

Borogard® ZB in woodfiber-plastic composites



Weather takes a toll on both the plastic and wood components of woodfiber-plastic composites (WPCs) leaving them susceptible to rot, decay, mold, and degradation.

Woodfiber-plastic composites (WPCs) continue to evolve and have now become the fastest growing segment of the outdoor decking market. They offer a wide range of advantages over pressure-treated lumber and naturally durable cedar or redwood, including weather resistance, long service life, and low maintenance.

Consumers rank durability as the most important attribute in choosing decking material, followed by low maintenance and appearance.¹ To meet this demand, WPC manufacturers are increasingly relying on *Borogard ZB*. *Borogard ZB* protects against wood destroying organisms like decay fungi to enhance durability; and, inhibits mold growth to keep decks looking good and easy to maintain.

Initially, the perceived advantage of WPCs over solid wood was the “fact” that the wood fibers were completely encapsulated in plastic—preventing exposure to wood destroying organisms and the moisture absorption that creates a welcoming environment for many of them. That fact turned out to be a myth. In reality, weather takes a toll on both the plastic and wood components of WPCs—particularly in the exterior applications they were designed for—leaving them susceptible to rot, decay, mold, and degradation.

Borogard ZB has been used successfully to protect wood composite products for more than 15 years, making it the benchmark against which other preservatives are measured. *Borogard ZB* is safe for people and the planet, the most cost-effective preservative available, and offers these vital performance attributes:

- Protects against rot and decay
- Inhibits mold in exterior applications
- Enhances UV light stabilization

Protects against rot and decay

The wood component of WPCs is inherently susceptible to moisture absorption—something that is not always reflected in standard industry evaluation methods. In these tests, full-sized boards soaked in water for 24 hours show weight gains of about 2%. This translates to a wood moisture content of about 4% in WPCs made with equal amounts of wood and plastic.

These tests are not, however, an accurate reflection of what happens to WPCs in the real world. Field tests run on WPCs have shown that exposure to the elements for upwards of one year can yield moisture contents for the wood component which are high enough to initiate and support fungal decay. Wood moisture contents in excess of 40% have been achieved—far above the minimum of 25% that constitutes the necessary environment for decay fungi to begin destroying wood. Not surprisingly, susceptibility to decay and rot has been demonstrated in untreated WPC samples that have been in the field for less than 18 months.



Field tests show decay fungi thriving on untreated WPCs.

¹ Smith, PM and MP. Wolcott. 2005. Wood-Plastic Composites in Emerging Products and Markets. In: Proc. The Eighth International Conference on Woodfiber-Plastic Composites. Forest Products Society. Madison, WI. pp. 335-343.

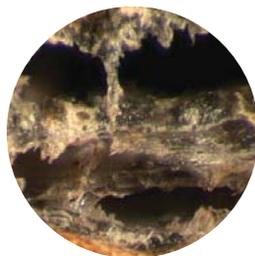




These two images show the surfaces of WPC samples exposed to decay fungi in a laboratory soil block evaluation at 25x magnification. The WPC in the photo on the left was treated with *Borogard ZB*. The photo on the right shows an untreated WPC sample of similar composition. The decay fungi completely digested the wood, leaving void spaces in the plastic.



WPC treated with *Borogard ZB*



Untreated WPC

Borogard ZB for built-in protection

Independent university research confirms these findings. Standard laboratory tests of untreated WPCs' performance against decay fungi show weight losses of between 10 and 20% in as little as sixteen weeks. These losses equate to a reduction of between 20 and 40% of WPCs' wood component. Field tests show that natural weathering makes WPCs even more susceptible to decay and rot.

Research also proves there is a solution. In test after test, WPCs treated with *Borogard ZB* have resisted the ravages of a full range of wood-destroying organisms. *Borogard ZB*'s biostatic properties, low

cost and excellent safety attributes make it the leading preservative treatment available.

Inhibits mold in exterior applications

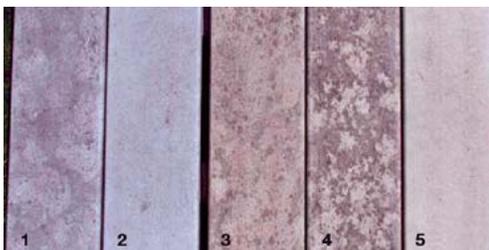
Consumers want decking materials that look good and are easy to maintain. Unfortunately, another of wood's natural enemies—mold—can wreak havoc on WPCs, both in inventory and in use. Mold can stain the surface of WPCs, effectively eliminating the “low maintenance” advantage and dramatically impacting the appearance.

However there is also good news from the lab and the field: *Borogard ZB*'s biostatic properties inhibit mold in exterior applications. In laboratory and outdoor field tests, *Borogard ZB* has been shown to dramatically reduce the appearance of unsightly mold.

Enhances UV light stabilization

WPCs are under attack even on dry sunny days. Ultraviolet light degrades the plastic component of WPCs, leaving the wood component exposed. Moreover, WPCs are more susceptible to UV degradation than pure plastic systems, most likely because wood's natural vulnerability to UV degradation accelerates the breakdown rate.

Hindered amine light stabilizers (HALS) have long been used to protect plastics against UV degradation, often in combination with UV light absorbers. *Borogard ZB* acts as a synergist to boost the HALS system's performance. Tests conducted on WPCs containing HALS and *Borogard ZB* show a significant reduction in UV degradation compared to samples without *Borogard ZB*. Slowing down this plastic degradation helps to protect the surface of WPCs, minimizing the exposure of the wood component, and its related susceptibility to mold, rot, and decay.



Visual results of aesthetic mold on WPC boards after 3.5 years in an outdoor field test. Boards 1, 3 and 4 do not contain *Borogard ZB*; boards 2 and 5 are treated with *Borogard ZB*.



WPC samples at 10X magnification after 3.5 years in an outdoor field test. The image on the left is a sample treated with *Borogard ZB* and HALS; the image on the right is a sample treated with HALS, but no *Borogard ZB*.





The building products industry has relied on *Borogard ZB* for more than 15 years as the benchmark preservative treatment for engineered wood products. *Borogard ZB* is the only zinc borate preservative produced in the United States, and the only one consistently produced using the highest quality raw materials—leading to a final product with extremely low levels of impurities. Since 2000, a growing number of WPC producers have recognized this and are choosing *Borogard ZB* for its process and product benefits:

Excellent performance

- *Borogard ZB* has broad-spectrum efficacy against all wood destroying organisms.
- *Borogard ZB* is a completely reacted zinc borate and is distributed homogeneously throughout the WPC. Its protection is continuous, despite surface abrasion, end cuts and sanding that occur during installation.

About U.S. Borax

U.S. Borax, part of Rio Tinto, is a global leader in the supply and science of borates—naturally-occurring minerals containing boron and other elements. We are 1,000 people serving 500 customers with more than 1,700 delivery locations globally. We supply 30% of the world's need for refined borates from our world-class mine in Boron, California, about 100 miles northeast of Los Angeles. We pioneer the elements of modern living, including:

- **Minerals that make a difference:** Consistent product quality secured by ISO 9001:2015 registration of its integrated quality management systems
- **People who make a difference:** Experts in borate chemistry, technical support, and customer service
- **Solutions that make a difference:** Strategic inventory placement and long-term contracts with shippers to ensure supply reliability

- *Borogard ZB* is thermally stable under WPC manufacturing conditions, and simple to introduce into existing manufacturing processes.
- *Borogard ZB*'s particle size and shape has been optimized to yield a product that is sparingly soluble in water—making it resistant to leaching and weathering—and has proven effective over a longer time period than competitive products.
- *Borogard ZB* acts as a synergist to boost HALS performance.

Excellent cost

- *Borogard ZB* is the most cost-effective protection available for WPCs and other composites.

Excellent safety

- *Borogard ZB* is effective against insects and fungi, but safe for people, pets and the environment.

About 20 Mule Team® products

20 Mule Team borates are produced from naturally occurring minerals and have an excellent reputation for safety when used as directed. Borates are essential nutrients for plants and key ingredients in fiberglass, glass, ceramics, detergents, fertilizers, wood preservatives, flame retardants, and personal care products.

