweight Spectra® fiber products have little effect on a vehicle's center of gravity or balance, it is easy to maintain both speed and maneuverability.

Spectra® fiber based composites have been used to armor:

- C-130 gunships
- CH-46 helicopters
- HMMWV
- Armored money carriers
- VIP vehicles
- Police cars and boats



Future Innovations

At Honeywell, we are continually researching new material solutions as the needs of manufacturers, military commands and law enforcement agencies continue to change and evolve. Spectra® fiber technology was born from innovation and continues to be our driving force.

To learn more about Honeywell Spectra® fiber products, visit our website at www.honeywell.com/spectra

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