

Wear-Resistant Cera-VAM® Ceramic

Coal handling demands a lot from power plant equipment. Abrasive coals with high ash content can quickly wear out unprotected feed spouts, pulverizer housings, classifier cones, burner lines, and other components. Properly installed, Cera-VAM® ceramic lining, provided exclusively by The Babcock & Wilcox Company (B&W), can extend the life of these components, thereby reducing overall costs and enhancing plant availability.

Cera-VAM ceramic performs

Since 1974, Cera-VAM ceramic lining has enabled electric utilities to significantly cut costs. Cera-VAM lining combines surface hardness with durability to protect coal handling systems from premature wear. Its properties inhibit abrasive and impingement erosion caused by the sliding and impact of coal particles.

Though the initial cost of Cera-VAM-lined components may be higher than unlined components due to additional installation expenses, the cost differential is more than offset by Cera-VAM's longer wear-life. When this is combined with the cost savings of reduced downtime and repeat installation, the advantages of Cera-VAM are even more dramatic.

Cera-VAM ceramic protects against sliding and impingement erosion

Cera-VAM ceramic is one of the most wear-resistant engineering materials suitable for power plant applications.



Cera-VAM ceramic offers extended wear-life for pulverized coal piping.

As a high-density lumina ceramic, it is composed of high-purity alpha aluminum oxide bonded by interlocking crystalline aluminum silicate. For the purposes of lining systems and components, it is formed into thick, wear-resistant bricks, or thin, impact-resistant tiles.

Cera-VAM lining ranks nine on the MOH hardness scale, with the diamond (10 MOH) the only harder substance. Nearly as hard as diamonds, Cera-VAM ceramic will outperform wear-resistant cast irons, silicon carbides, and tool steels and is more than 10 times resistant to abrasive blasting than cast basalt.

In addition, Cera-VAM ceramic is highly resistant to chemical attack and corrosion. It has good resistance to most acids, mild to medium alkaline solutions, organic



Pulverizer turret panels with Cera-VAM ceramic lining provide added protection against wear at the top of the pulverizer turret.

solvents, salt solutions, and molten salts. High-density Cera-VAM ceramic is also gas-tight, which enhances its protective properties and resistance to chemical corrosion. Because of these properties, Cera-VAM ceramic can help make even the most difficult coal a practical, economical fuel.



Types and Features of Cera-VAM® ceramic

Slip cast	complex geometries
Brick	high abrasion resistance
Vacuum-bonded tile	high impact resistance

Knoop scale relative hardness (100 g load, kg/mm²)

Diamond	6,500 – 10,000
Sapphire	1,800 – 2,200
Cera-VAM ceramic	1,700 – 2,000
Porcelain	500 – 800
Quartz	600 – 800
Rc 40-65 tool steels	400 – 900

Note: higher numbers indicate superior wear resistance

Dry rubbing abrasion resistance (based on volume loss)

Cera-VAM ceramic	1.00
Nitride bonded silicon carbide	2.40
Fused cast alumina	2.70
AR-360 wear steel	3.41
T-1 tool steel	3.95

Note: lower numbers indicate superior wear resistance

Abrasive grain blast relative abrasion (based on volume loss)

Cera-VAM ceramic	1.00
Fused cast alumina	4.38
Nitride bonded silicon carbide	5.00
Basalt	10.75
Stone hard castable	43.75

Note: lower numbers indicate superior wear resistance

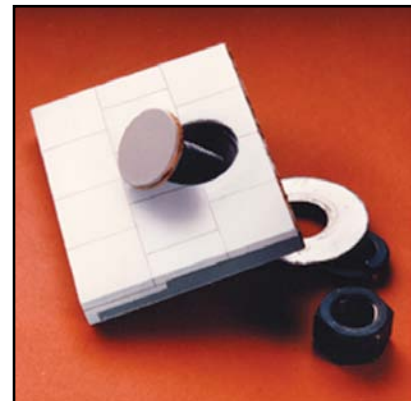
Cera-VAM® ceramic physical properties (typical)

Alumina content	90%
Hardness, MOH scale	9
Bulk density, lb/ft ³ (kg/m ³)	215 (3444)
Flexural strength, 10 ³ psi (kPa)40 (276)
Compressive strength, 10 ³ psi (kPa)	256 (1765)
Weibull modulus	24
Fracture toughness, ksi • in ^{1/2} (MPa • m ^{1/2})	3.75 (4.12)
Young's modulus, 10 ⁶ psi (kPa)	39 (269)
Shear modulus, 10 ⁶ psi (kPa)	16 (110)
Poisson's ratio	0.215
Thermal Exp. Coef., 1000C [10 ⁻⁶ in./in./F] (10 ⁻⁶ m/m/K)	4.61 (8.298)
Maximum use temperature, F (C)	2280 (1249)
Average grain size (microns)	3.4

Cera-VAM ceramic, with an operating range up to 2280 F (1249 C), is unaffected by temperatures that typically occur in coal handling system applications. This high temperature resistance is extremely important in pulverizers, burner lines, fan housings, ash pumps, coal feeders, classifiers and valves.

An example of saving money with Cera-VAM® lining

At a large eastern U.S. power station, the pulverizer classifier cones – originally fabricated of 3/8 in. (9.5 mm) carbon steel – wore out after only 3,000 hours of operation. B&W supplied replacement cones lined with Cera-VAM ceramic. Annual inspections after installation indicate that lined cones should last at least 120,000 hours, or almost 40 times the wear-life of the original carbon steel.



Vacuum-bonded plates of Cera-VAM tile can be applied by bolting or welding through specially designed openings.



Typical Cera-VAM bricks for lining pipe are about 1 in. thick, 2 in. wide, and 9 in. long (25.4 mm x 50.8 mm x 228.6 mm) and weigh about 22 oz (623.8 g) each. Specially designed 6 to 9 degree angled edges create a keystone effect to help lock bricks in place.

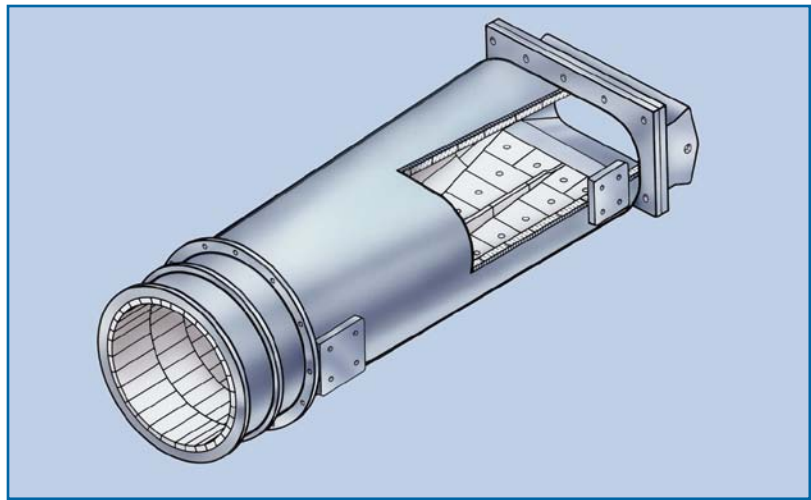
Despite the higher initial material price, the lifetime cost of the lined cones is eighty percent less than the original mild steel cones. If the costs of downtime and re-installation were included in this comparison, the Cera-VAM ceramic lined cones would have an even greater advantage compared to the plain steel cones.

Methods for applying Cera-VAM® ceramic

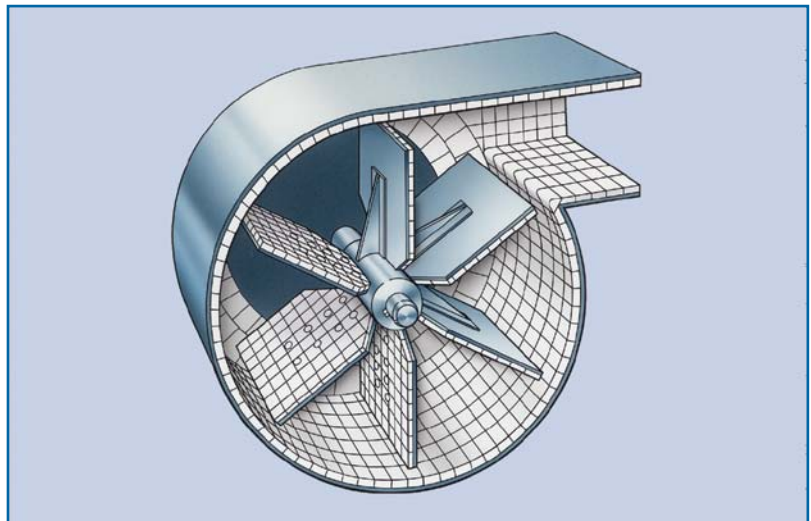
- Welding or bolting
- Tongue-and-groove brick
- Vacuum-bonded tile
- Fitted brick with mortar or cement backing (for pipe lining)

Engineered by Babcock & Wilcox

The combination of Cera-VAM ceramic's wear-resistant properties and B&W's engineering has paid off for many utilities by extending the life of coal-handling and preparation systems. If you are having wear problems, retrofitting with Cera-VAM ceramic lining may help you increase your station's reliability. If you're planning a new coal station, Cera-VAM ceramic lining in original components can help reduce potential problems.



B&W offers upgrades of competitive equipment such as this Cera-VAM-lined burner nozzle for corner-fired boilers.



Vacuum-bonded tile has been used to improve wear resistance of fans.



Cera-VAM ceramic lined burners can extend burner life.





Cera-VAM bricks are pre-formed to follow the bends of burner line elbows.

delivering
proven results

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