Fraunhofer USA

FRAUNHOFER USA CENTER FOR SUSTAINABLE ENERGY SYSTEMS CSE

# PRESS RELEASE



## What materials are future buildings made of?

### Fraunhofer USA exhibits new generation of building materials at BAU 2019

**Fire, cold, heat, water, ice - building materials have to withstand a variety of different conditions while also contributing to a healthy living environment. In addition, the materials themselves - and the manufacturing processes required to make them - should be efficient and sustainable. The Boston-based Fraunhofer USA Center for Sustainable Energy Systems CSE exhibits a new generation of insulation and thermal storage materials at BAU in Munich from January 14 to January 19, 2019, Hall C2, Booth 528.**

#### New generation of non-corrosive phenolic foams for building insulation

When phenolic foam was first used in North American buildings, it was acidic with a pH level of below 3.0. This led to a series of building collapses in the 1980s, caused by the corrosion of metal roofs. Fraunhofer CSE, together with Lodz University of Technology, Poland, continued the development of a new type of non-corrosive phenolic foam, further developing non-corrosive catalysts and increasing the pH level. This project is a continuation of the U.S. Department of Energy-funded project "Bio-Based, Low Acidic Phenolic Foam."

**Phenolic foam test hut on the rooftop of Fraunhofer CSE's Boston office building. © Fraunhofer USA Center for Sustainable Energy Systems CSE**

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## Nanoporous wood-based composite

Engineered wood products (EWP), such as plywood, oriented strand boards (OSB), and particleboards, are common sheathing materials used by North American builders. Their advantages are excellent mechanical strength, nailability, fastener-holding capacity, relatively low weight, low cost, workability and easy installation. However, the engineered wood products are as thermally conductive as wood and offer a nominal thermal conductivity of only around 0.15 W/m-K. Fraunhofer CSE and Virginia Commonwealth University (VCU) are developing a nanoengineered wood-based composite (NWC) board that will offer enhanced thermal insulation compared to conventional EWPs, while meeting the code compliance for structural performance. NWC will be flame-resistive, nailable, and exhibit a thermal conductivity of around 0.05 W/m-K - three times lower than wood. NWC board will weigh as much as a similar sized OSB board to be able to meet the handling requirement at construction sites. The proposed board products will find applications as a wall sheathing and floor and roof decking in residential and small commercial wood-framed buildings. This project is funded by Fraunhofer USA.

## Nanoporous PIR-based thermal insulation

Fraunhofer CSE and partner Virginia Commonwealth University (VCU) are developing a new polyisocyanurate (PIR)-based aerogel insulation that is better, more affordable, and more robust than a conventional PIR foam. The project team uses a new low-capital intensive freeze-drying method to remove pore-filling solvents in the foam. Due to its nanoporous and open-cell structure as well as the lack of a blowing agent, the improved PIR-based aerogel foam will age less than conventional PIR foam. The target thermal conductivity is 0.012 W/m-K, almost half of a conventional PIR foam. This project is funded by the U.S. Department of Energy.

## Transparent aerogel for window applications

For the Advanced Research Project Agency- Energy's (ARPA-E) Single-Pane Highly Insulating Efficient Lucid Design (SHIELD) program, Fraunhofer CSE, in collaboration with Virginia Commonwealth University (VCU) and Missouri University of Science and Technology (Missouri S&T), is developing highly performing aerogel-based window panes. Aerogels are highly nanoporous materials that exhibit thermal conductivity as low as 0.015 W/m-K. Aerogels have several challenges as a window pane:

- Mechanical fragility,
- High production cost due to use of supercritical drying method in its chemistry, which is capital intensive and poses liability issues,
- Low optical transparency.

The project partners are modifying the chemistry and processing of silica aerogels to reduce the cost of their production and increase their transparency for use in window retrofits. The team has been investigating crosslinking of aerogels to produce stronger aerogels that are more durable.

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