

TRU-CORE™ INFUSION TREATMENT FOR WOOD AND WOOD COMPOSITES

Alan Ross
Kop-Coat, Inc.
Pittsburgh, PA

Summary

A new treating system has been developed for protecting wood and wood-based composites from biological organisms including decay, mold and termites. The system is surface-applied but rapidly penetrates to the core of most lumber and wood composites including LVL and OSB. The treating solution is mixed on-site in a fully contained module and is applied by dip or in-line spray. Formulations can be customized to provide desired levels of protection. Unlike a pressure treating plant, the mixing and application equipment can be installed at the end of a planer or a panel manufacturing line. It can be easily taken off-line when not in use. The capital cost is generally less than that for a pressure treating plant. These systems have been in commercial use in New Zealand for over three years. They are utilized in a number of mills to protect framing timber from decay and mold. The treatment meets New Zealand Specification 3640 for Hazard Class H1.2 and is being certified for use in Class H3.1. In the U.S., a major siding manufacturer is using a Tru-Core™ treatment system to provide UC 3A decay and termite protection to its siding products. Additionally, the system has completed a successful plant trial at a U.S. OSB manufacturing facility. Treated OSB was shown in independent testing to be resistant to decay, mold, and Formosan termites and it successfully passed an ASTM E84-05 flame spread test with a Class B rating. Mechanical properties and appearance of the OSB were not negatively affected by the treatment. Results of the OSB trial are presented in this report. In Canada, a joint development project is in progress between Kop-Coat, Inc. and FP Innovations/ Forintek laboratory to evaluate the treatability of post-Mountain Pine Beetle killed lumber with the Tru-Core™ Infusion system.

1. Introduction

This paper describes a new type of treatment system which has been developed for the protection of solid wood and wood composites such as LVL and OSB. The most unique feature of this system is that it is applied as a surface treatment by dip, flood coat or spray but it rapidly penetrates to the core of most substrates without the need for physical means such as typically provided by pressure- or vacuum-treatment. While the treatment employs the use of borates (along with other preservatives and insecticides) it is not a diffusion system in that it can be applied to substrates with the addition of as little as 2-3% to the moisture content and it does not require the presence of large amounts of moisture to affect penetration. Unlike diffusion systems which typically require several weeks of conditioning for complete preservative distribution, the Tru-Core™ Infusion system requires only about 24-36 hours of conditioning for penetration to the core. The technology of the Tru-Core™ Infusion System is protected by a number of patents and pending patents around the world.

2. Applications

New Zealand:

The Tru-Core™ system is in commercial use at eleven operating licensees in New Zealand. One of its main uses is to treat radiata pine framing timber for the New Zealand home construction market. In New Zealand, framing timber is required to have a minimum 50 year service life under the 2004 Building Code. Following a number of instances of decay in residential buildings, framing timber is now required to incorporate fungicidal protection in the event of exposure to dampness. The protection may be short term (i.e. two years), but would allow a reasonable time for the homeowner to recognize the problem and take remedial action to eliminate the source of moisture.

The preservative treatment specification for framing is given in New Zealand Standard 3640:2003 *Chemical Preservation of Round and Sawn Timber*. Hazard class 1.1 applies to timber used in situations protected from the weather, dry in service (less than 18% moisture content), and where resistance to the borer *Anobium punctatum* is required. Hazard class 1.2 applies to timber used in situations protected from the weather, but where there is a risk of moisture conducive to decay. Borate treated timber is required to have the sapwood completely penetrated and a concentration of 0.40% boric acid equivalent (BAE) in the sapwood cross section. In addition, boron penetration must be demonstrated in the central ninth core of the sapwood cross section. Hazard class 3.1 applies to lumber products used outdoors, out of ground contact, where there is no possibility of water entrapment. Typical applications include fascia and weatherboard.

North America:

A U. S. siding manufacturer is using a Tru-Core™ treatment to protect trim and fascia board from decay and termite attack. Treated boards are coated with a special primer prior to shipment. This provides protection equivalent to that specified in AWWA Use Category 3A (aboveground, outdoors, protected from the weather).

A plant trial using the Tru-Core™ treatment was conducted at a U.S. OSB manufacturing facility. The treated OSB was then subjected to third-party testing for durability and physical properties. A description of the trial and the test result follows.

OSB Treatment Plant Trial

Description of the Trial:

A spray application system was installed on the production line of an OSB manufacturing plant so that the preservative treatment was applied to the panels between the forming press and the stacker. The panels measured 122cm by 244cm by 11.1mm (4 ft. by 8 ft. by 7/16 in). They were prepared from oriented strands of southern yellow pine (SYP) bound with a phenol-formaldehyde resin. At the point of application, after the press and the trimmer, the panel surface temperature was approximately 120° C. Panels were sprayed on both top and bottom surfaces in a one foot wide strip running along the center portion of each board as it passed along the production line. A red dye was added to the treatment to help visualize the area of application. The line speed at the point of application was approximately 370 lineal feet per

minute. After treatment, panels were hot-stacked for conditioning and final curing of the resin. Panels were examined 24-36 hours later. They were found to be completely dry to the touch. The treated areas were cut out of each panel and sent off for testing and analysis.

Performance:

Decay Resistance: A soil block test was conducted on treated OSB from the trial described above. Test blocks were cut into rectangles measuring 19mm by 19mm (0.75 in. by 0.75 in.) by the thickness of the treated OSB panel. Control blocks of the same size were cut from untreated panels produced at the same plant. Untreated solid SYP was also used as a control. The test was conducted by Mississippi State University following the method of AWWA E10-01 using *G. trabeum* as the test fungus. The untreated solid SYP control lost 61% weight; the untreated SYP OSB lost 42% weight; and the Tru-Core™ treated SYP OSB lost only 1.6% weight, which is statistically insignificant.

Formosan Termite Resistance: A laboratory termite test was conducted by Louisiana State University following the method of AWWA E1-97 for single choice testing. Test blocks were cut from the treated OSB into rectangles measuring 19mm by 19mm (0.75 in. by 0.75 in.) by the thickness of the OSB panel. Control blocks of the same size were cut from untreated SYP OSB panels produced at the same plant. Solid untreated SYP blocks were also used as a control. Performance was measured in terms of Percent Mortality, Percent Weight Loss and Visual Rating. Percent Mortality was obtained by counting all live termites remaining in each jar at the conclusion of the test (28 days) and dividing by the original number of termites placed in that jar (approximately 400). Percent Weight Loss was obtained by dividing the final oven dry weight of each test block by the original oven dry weight of that block. Visual Rating was conducted by estimating the extent of damage done to each block using a scale of 0 to 10 with 0 being complete failure and 10 being sound with nibbles allowed. The Tru-Core™ treated OSB had a termite mortality of 43.62% compared to 16.52% for the untreated OSB and 10.99% for the untreated SYP control. The untreated solid SYP control lost 26.85% of its weight compared to 8.65% for the untreated OSB control and 0.89% for the Tru-Core™ treated OSB. In terms of Visual Rating, using the 0 (worst) to 10 (best) scale, the untreated solid SYP had an average rating of 1.6; the untreated SYP OSB had an average rating of 5.1; and the Tru-Core™ treated OSB had an average rating of 9.8.

Mold Resistance: This test was conducted by Louisiana State University in a Mold Chamber following the method of AWWA E24-06. Test samples were 7.62cm by 12.70cm (3 in. by 5 in.) by the thickness of the OSB. They were suspended in the Mold Chamber for a period of eight weeks. Evaluations were conducted every two weeks using a visual rating scale of 0 (best) to 5 (worst). At the end of the test period the Tru-Core™ treated SYP OSB had a rating of 1.4 (minimal mold attack). All control samples were completely mold covered with ratings of 5.0.

Flame Spread: This test was conducted by Intertek Testing Services following the method of ASTM E84-05. The sample material tested consisted of three 243cm by 51cm by 1.27cm (8ft. by 20 in. by 0.5 in.) panels of treated OSB. The control sample material was untreated OSB, from the same manufacturing facility, of the same size and mounted in the same manner. For each trial run the three 8 ft. panels were placed on the upper edge of the flame spread tunnel and butted together to form the required 24 ft. sample length. A layer of 6 mm reinforced cement board was placed over top of the samples, the lid was lowered onto place, and then tested in

accordance with ASTM E84-05. The flame spread of the Tru-Core™ treated OSB was determined to be 72 while that of the untreated OSB was 109. Using the traditional ratings system, the treated OSB would have a Class B flame spread rating, while the untreated OSB would have a Class C flame spread rating.

Physical Property Testing: Panels of treated and untreated OSB were tested for physical and water absorption properties by Timber Products Inspection following the methods of ASTM D1037-99. Specific tests run included static bending, tensile strength perpendicular to the surface, water absorption and thickness swelling. The Tru-Core™ treatment had no detrimental effects on the physical properties of the OSB.

Opportunities in Canada

The mountain pine beetle (MPB) has killed 40 percent of British Columbia's pine forest in the past few years. It is estimated that by 2015, more than a billion cubic meters of pine will be dead. If the economic value of this lumber is not captured, it could result in more than a \$30 billion direct loss to the B.C. forest industry. Preservative treatment to achieve termite and decay resistance has potential to develop new products and markets for post-MPB lumber, thus recovering some of the lost economic value. Forintek (now part of FP Innovations) has undertaken a project to utilize the Tru-Core™ Infusion process to treat post-MPB pine, making it resistant to decay and the highly destructive Formosan subterranean termite. The objective of Forintek's work is to demonstrate the termite resistance of post-MPB lumber treated using the Tru-Core™ Infusion process with various combinations of borates and organic insecticides, and to determine if these are equal to or better than conventional treatments with borate alone. Post-MPB lumber which had been attacked on three sides by sapstain fungi, was treated with a range of preservative formulations using the Tru-Core™ process and installed in field tests in Hawaii and Japan at test sites with confirmed populations of Formosan subterranean termites. The termite resistance will be tested compared with a standard high level borate pressure treatment and a reference preservative, ACQ.

3. Conclusions

The Tru-Core™ Infusion System is a unique, proprietary treatment for solid wood and wood composites. Although it is surface-applied, it is capable of penetrating most substrates to the core after a brief (24-36 hour) activation period. It has been shown to treat green lumber, dry lumber and wood composites including LVL and OSB. Although the system utilizes borates, along with other fungicides and insecticides, it is not a classical diffusion system in that it adds very little moisture to the treated substrate (2-3%) and it requires only a matter of hours for complete penetration rather than the days to weeks associated with diffusion systems. The treatment components are mixed on-site in a computer-controlled, modular, automated system. Application is in-line and can be coupled to a planer line at a sawmill or an OSB manufacturing line, thus bypassing the need for a treating service. The system is easily adaptable to specific performance needs such as decay resistance, mold resistance and termite resistance. All materials used have an excellent health, safety and environmental profile with zero volatile organic compounds (VOCs) emitted.

On OSB the Tru-Core™ Infusion System was shown via third party testing to protect against

decay fungi, Formosan termites and mold. In addition it reduced the flame spread rating from a Class C to a Class B. The treatment had no deleterious effects on the physical properties of the OSB, as demonstrated in third party testing.

The Tru-Core™ Infusion System is in commercial use in New Zealand on framing lumber where it meets the New Zealand standard for timber framing protection. It is also in commercial use in the U.S. for the protection of exterior, painted trim board and fascia.

New opportunities for the Tru-Core™ Infusion system in Canada include the treatment of post-MPB killed pine for decay and Formosan termite resistance, being evaluated by researchers at Forintek. Field termite studies are currently in progress in Hawaii and Japan.