

# Thermal Energy Modulating Cement Materials (Mortars) for Efficient Floor and Other Applications (2024-019)

Novel cement (mortar) material for thermal energy management by unidirectionally controlling heat flow in floors and walls.

## Market Overview

Thermal energy loss from heated floors, houses, and other enclosures costs millions of dollars in energy bills, carbon emissions, and global warming. More than half of floor heating is wasted due to cement materials (mortars) used in subfloors' inability to direct energy toward the directions that need energy dissipation. For instance, during colder weather and winter in northern regions of the US and Canada, millions of houses and buildings lose heat energy due to poor insulation and mortars used for those constructions. Our ceramic-cement-oxide mixed mortar presents a unique solution as it conserves energy and efficiently transfers thermal energy towards heating flooring unidirectionally. The material prevents more than 90% energy loss compared to traditional mortar materials, gypsum, or other insulation materials. In addition, the same materials that can be applied as insulators could also be used to reduce excess heat from outside, such as Arizona or the Middle East, to keep houses cooler during hot weather and expand the invention's market potential.

## Technical Summary

The novel invention was developed by combining ceramic-cement-oxides. This material has also been tested for industry required functional properties and it preforms the same or better than any North American standards. The testing approach is twofold: demonstrating lab scale works and using AI to support why the mortar is unique and works for previously mentioned applications. As the new ceramic-cement-oxide mixed mortar passes all necessary tests and provides better heat management, this new material presents a unique advantage in comparison to traditional mortar.

### Application

Flooring, insulation, building heat management

### Development Stage

TRL 5

### Advantages

- Novel material which prevents more than 90% energy loss compared to traditional insulation materials.
- Save energy costs in both cold and hot conditions.
- Unidirectionally heats floors from any heated source.
- Preforms the same or better than any North American standards for mortar.

## About the Inventors



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Dr. M.Z. Naser received his Ph.D. from Michigan State University. He is a tenure-track professor at the School of Civil and Environmental Engineering and a member of the Artificial Intelligence Research Institute for Science and Engineering (AIRISE) at Clemson University. He also serves as the chair of the ASCE Advances in Technology committee and is among the top 2% of highly cited scientists worldwide, according to the Elsevier-Stanford 2022 study.

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