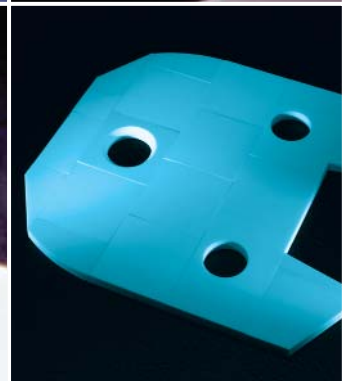


COORSTEK
Amazing Solutions.®



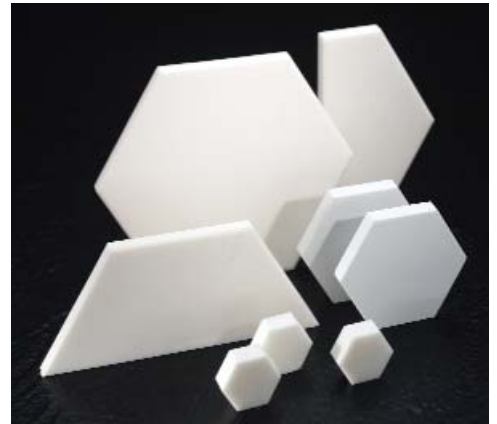
CS CERASHIELD™
Z-PLUS™ ALUMINA

CERAMIC ARMOR

CERASHIELD™ ARMOR CERAMICS

Advanced Ceramic Vehicle Tiles

Exceptionally well-suited for vehicular applications, CoorsTek® produces lightweight technical ceramic tiles using tight-tolerance manufacturing standards, high-purity formulations, and controlled microstructures to ensure durable, everyday performance and a consistently reliable defense to unexpected threats.



Assembled modular
panels developed
specifically for
your custom
application

- **Shapes and Sizes for All Needs**

CoorsTek offers CeraShield™ advanced ceramic vehicle tiles in a variety of shapes and sizes. Choose from square or hexagon shapes at various imperial and metric measurements, or let our specialists help you select custom shapes, thicknesses, and configurations to optimize your armor system design.

- **Modular Assembly**

CoorsTek provides assembly services to form multiple tiles into custom panels of complex shapes and configurations – including holes & cutouts. Perfect for aircraft, armored vehicles, and executive vehicles, our modular panels provide a custom fit and superior performance.

- **Vacuum-Bonding Capabilities**

We've perfected the bonding process to perform under some of the harshest industrial environments on the planet. Our specialized process bonds the ceramic to a variety of customer-specified substrate materials for a thoroughly robust and integrated solution.

Contact our vehicle armor specialists today at +1.303.277.4481 or armor@coorstek.com for more information.



For expert
engineering and
design assistance
with your next
project, call us at
+1.800.821.6110

FOR SUPERIOR LIGHTWEIGHT PROTECTION

Next-Generation Ceramic Torso Plates

CoorsTek offers lightweight, superior-quality torso plates in a wide variety of shapes, sizes, thicknesses, and materials including:

- **CeraShield™ High-Density Aluminum Oxides**

- The traditional monolithic plate material, CoorsTek offers extremely high-volume, multi-facility production capacity
- Standard sizes and shapes including all SAPI sizes.
- Custom thicknesses available from 1 mm and up

- **CeraShield Silicon Carbides**

- Superior hardness for advanced threats
- Lower weight with higher performance benefits

- **CeraShield Boron Carbides**

- Lowest density for ultra-lightweight designs

Representative examples of our standard plates are illustrated below. Most sizes and shapes are offered in all CeraShield materials. Custom shapes, sizes, and thicknesses are readily manufactured to customer specification.

Contact our ceramic torso armor components specialist today at +1.303.277.4481 or armor@coorstek.com for more information.



SAPI



Groin Plate



Front Plate-Double Curve



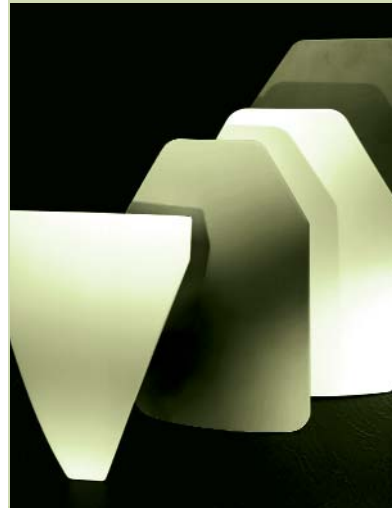
Back Plate - Double Curve



Multi Curve



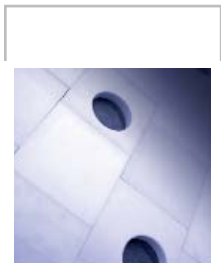
Triple Curve



Lightweight
aluminas,
silicon carbides,
boron carbides,
and hybrid blends

For expert
design-for-
manufacturability
assistance with
your next project,
call us at
+1.800.821.6110

PROVEN PERFORMANCE FOR ADVANCED ARMOR



Customized design and assembly of modular vehicle armor systems

Worldwide Leaders in Technical Ceramics

A recognized worldwide leader in the engineering and manufacturing of technical ceramics, CoorsTek provides advanced materials and design configurations for ballistic-grade ceramics used in appliqué and integrated armor systems.

Performance Advantages

CoorsTek CeraShield™ ceramics offer many advantages over conventional materials. Our specially formulated ceramic armor materials provide:

- Low weight
- High hardness
- Controlled, uniform microstructure
- Dimensional stability over wide temperature range
- Compatibility for use in finished armor systems with proven ballistic performance for National Institute of Justice (N.I.J.) and international design standards^(C).

Variety of Materials for a Variety of Applications

CoorsTek offers a wide range of CeraShield™ materials to satisfy your specific ballistic application:

- High-density aluminum oxides
- Zirconia-toughened aluminas
- Boron carbides
- Silicon carbides

Advanced Manufacturing Capabilities

Our state-of-the-art forming methods and statistically controlled processing ensure leading-edge, low-cost manufacturing. Advanced capabilities in green

machining and precision grinding enable extreme customization of design to meet the most demanding applications.

Expert Design Assistance for Amazing Performance

CoorsTek engineers offer assistance:

- Selecting the BEST material for YOUR application
- Designing for manufacturability:
 - Optimize performance
 - Minimize manufacturing cost

Quality with a Passion for Excellence

CoorsTek OpXSM Operational Excellence quality and manufacturing system blends proven, best-practice techniques like lean, six sigma, on-line SPC, and ISO 9000-2000 certification to ensure exceptional product quality and traceability.

For nearly 100 years...

Since 1910, CoorsTek has solved technical challenges for innovative customers like you. With armor tile production dating back to the 1960's our long-term experience, broad range of materials, variety of cost-effective manufacturing techniques, and unparalleled capacity (over two million square feet of manufacturing capacity) provide peace of mind for manufacturers around the globe.

Call us today at +1.303-277-4481 for assistance.



CoorsTek exclusive OpX manufacturing and quality system



Quick-Turn Prototyping and Manufacturing

CeraShield™ Ceramic Armor Materials											
Property	Units	Test	AD-90 90% Alumina	Z-PLUS™ 94 Zirconia-Impr. Alumina	AD-96 96% Alumina	FG-98 98% Alumina	CAP 4 98.5% Alumina	CAP 3 99.5% Alumina	SC-DS Direct-Sintered Silicon Carbide	SC-RB Reaction-Bonded Silicon Carbide	Boron Carbide Reaction-Bonded Boron Carbide
Density	gm/cc	ASTM-C 20	3.60	3.70	3.72	3.80	3.80	3.90	3.15	3.10	2.65
Flexural Strength (MOR), 20° C	MPa (psi X 10 ³)	ASTM-F417	338 (49)	352 (51)	358 (52)	375 (54)	375 (54)	379 (55)	480 (70)	462 (67)	250 (36)
Elastic Modulus, 20° C	GPa (psi X 10 ³)	ASTM-C848	276 (40)	303 (44)	303 (44)	350 (51)	350 (51)	370 (54)	410 (59)	393 (57)	379 (55)
Poisson's Ratio, 20° C	—	ASTM-C848	0.22	0.21	0.21	0.22	0.22	0.22	0.21	0.19	0.18
Compressive Strength, 20° C	MPa (psi X 10 ³)	ASTM-C773	2482 (360)	2103 (305)	2068 (300)	2500 (363)	2500 (363)	2600 (377)	3500 (507)	2500 (363)	1721 (250)
Hardness	GPa (kg/mm ²)	KNOOP 1000 gm ROCKWELL 45N	10.4 (1058) 75	11.5 (1175) 78	11.5 (1175) 78	13.7 (1400) 82	13.7 (1400) 82	14.1 (1440) 83	26 (2800) 90	24.5 (2500) *	25.5 (2600) *
Fracture Toughness, K1c	MPa m ^{1/2}	Notched Beam	3 - 4	4 - 5	4 - 5	4 - 5	4 - 5	4 - 5	3 - 4	3 - 4	3 - 4
Thermal Conductivity, 20° C	W/m K	ASTM-C408	16.7	22.4	24.7	27.5	27.5	30.0	150.0	100.0	50.0
CTE, 25-1000° C	1X 10 ⁻⁶ /°C	ASTM-C372	8.1	8.2	8.2	8.2	8.2	8.2	3.5	3.5	4.5

*Not available, Note: The chart is intended to illustrate typical properties. Engineering data is representative. Property values vary somewhat with method of manufacture, size, and shape of part. Any suggested applications are not made as a representation or warranty that the material will ultimately be suitable for such applications. The customer is ultimately responsible for all design and material suitability decisions. Data contained herein is not to be construed as absolute and does not constitute a representation or warranty for which CoorsTek assumes legal responsibility. ANY WARRANTY OR REPRESENTATION FOR WHICH COORST^{TEK} IS RESPONSIBLE SHALL BE SUBJECT TO A SEPARATELY NEGOTIATED AGREEMENT. ©CeraShield™ armor ceramics are not rated by the National Institute of Justice (N.I.J.). Manufacturers of finished ceramic armor systems have achieved N.I.J. Level III and IV ratings for complete armor systems incorporating CeraShield™ armor ceramic components.

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