# Could ‘Nanowood’ Replace Styrofoam?

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Expanded polystyrene is commonly referred to as “Styrofoam.” It is an excellent **insulator**. That’s why it’s a popular material for **insulating** buildings. It is also why those cheap little cups of deli coffee still burn your tongue after 30 minutes. But its environmental record leaves something to be desired because it’s nonbiodegradable. This makes it harmful to animals who accidentally eat it. And it is made from potential carcinogens.

Researchers at the University of Maryland have developed an **alternative**. It is a super-lightweight insulating **material**. They say it could prove to be better and more eco-friendly. The material is made from tiny wood **fibers** and is called *nanowood*. It blocks heat at least 10 degrees better than Styrofoam or silica aerogel. Silica aerogel is a common insulator. And nanowood can take at least 30 times more pressure before being crushed.

Tian Li is the lead author of the study that was published in the journal *Science Advances*. Tian Li is a postdoctoral researcher who works in the lab of materials scientist Liangbing Hu. “To the best of our knowledge, the strength of our nanowood represents the highest value among available super insulating materials.” This is according to the study authors.

Hu and his team had been working on nanocellulose. This is the nano-sized versions of the fibrous material that makes plants and trees **rigid**. Nanocellulose has an impressive strength-to-weight ratio - about eight times greater than that of steel.

Lignin is the **polymer** that holds the cellulose of wood together. Lignin is a heat conductor. For the nanowood, the team removed the lignin. Removing the lignin gave the resulting product powerful insulating capabilities and turned the product white, meaning it reflects light.

The researchers think nanowood has enormous **potential** as a green building material. Using it could potentially “save billions” in energy costs says Li. In addition to using it where traditional insulators like Styrofoam are used, thin strips of nanowood can be rolled and shaped to insulate the insides of pipes or other curved spaces. And unlike glass or wool insulators, nanowood doesn’t irritate lungs or cause allergic reactions.

“What I find impressive about nanowood, as described in the paper, is that the treatment process that the authors developed allows them to keep key features of wood—particularly its hierarchical structure across length scales from nano to macro, while dramatically altering other key properties, particularly thermal conductivity and optical reflectivity,” says Mark Swihart. He is a professor of chemical and biological engineering at the University at Buffalo who studies nanomaterials.

Synthetically recreating the hierarchical structures of natural materials like wood is extremely difficult, Swihart says, but the University of Maryland process seems to be simpler and more scalable than most

methods of producing nanostructured materials. Swihart thinks nanowood may one day be a useful material on the commercial market, but it may be a while.

“For the foreseeable future, the material is inherently going to be more expensive than alternatives already produced at large scale, such as various types of foam board,” he says. “Even though it may outperform those **alternatives**, if it performs the same basic function, then entering the market will be very challenging.”

The University of Maryland team is more **optimistic** about nanowood’s near-term potential. They say the material can be produced fairly cheaply and quickly using fast-growing trees like balsa. The team is currently working on commercial applications and expect a product to be available in a year or so.