

**VACUUM BONDING**

# V A C U U M B O N D I N G

## **Ceramics for Wear – A Natural Choice!**

Alumina ceramics have been used by the power industry for years as a cost-effective, wear-resistant material. Ceramic material gives continuous protection to fan linings, chute liners, hopper bottoms, and dozens of other stationary high-wear points. Now, the technology is available for using alumina on moving parts as well.

## **Cera-Fan™ Composites for Moving Parts**

Two key ingredients make Cera-Fan composite technology possible:

1. Development of a ceramic body nearly twice as wear-resistant as most commercial aluminum oxide bodies.
2. CoorsTek proprietary vacuum-bonding process chemically locks small ceramic tiles to a structural substrate.

Combining these two technologies yields a structural composite with the strength and impact resistance of a structural metal and the wear resistance of a specialized ceramic. We call this Cera-Fan composite.

## **Several Advantages...**

In addition to the obvious advantage of longer wear life, Cera-Fan blades have several benefits that may not be immediately apparent:

1. Lighter weight – Ceramic has only 40% the density of steel. A  $\frac{1}{8}$ " overlay of ceramic on a  $\frac{5}{16}$ " steel plate weighs 55% as much as a  $\frac{3}{8}$ " deck plate blade. This allows the use of an extended-length blade without creating undue stress on the spider. It also means that bearing life may be extended.
2. Even wear – Unlike most hard-facings, ceramic is an extremely uniform material. There are no hard or soft spots that wear at uneven rates. This means that rebalancing of the fan between overhauls is almost eliminated.
3. Minimum downtime – Cera-Fan composite blades allow fans to run much longer by eliminating the major sources of unscheduled downtime.



## **Used Wherever Moving Parts Receive Abuse**

Cera-Fan composite blades are now quite common in utility boilers where exhaustor fans are used to blow pulverized coal into the boiler. Steel fan blades and whizzers that would last only two to three months have been replaced with Cera-Fan composite blades that are still running after four years.

## **Industry-Proven Cera-Fan Composites Provide Unmatched Performance**

Cera-Fan composite blades have been successfully tested and proven in power plants around the world. Some fans are still in service after 35,000 hours of use.

Several competitors have tried to mimic the Cera-Fan composite design using commercial ceramic tiles and adhesives. To date, no one has proven even half the life or reliability of the Cera-Fan composite. These are the most cost-effective fan blades that money can buy.

Our proprietary vacuum bonding process is designed for the most severe wear applications

## Numerous Applications

In addition to power plants, Cera-Fan™ composites are common in manufacturing of:

- Cement
- Chipboard
- Asphalt
- Steel
- Numerous other manufacturing environments handling abrasive materials

## Design Advantages

1. Structural bonding – Provides opportunities for custom designs that are not available with hard-facing or coatings. The ceramic used is a fully-dense, fired body, not a porous flame-sprayed coating. By using small tiles rather than a continuous coating, the blade can flex and twist with no damage to the individual tiles.
2. Strength and versatility – Special shapes are used to protect the leading edge of the blade. The structure of the blade can't erode out from under the ceramic. In high-wear areas, an extra layer of ceramic is inlaid to prolong the life of the blade. The tiles can be applied in special staggered patterns to prevent wear along the joints.
3. Bolted-in-place applications – Cera-Fan composite blades come with special bolts which have either a ceramic cap bonded to the top or a tight-fit cap bonded to the bolt top after installation. The choice of bolt caps depends on the wear pattern of the particular fan. If wear occurs over the bolt pattern, tight-fit caps are highly recommended. All the tools, materials, and instructions needed for cap installation are provided with each blade.

## Welded-In-Place Applications

Because welding directly to the blade may damage the chemical bond, pre-welded tabs are provided for weld-in-place blades. Uniform-weight blades (typically  $\pm \frac{1}{2}$  lb.) generally don't require weld-on weights – balancing weights are welded to the spider as needed. For applications where blades must be individually balanced with weld-on weights, a special balancing angle can be provided on each blade.

## Normal Operating Temperatures

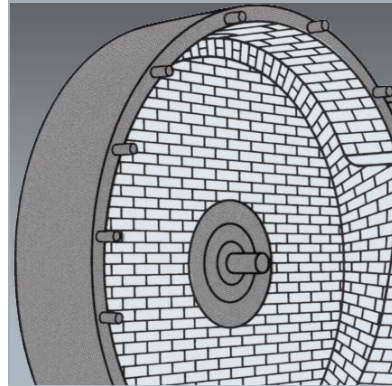
The bonding system used for exhauster blades is designed for continuous use up to 215° F. Above this point the adhesive layer will gradually begin to soften. The blade should not be operated above 215° F continuously for over a year.

Special, high-temperature bonding is available for most ID fans and gas recirculating fans. Please specify operating temperatures when ordering blades.

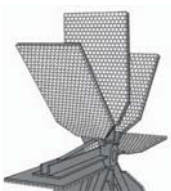
## About Bonding

The most common question asked by customers who see the remarkable impact resistance and strength of those composites is "What kind of glue are you using?" The answer is not as simple as it may appear.

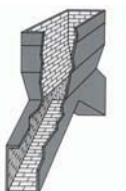
In fact, we use a variety of different polymers for bonding. These compounds are very specific to the particular substrate being bonded and to the specific conditions they will see in service. Some of the compounds are commercial products, some are custom-formulated to our specifications, and some are compounded in-house.



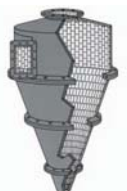
For expert assistance with your next project, please call 303-277-4057



exhauster fan



chute



cyclone



piping assembly

### Specialized Surface Treatments

The key to the success of bonding depends on the selection of appropriate surface treatments and on the optimum tie/temperature/pressure schedules required. A typical commercial epoxy may advertise an optimum bond strength of 1500 psi. Yet using carefully controlled procedures, strengths of up to 6000 psi are possible with these same compounds. To achieve and maintain the structural integrity of the Cera-Fan composites, we have developed a number of proprietary processes where each step is carefully monitored and tested.

### Alternate Materials

An advantage of structural bonding is its compatibility with a large number of materials. If a particular application is so abrasive that aluminum oxide just won't hold up, the high-wear areas can be inlaid with tungsten carbide, fine-grained silicon carbide, or a variety of exotic new materials. By limiting the use of exotic materials to the most severe wear points, the cost and weight of the blades is kept under control.

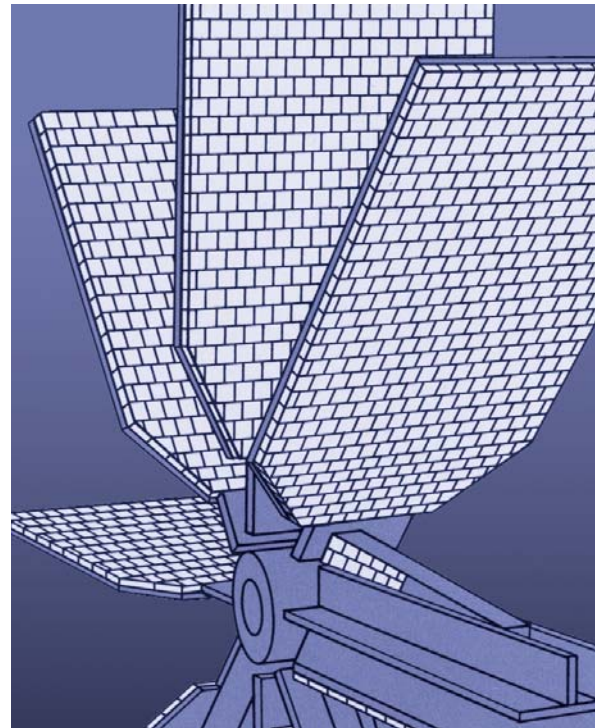
For weight-sensitive applications, bonded-composites may offer a cost-effective solution. While steel remains the material of choice, a much lighter system can be built using aluminum substrates. This provides both a lighter-weight structure and a much stiffer blade.

### How To Order

Cera-Fan blades are custom designed to solve individual wear problems.

To order a set of blades, a drawing should be provided showing dimensions and bolt locations along with shading of high-wear areas. If drawings are not available, send us a worn-out blade.

We will prepare a drawing and submit it with a quote for approval. Manufacture will proceed only upon return of an approved drawing. Call us at 303.277.4057 for more information.



### Properties of Cera-Fan™ Alumina Ceramic Body

Property	Units	Value
Hardness (Rockwell)	R45N	75
Hardness (KNOOP)	GPa	10.4
Compressive Strength	Kpsi	360
Flexural Strength	Kpsi	49
CTE	IN/IN/°F	0.0000034
Density	LBS/CU IN	130

### Materials Comparison

Material Composition	Weight (lbs./square foot)	Impact Resistance	Fatigue Strength
1/8" Ceramic on 5/16" Steel	15.5	Excellent	Excellent
3/16" Ceramic on 5/16" Steel	16.3	Good	Excellent
1/8" Ceramic on 5/8" Aluminum	11.3	Good	Excellent
5/8" AR Diamond Plate	27.9	Excellent	Good
3/32" Tungsten Carbide on 3/8" Steel	23.0	Fair	Fair
1/4" Chrome Carbide on 3/16" Steel	31.3	Good	Fair

**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. This data is not to be construed as absolute and does not constitute a warranty for which we assume legal responsibility.

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