“Green” Triboelectric Power Boards Turn Footsteps into Electricity and More

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a new class of triboelectric nanogenerator (TENG) energy harvesting devices that are made from renewable cellulose and/or wood fibers and as affordable as conventional materials.

Overview

Mechanical energy takes many forms in the environment, from ambient vibrations to individual footsteps. It represents a sustainable and largely untapped energy source that could be harnessed to power portable electronics, among many other applications.

To achieve this, a new technology called the triboelectric nanogenerator (TENG) was recently developed to turn mechanical energy into useful electric current. TENGs are relatively lightweight, efficient and easy to manufacture. They are made of positive and negative triboelectric layers that transfer charge upon contact. Commonly used materials include various synthetic polymers (e.g., PVDF, PDMS, PET).

The Invention

UW–Madison researchers have developed the first TENG device built entirely from biodegradable and green materials. The two active layers comprise cellulose nanofibrils (CNFs) or wood fibers chemically treated to alter their electron affinity. CNFs and wood fibers are ideal because they have high surface areas, can be functionalized with a variety of chemical groups and can be formed into flexible and optically transparent films.

Applications

- The new TENGs can be used to drive small electronics, charge batteries and capacitors, be integrated into wearable electronics, flooring, packaging and more.

Key Benefits

- Cost and performance on par with conventional materials
- Cellulose and wood fibers are abundant, cheap and derived from renewable sources (wood pulp).
- Small, flexible and lightweight design

Stage of Development

The new CNF-based TENG device exhibits comparable performance to those made from synthetic polymers. It has been integrated with fiberboard made from recycled cardboard, creating a power board with high electric outputs using eco-friendly wood-extracted materials. Specifically, it produced electric outputs up to ~30 V and ~90 µA when subjected to a normal human step, and was capable of lighting up to 35 LEDs.

The development of this technology was supported by WARF Accelerator. WARF Accelerator selects WARF's most commercially promising technologies and provides expert assistance and funding to enable achievement of commercially significant milestones. WARF believes that these technologies are especially attractive opportunities for licensing.

Additional Information

For More Information About the Inventors

- Xudong Wang

Publications

- Read a news story about this technology

Tech Fields

- Clean Technology : Energy storage, delivery & resource efficiencies

For current licensing status, please contact Michael Carey at mcarey@warf.org or 608-960-9867