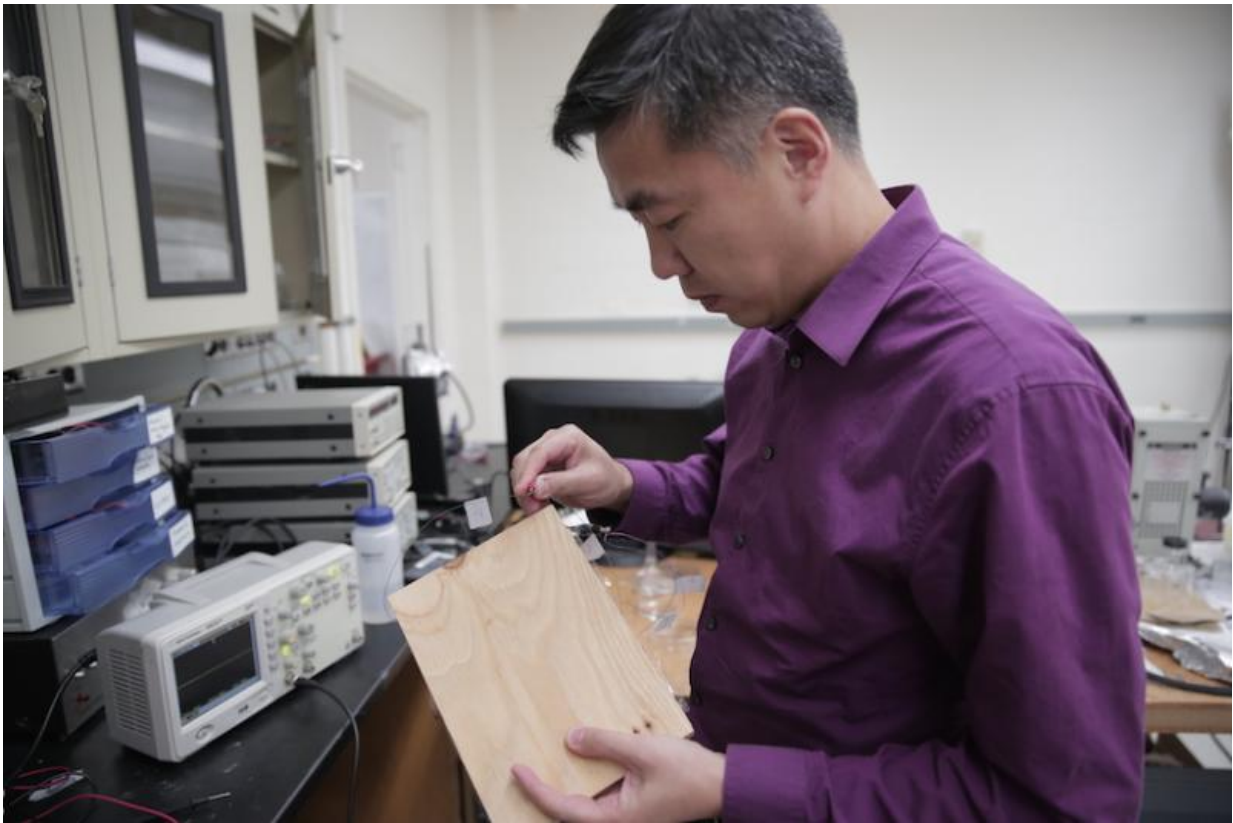


The next big renewable energy source could be right beneath your feet

October 20 2016, by Will Cushman



Credit: University of Wisconsin-Madison

Flooring can be made from any number of sustainable materials, making it an eco-friendly option in homes and businesses alike.

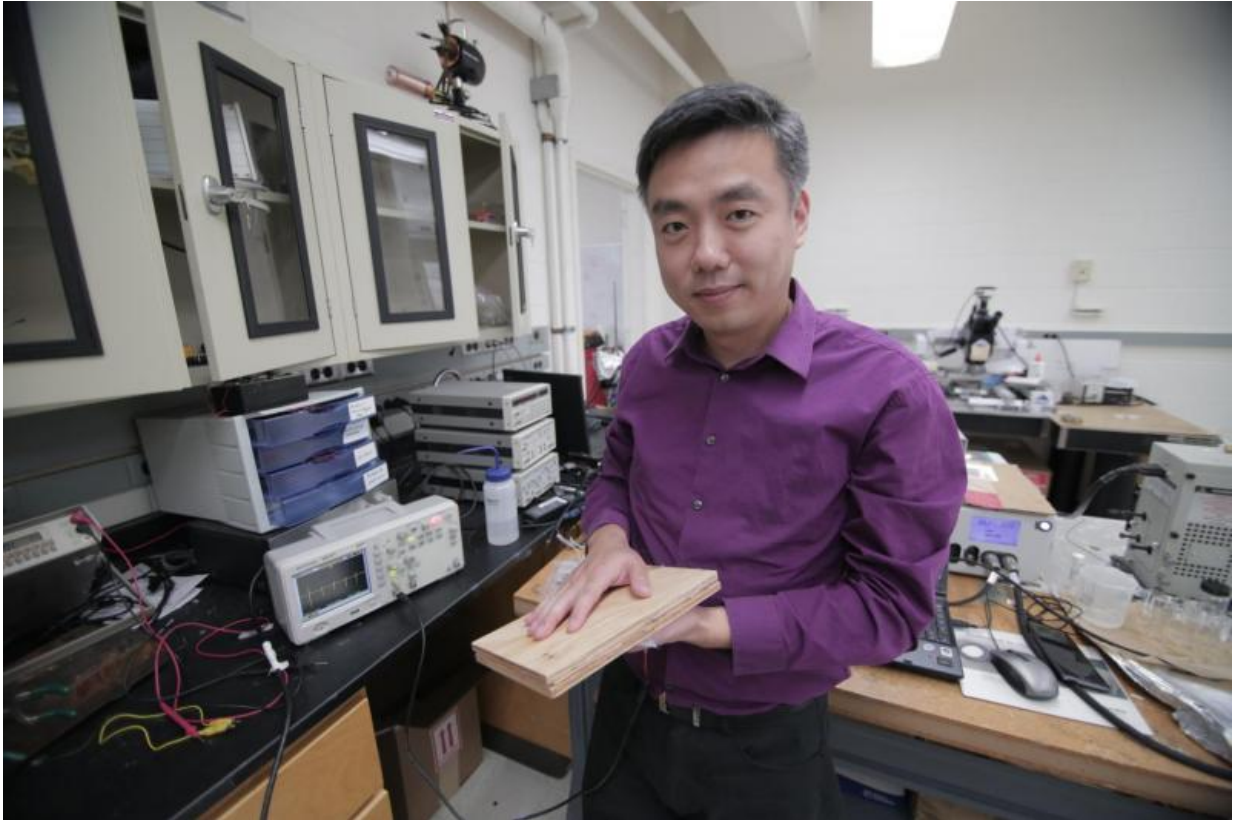
Now, however, flooring could be even more "green," thanks to an inexpensive, simple method developed by University of Wisconsin-Madison materials engineers that allows them to convert footsteps on the flooring into usable electricity.

Xudong Wang, an associate professor of materials science and engineering at UW-Madison, his graduate student Chunhua Yao and their collaborators published details of the advance on Sept. 24, 2016, in the journal *Nano Energy*.

The method puts to good use a common waste material: wood pulp. The pulp, which is already a common component of flooring, is partly made of cellulose nanofibers. They're tiny fibers that when chemically treated produce an electrical charge when they come into contact with untreated nano fibers. When the nano fibers are embedded within flooring, they're able to produce electricity that can be harnessed to power lights or charge batteries. And because wood pulp is a cheap, abundant and renewable waste product of several industries, flooring that incorporates the new technology could be as affordable as conventional materials.

While there are existing similar materials for harnessing footstep energy, they're costly, non-recyclable and impractical at a large scale.

Wang's research centers around using vibration to generate electricity. For years, he has been testing different materials in an effort to maximize the merits of a technology called a triboelectric nanogenerator (TENG). Triboelectricity is the same phenomenon that produces static electricity on clothing. Chemically treated cellulose nanofibers are a simple, low-cost and effective alternative for harnessing this broadly-existing mechanical energy source, Wang says.



Associate Professor Xudong Wang holds a prototype of the researchers' energy harvesting technology, which uses wood pulp and exploits nano fibers. The technology could be incorporated into flooring and convert footsteps on the flooring into usable electricity. Credit: Stephanie Precourt

The UW-Madison team's breakthrough is the latest advance in a green energy research field called "roadside energy harvesting" that could, in some settings, rival solar power—and it doesn't depend on fair weather. Researchers like Wang who study roadside energy harvesting methods see the ground as holding great renewable energy potential well beyond its limited fossil fuel reserves.

"Roadside energy harvesting requires thinking about the places where there is abundant energy we could be harvesting," Wang says. "We've

been working a lot on harvesting energy from human activities. One way is to build something to put on people, and another way is to build something that has constant access to people. The ground is the most-used place."

Heavy traffic floors in hallways and places like stadiums and malls that incorporate the technology could produce significant amounts of energy, Wang says. Each functional portion inside such flooring has two differently charged materials—including the cellulose nano fibers, and would be a millimeter or less thick. The floor could include several layers of the functional unit for higher energy output.

"So once we put these two materials together, electrons move from one to another based on their different electron affinity," Wang says.

The electron transfer creates a charge imbalance that naturally wants to right itself; but as the electrons return, they pass through an external circuit. The energy that process creates is the end result of TENGs.

Wang says the TENG technology could be easily incorporated into all kinds of flooring once it's ready for the market. Wang is now optimizing the technology, and he hopes to build an educational prototype in a high-profile spot on the UW-Madison campus where he can demonstrate the concept. He already knows it would be cheap and durable.

"Our initial test in our lab shows that it works for millions of cycles without any problem," Wang says. "We haven't converted those numbers into year of life for a floor yet, but I think with appropriate design it can definitely outlast the floor itself."

More information: Chunhua Yao et al. Triboelectric nanogenerators and power-boards from cellulose nanofibrils and recycled materials, *Nano Energy* (2016). [DOI: 10.1016/j.nanoen.2016.09.036](https://doi.org/10.1016/j.nanoen.2016.09.036)

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