EPS Molders Association

Newsline

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EPS Radiant Floor Heat Panels

Increasing interest in energy-efficient products and ways to minimize a home's carbon footprint are on the minds of many home owners. With this growing trend, radiant floor heating continues to emerge from Europe into the U.S. housing market.

A recent survey by the National Association of Home Builders Research Center shows that almost a quarter (23 percent) of 302 home builders surveyed intend to "increase" or "greatly increase" their use of radiant floor systems. They cited

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INSULATED VINYL SIDING COMBINES TWO HIGH-PERFORMANCE MATERIALS FOR DURABILITY AND ENERGY EFFICIENCY.

Double Duty EPS

Insulated Vinyl Siding Offers Strength, High R-Values & Curb Appeal

One of the newest hybrid products to hit the market, insulated vinyl siding is catching the eye of contractors and home owners. By combining two high-performance materials to make an even better product, insulated vinyl systems inherit the durability and energy efficiency of the foam backing material and the easy care of a vinyl exterior. Mostly used in remodeling applications, the product is more impact-resistant than traditional vinyl siding and is virtually maintenance free. Plus, it offers better insulating properties than any other type of cladding.

The thermal and mechanical properties of expandable polystyrene (EPS) make it ideal for residential, commercial and industrial applications where R-value and moisture resistance are critical. EPS insulated siding marries an exterior siding panel (skin), whether metal, vinyl, composite, or other cladding material, with a shaped foam backer (core) precisely contoured to fit the siding profile at all points of contact. Insulated siding is just one of many highly engineered building products capitalizing on the inherent design flexibility, energy-efficiency and structural integrity of EPS material science.

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THE CUTTING EDGE

The EPS Molders Association represents more than 50 U.S. and Canadian manufacturers of building insulation products – and almost just as many applications. Expanded polystyrene (EPS) is used in a variety of building projects from the foundation up. To bring you the latest in EPS product development, testing and building code issues *EPS Newsline* is a great source, helping you to envision how EPS may fit into your next project.EPSMA recently completed a test program on freeze-thaw cycling to demonstrate the moisture resistance properties of foam plastics. Using a new ASTM test protocol, the results compare how laboratory testing measures up against the minimum performance specifications dictated by ASTM C578. Moisture resistance is an important quality to assess when choosing insulation in any application but especially below grade. Two stories in this issue show how EPS is used in radiant floor heating and insulating concrete form foundations – both with great results. Other EPS solutions highlighted in this issue include insulated vinyl siding and interior trim. To find out more about EPS applications visit our website at www.epsmolders.org.

Betsy Steiner
Executive Director

Laboratory Testing

Demonstrates EPS Performance

To show that expanded polystyrene insulation provides excellent moisture protection while providing consistent R- values over long term environmental conditions, the EPS Molders Association commissioned an independent test laboratory, Intertek EL SEMKO, to conduct environmental cycling tests on foam insulation.

Intertek performed the tests using ASTM C1512-07, Standard Test Method for Characterizing the Effect of Exposure to Environmental Cycling on Thermal Performance of Insulation Products.

The purpose of the test initiative was to assess the effect of freeze-thaw cycling on polystyrene foam insulation, measuring the ability of the products to maintain thermal performance and other critical physical properties after being subjected to standardized exposure conditions. The test included three expandable polystyrene foam product types, Type I, Type II and Type IX. The tests were performed on 25 mm (1") thick specimens.

Testing confirmed that all of the EPS material types retained their thermal and mechanical properties even after being subjected to freeze-thaw cycling. Results confirmed no loss in R-value or change in material properties and the moisture content was less than the maximum allowable percentage specified in ASTM C578, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation. Additionally, EPS test samples met all C578 material properties before and after the C1512 environmental test.

It is important to note that the use of other ASTM test procedures to evaluate the effects of freeze-thaw conditioning on foam insulations have lead to confusion. Reporting the results of tests designed for concrete or other materials and applications are inappropriate and unsuitable. ASTM C1512 was developed specifically to address the need to evaluate building insulations under exposure to moisture and freeze-thaw cycles.

The moisture resistance of EPS insulation has been consistently proven in laboratory tests and field-use conditions. Tests in geofoam applications in Norway indicate that after 30 years the moisture content of samples located above the ground water table was less than 1% by volume.

ASTM CI5I2 TEST RESULTS

EPS MATERIAL TYPE I	Pre-Cycling	Post-Cycling	ASTM C578 Minimum Requirements
Density (lbs/ft^3)	0.95	0.95	0.90
Moisture Content %	4.73	2.68	4.0
Compressive Strength (psi)	13.7	13.7	10.0
Thermal Resistance (°F·ft^2·h/Btu)	3.74	3.70	3.6

Double Duty EPS

Insulated Vinyl Siding Offers Strength, High R-Values & Curb Appeal

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EPS Molders Association (EPSMA) past President and inventor of Progressive Foam's Fullback® Thermal Support System, Pat Culpepper is quick to give EPS the credit. "The excellent characteristics of EPS deliver a host of benefits not available with any other product we know. As innovators, we're vigilant about sourcing alternative insulation products. None come close to matching the cost-effectiveness and energy-efficiency of EPS," claims Culpepper.

Performance Benefits with EPS Foam

When siding or exterior cladding with EPS is applied to the exterior wall it helps to create an envelope around the structure covering all the wall cavities and studs to increase resistance to heat transfer either out of or into the building. Without a continuous insulation barrier, energy transfer through the studs (referred to as thermal bridging) is more prevalent especially in wood and metal frame construction. Insulated siding prevents thermal bridging and enhances the overall system R-value.

The backing increases the siding's R-value by as much as five times that of regular vinyl helping to reduce annual heating and cooling energy costs by up to 20%. EPS manufacturers can achieve varying R-values depending on density and thickness to provide the exact level of insulation required. One leader in this innovative application, Progressive Foam Technologies, has also achieved Energy Star® qualification as part of the Home Sealing effort sponsored by the Department of Energy (DOE). This makes insulated vinyl siding a great way to improve on any construction method that only insulates in between wall studs.

Impact Resistance

The most important mechanical property of EPS in insulation and building products is compressive resistance – its ability to resist compressive stresses. This ability increases as EPS density becomes higher. Most products are made at 1.0 pcf (pound per cubic foot). Tests performed by an independent laboratory concluded that siding panels insulated with EPS foam absorbed impacts from 160 PSI to 340 PSI, depending upon the siding material. It is conservative to conclude that the rigid EPS foam structural support used in today's premium engineered siding products increases the impact resistance of ordinary vinyl siding by more than 400%.

Vapor Permeability

The average family of four can generate up to six gallons of water vapor a day through normal household activities. If this is not released, it can condense on and between wall studs and result in both structural and health-related problems. Building scientists measure a structure's ability to breathe in terms of permeability. A perm rating for a material is the number of grains of water vapor (7,000 grains = 1 lb.) that will pass through one cubic foot in one hour when the vapor pressure differential between the two sides of the material equals 1 inch of mercury (0.49 psi).

EPS enjoys a naturally high permeability rating. For example, some systems are rated at 5.0 perm per inch, five times what is required to prevent pockets of moisture from building up behind panels. Independent lab tests of three EPS products conducted in accordance with ASTM E96-05, Standard Test Methods for Water Vapor Transmission of Materials (Desiccant Method), calculated the average moisture vapor transmission rate (MVTR) to be 0.804 g/h·m^2 — three times that of ¼" extruded polystyrene fanfold.

EPS is an ideal choice because it does not rot, is resistant to mold and mildew—and is proven to be a safe, highly effective compound with excellent thermal properties and added sturdiness when used as a part of a hybrid insulating system. And, it is highly compatible with a variety of traditional building materials, such as metal, wood, masonry and other plastics. Insulated vinyl siding is not as brittle in the winter and won't buckle in the summer, it won't dent or cup, which improves the home's appearance and prevents callbacks.

Installers often prefer insulated products over hollow vinyl siding because they're more rigid allowing them to lay flat even on irregular walls. And, attached versions save installation time when compared with drop-in foam-backed products. While EPS backing can add $30 to $40 per square (10'x10') to a vinyl siding job, premium vinyl, wood, and fiber-cement claddings don't offer near the R-value and can require special tools making it more difficult to install.

Traditional vinyl siding sales total about 35 million squares annually, compared with 1 million squares for insulated vinyl siding, but because of its unique benefits, significant growth is forecasted. Business consulting firm Hadley Associates predicts insulated vinyl siding sales will double to quadruple during the next five years. This remarkable success evolved from EPS manufacturers working in close relationship with major vinyl siding manufacturers and the Vinyl Siding Institute (www.vinylsiding.org) to offer state-of-the-art energy efficiency to remodelers and new construction projects.

Current vinyl siding manufacturers supporting the EPS Insulated Siding Category:

Alcoa Building Products
Alside Vinyl Siding
CertainTeed
Exterior Portfolio by Crane
Heartland
Infinite Building Products
Kaycan
Mitten Vinyl
Napco
Norandex Inc.
Reynolds Building Products
Resource Materials Corporation
Variform, Inc.
Wolverine Vinyl Siding

EPS Radiant Floor Heat Panels

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radiant heat's ability to provide even heat and cleaner air with lower operating costs as the primary factors for choosing them over competing systems.

In addition to heating residential and commercial living space, radiant floor heat is ideal for use in basements, garages and on walkways and driveways for melting snow and ice beneath the concrete slab. In most modern radiant floor heating systems, warm water circulates through plastic tubing either embedded in a floor slab or attached to the underside of subflooring. The thermal mass of the slab retains heat and radiates it slowly to the living space above. A crucial requirement for radiant floor heating systems is adequate insulation beneath the heated slab or beneath the tubing.

There are three types of radiant floor heat:

- Radiant air floors where air is the heat-carrying medium, mainly used in commercial buildings;
- Electric radiant floors; and
- Hot water (hydronic) radiant floors, usually less expensive and used most often in residential construction.

Photography courtesy of Createc Corporation.

All three types can be further subdivided by the type of installation: those that make use of the large thermal mass of a concrete slab floor or lightweight concrete over a wooden subfloor (these are called "wet installations"); and those in which the installer "sandwiches" the radiant floor tubing between two layers of plywood or attaches the tubing under the finished floor or subfloor ("dry installations").

When used as part of a radiant floor heating system expanded polystyrene (EPS) foam works as a thermal break, ensuring uniform and efficient heat distribution throughout the floor area. Expanded polystyrene is a lightweight, easy to handle, rigid thermal insulation. Its closed cell structure assures long lasting, stable thermal insulation properties and water-resistance. EPS insulation does not promote mold or mildew, has no pest nutrient value, will not decay over time and is CFC free. It is available in several compressive strengths to withstand load and backfill forces. In radiant heat applications, EPS insulation can be used with slab-on-grade or in sandwich slab applications, and its design versatility allows for customized installations.

The EPS material type (density) and thickness needed under the slab depends on the function of the heated space. Factors such as climate and occupancy will influence the required R-value. From a small bathroom to commercial garage decks with heavy vehicle loading, EPS can meet a variety of radiant heat design considerations. Some manufacturers provide EPS panels with grooves that are designed to securely hold the radiant heat tubing. This allows the tube to be "walked" into the panels, allowing for speedy installation at reduced project costs. With this type of system, the cost to purchase and install wire mesh may also be eliminated. And, if the installers do not like the layout, the EPS panels can be easily reconfigured.

Without insulation slab-on-grade radiant floor heating systems have the potential for significant heat loss into the ground, known

This innovative heating system has ancient origins — Romans built fires beneath floors to warm their villas and early Korean buildings were similarly heated by channeling flue gases beneath floors and venting up through chimneys. In more recent times, Frank Lloyd Wright piped hot water, rather than air, through the floors of many of his buildings in the 1930's. Today manufacturers have significantly streamlined the components and design of radiant floor systems.

as a heat sink. When a floor heating system is turned off, the heat escapes from the soil underneath causing the room temperature to continually increase. According to Paul Torcellini, Ph.D., P.E., of the National Renewable Energy Laboratory, even with insulation under the slab, 20% of the heat entering the slab can be lost into the ground. This reduces the overall efficiency of the radiant-slab system and offsets potential energy savings. Installed EPS insulation significantly reduces the heat sink effect and allows the system to react more efficiently and accurately to temperature shifts.

Because of its superior insulating properties EPS enables the slab to reach a desired temperature quicker; resulting in greater control of the room temperature. A Canadian study conducted by Dr. John Straube documented the amount of the energy savings from insulated, hydronically heated slabs and found that heat loss can be reduced by as much as 46% if insulated with 2" R8 EPS.

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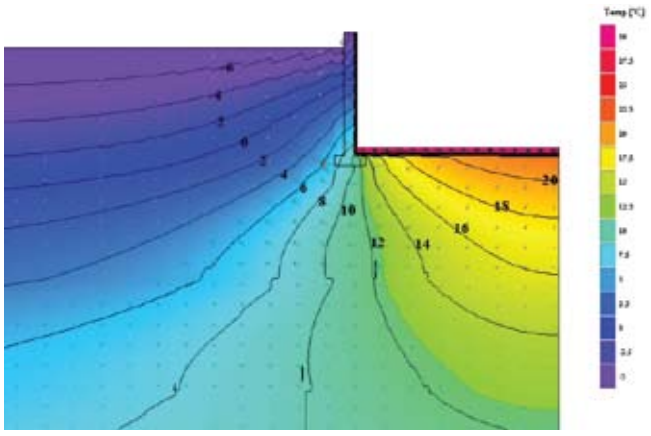
Radiant floor heating offers a number of advantages; it is more efficient than baseboard heating and usually more efficient than forced-air heating because no energy is lost through ducts. The lack of moving air can also be advantageous to people with severe allergies. Hydronic systems use little electricity, a benefit for homes off the power grid or in areas with high electricity prices. The hydronic systems can also be heated with a wide variety of energy sources, including standard gas, oil or wood-fired boilers, solar water heaters or some combination of these heat sources.

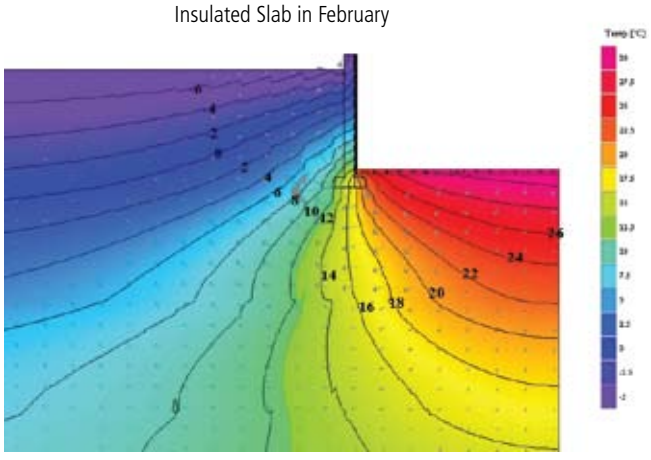
By far, the biggest selling point for radiant floor heating is comfort. The large radiant surface means that most of the heat will be delivered by radiation—heating occupants directly—rather than by convection. Warmer floor surfaces in a living space result in a higher mean radiant temperature to provide maximum comfort, typically six to eight degrees below a normal thermostat setting. EPS insulation keeps the floor warm, allowing occupants to walk around barefoot even in winter. Radiant floor heating is extremely quiet, an important feature in high-rise buildings where acoustics are an issue. And because they are "invisible" these systems allow for flexible furniture layouts. EPS insulation allows occupants to enjoy maximum comfort.

EPS Radiant Floor Heat Featured on This Old House

When the Favat family of Weston, MA outgrew their 1970's Cape Cod house but not their neighborhood, This Old House stepped in to help them build their dream home, a 3,800 sq. ft. timber-framed barn that combines rustic and modern elements. The Favat's old house was carefully deconstructed so that 85% of the materials could be salvaged for reuse; many in a nearby Habitat for Humanity project. What makes this TOH project unique is that the new home was constructed with modular panels and finished within a matter of weeks. And, it employed a number of green elements, including radiant floor heat with EPS insulation, supplemental solar power and a rain garden to protect nearby wetlands. EPSMA member Concrete Block Insulating Systems Inc. (CBIS Inc.) of West Brookfield, Massachusetts manufactured the EPS insulation for the Crete-Heat, LLC floor panel system, who donated the floor panels. Jeff Nickerson, president of CBIS, assisted with the installation of the panels alongside members of TOH.



Insulated Slab in February



Uninsulated Slab in February

ICF House

Featured on Extreme Makeover: Home Edition

The ABC television program, Extreme Makeover: Home Edition, the show that radically rebuilds homes for families in need, featured its first "green" home built for the Vitale Family of Athens, Vermont last fall. This highly energy-efficient and handicapped accessible home was built in just days using expanded polystyrene insulating concrete forms (ICFs).

As in all episodes of Extreme Makeover: Home Edition, the rebuilding is completed in four days, including interior design and landscaping. A team of contractors, designers and several hundred workers and volunteers swarmed the site to complete the spacious 2,900 sq. ft. home in under a week.

ICFs are lightweight, hollow EPS foam blocks connected by plastic or steel ties and held in place with concrete that's poured into the space between the foam panels to form a thermally insulated wall. The EPS panels remain in place to provide permanent, highly insulated walls which contributes to the home's comfort and energy efficiency. The ICF installation process saves manpower time and costs and reduces worker injuries. In addition to superior insulation, ICF walls provide safety, strength and significant noise reduction. Expanded polystyrene ICFs contain no CFCs, formaldehyde, asbestos or fiberglass, nor is there any degree of "off-gassing" or the accompanying loss of R-value. Their design flexibility allows contractors to build curved walls and custom angles without worrying about structural load considerations.

Photography courtesy of CBIS, Inc.

The first job was demolishing the existing hunting shack, clearing the debris and digging the hole for the frost wall. A high-performance, under-slab vapor barrier provided protection against water-vapor migration from the soil into the concrete slab and crawlspaces. As soon as the slab and footer forms were in place, crews poured the concrete mixture into the forms. The building team used an accelerator to ensure the concrete would cure in four hours.

One side of the slab was still being poured as the ICF crew set the vertical rebar for the wall. Volunteers handed rebar and ICFs forms down to ICF installers. As the ICF installers worked, framers were on the slab erecting floor supports. The ICF crew started building exterior walls while framers worked on first floor interior walls, HVAC crews and plumbers installed ducts, the mechanicals and under-floor plumbing.

Although the ICFs are a "behind the scenes" element of the Vitale Home, they are an integral part of the energy efficient, healthy home. The use of ICFs on both foundation and walls was

The Vitale family had been living in a dilapidated hunting shack, not a good environment for their two children especially their two-year-old son who suffers from ongoing health issues. Their new home will provide years of worry-free comfort allowing them to provide the care needed by their young family. EPSMA congratulates Extreme Makeover: Home Edition for another outstanding job.

Below Grade In-Situ Research

Proven Performance Under Tough Conditions

A joint research project on exterior insulation basement systems (EIBS) conducted by the National Research Council of Canada/Institute for Research in Construction (NRC-IRC) and the Expanded Polystyrene Association of Canada (EPAC) in 1995 uncovered new information on how to test key performance characteristics of foam insulation in below grade applications.

The joint NRC and EPAC research project evaluated the performance of EPS insulation in an exterior below-grade application. Measurements of moisture content after long-term exposure in below-grade applications confirms the thermal performance of EPS exterior foundation insulation. EPS insulation was attached to the foundation wall exterior that was exposed to soil backfill for 30 months. The moisture content of the EPS insulation samples removed after this length of exposure was in the range of 0.01 percent to 0.96 percent by volume. The project also instrumented and monitored specimen thermal performance, site weather conditions and soil moisture content.

Thorough analysis detected water at the form's outer surface during periods of heavy rain and major thaws, however, the concrete basement wall surface showed no evidence of water penetration through most of its height. The thermal performance of EPS was found to remain stable and was largely unaffected by water movement.

EPS durability was also measured as part of the research project. The in-situ thermal performance of the insulation was monitored continuously over the 30-month exposure period and found to be constant. Thermal and mechanical properties of material samples tested after removal were also unchanged.

Test Parameters & Results

1. The EPS insulation was directly exposed to high moisture content soil conditions, yet the moisture content in the foam insulation after the two-year exposure period was found to be less than 0.5 percent by volume on average.
2. The in-situ thermal performance of the EPS insulation was monitored over the two-year exposure period and found to remain constant (i.e. there was no loss in thermal resistance).
3. Samples taken from the field exposure underwent laboratory testing to confirm thermal performance and durability. Test results indicated there was no change in material properties after the two-year period.
4. The research project included development of a durability test protocol to provide a means of assessing performance of all insulation types subjected to extreme thermal gradient and environmental cycling.

Testing conducted as part of the NRC/EPAC project confirmed the method provided valid comparative ratings for the products tested versus field performance. The draft protocol served as the basis of a formal test protocol developed within ASTM International. C1512-07, Standard Test Method for Characterizing the Effect of Exposure to Environmental Cycling on Thermal Performance of Insulation Products is now recognized as an effective means to evaluate the ability of insulation products to maintain its thermal performance and other critical physical properties.

Measurements of moisture content after long-term exposure in below-grade applications confirm the performance of EPS insulation. Numerous published reports demonstrate water absorption by EPS insulation exposed in actual applications over extended periods of time is much less than values indicated by short term, exaggerated laboratory tests.

The EPS Molders Association has released two new technical bulletins, *EPS Insulation: Freeze-Thaw Cycling Tests Show No Loss of R-Value or Strength* and *EPS Insulation: Below Grade Testing Confirms R-Value Retention*. Contact our office to request copies.

estimated to reduce heating costs by 30 percent, a significant consideration for a New England home. The Vitale Home was Energy Star rated, it surpassed the builders expectations by achieving the highest available rating. The U.S. Department of Housing and Urban Development and the Partnership for Advancing Technology in Housing (PATH–www.pathnet.org) recognized ICFs as one of the Top Ten building technologies in 2006. The PATH toolbase website contains a section on ICFs. Not only does an ICF home help reduce the utility costs, but it may actually help generate some income. The Gainesville-based International Carbon Bank and Exchange calculated the amount of carbon emissions saved by a project home of the University of Florida, and paid $86 for 8.6 metric tons of carbon emission credits to the homeowner.

In addition to the ICF walls and foundations, the "green" Vitale home has state-of-the-art windows, low-flow toilets, sinks and showers, Vermont lumber, green-certified hardwood floors, Vermont slate, passive-solar heating, solar hot water and energy efficient appliances. EPS foam insulation can contribute toward green building recognition in a variety of point or credit categories including energy efficiency, recycled content, localized distribution, indoor air quality, sustainable sites and innovation.

EPSMA member Concrete Block Insulating Systems Inc. (CBIS Inc.) of West Brookfield, Massachusetts provided the ICFs for BuildBlock Building Systems LLC of Oklahoma City, who donated and oversaw the installation of the ICFs for the Vermont project. Jeff Nickerson, president of CBIS traveled to the remote job site and volunteered as part of the construction crew.

For more information, go to ABC's site: http://abc.go.com/primetime/xtremehome.

EPS Member Companies

AFM Corporation
Alamo Foam, A Division of HFP
American Polysteel, LLC
Arvron, Inc.
ARXX Corporation
BASF Corporation
Beaver Plastics Ltd.
Big Sky Insulations, Inc.
Cellofoam North America, Inc.
Comel S.N.C. Di Aldo Beccarao & C.
Concrete Block Insulating Systems, Inc.
Createc Corporation
Demand Products, Inc.
DiversiFoam Products
Drew Foam Companies, Inc.
EFP Corporation
Epsilon Holdings, LLC
Emmedue S.p.A.
Falcon Foam, A Division of Atlas Roofing
Flint Hills Resources, LP
Fox Blocks
Georgia Foam, Inc.
Groupe Isolofoam
Hendren Plastics, Inc.
HIRSCH USA
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Le Groupe LegerLite, Inc.
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Ship & Shore Environmental
StyroChem
Styro-Tek of Alabama, A Division of
Superior Metal Products Co., Inc.
The PCF Group
Therma Foam, LLC.
Thermal Foams, Inc.
Tri State Foam Products, Inc.
TRUEFOAM Limited
XYCorp, Inc.

EPS: Not Just Insulation

As more homeowners, builders and architects specify green building materials an innovative interior molding made from recycled EPS is receiving kudos. Timbron International produces a trim product that acts like mill wood but is made from 90% recycled polystyrene, 75% of which comes from post-consumer sources. Consumers now have the ability to purchase premium grade interior moldings that are environmentally intelligent. Timbron's moldings contribute to various green building rating systems, including LEED.

Timbron International has a proprietary process that extrudes a product with the same density as a soft wood. The recycled–material molding is designed for use as trim in kitchens, bathrooms, laundry rooms and basements. Its hardened exterior skin and soft cellular core can be cut, nailed, glued, sanded and painted, just like wood trim. The waterproof, mold, mildew and termite resistant properties of Timbron moldings make it the ideal addition to 'wet areas'; such as a bathroom, kitchen, laundry room or basement.

In 2006 Timbron was awarded one of the Top-10 Green Building Products by BuildingGreen, Inc., publisher of the GreenSpec® Directory and Environmental Building News™. In 2007, they received the Social Sustainability Earth Day Award for leading the way in corporate, social, and environmental responsibility.

Over the past several years Timbron has collected well over 50 million pounds of waste polystyrene. Their scope of collection includes a wide range of waste polystyrene such as electronic packaging, fish boxes, yogurt cups, CD cases, polystyrene food containers, colored cups, melt paddies, purges and regrind. Timbron works with municipal governments, computer, furniture and electronic manufacturers as a source of waste polystyrene. Timbron works with EPSMA members to source waste EPS for its closed-loop recycling process.

For further information visit www.timbron.com or view a brief Discovery channel segment at www.timbron.com/PlanetGreen.wmv. For information on EPS recycling go to the Alliance of Foam Packaging Recyclers at www.epspackaging.org.

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