Insulating Wood Panels for Energy Efficient Wall Retrofits

Amy Gong, Jiaqi Dai, Josh Cable, Liza Pikus, Soo-Hwan Jang, *InventWood, College Park, MD*
Contact: info@inventwood.com
Web: www.inventwood.com

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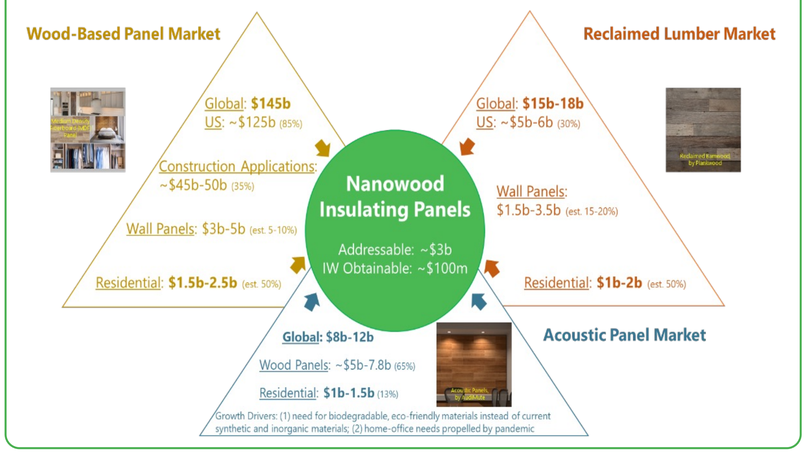
Abstract

Wood is one of good materials for wall planks. However, current wood wall planks are generally sold and installed purely for aesthetic purpose not thermally-insulative purpose. Herein, we propose and developed a nanowood for thermally-insulative wall planks. Furthermore, we tested nanowood's ability to hold various surface coatings such as paints and functional coatings for aesthetic and practical purposes. We envision that our nanowood can have great applications to wood wall planks.

Market Opportunity

Nanowood aims at three different market segments:

1. Wood-Based Panel Market
2. Reclaimed Lumber Market
3. Acoustic Panel Market



Methods

Wood Preparation
- Visual Inspection

Chemical Treatment
- Presoaking
- Delignification
- Bleaching

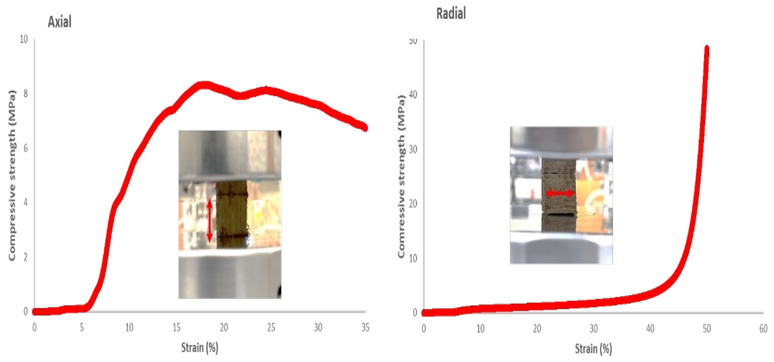
Drying
- Freeze Drying

Quality Assurance
- Visual Inspection
- Final Finishing

Results

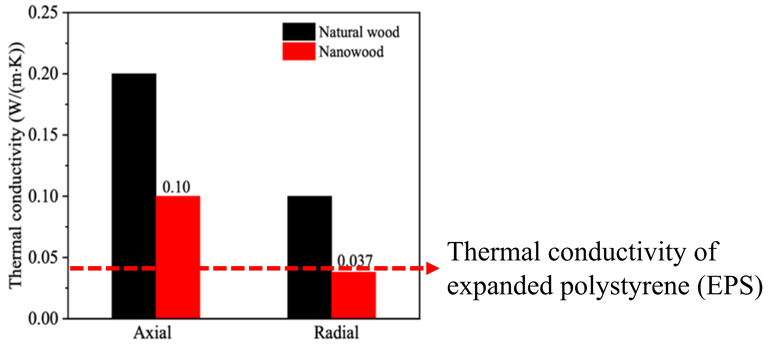
Mechanical Strength Evaluation:

The compressive strength of the nanowood panels (over 20 specimens) is up to 8.3MPa in axial and 48.4 MPa in radial direction.



Thermal Conductivity Evaluation:

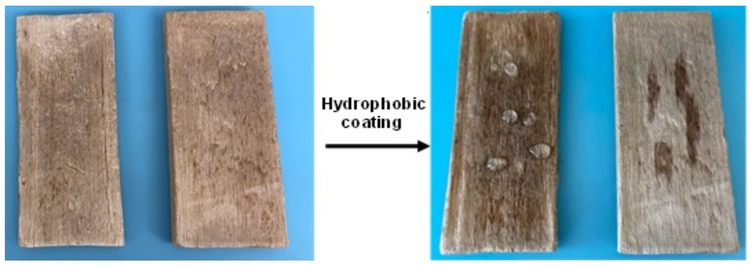
Nanowood exhibits a low thermal conductivity of ~0.037W/(m·K) in radial direction. One of representative commercial insulation panels is expanded polystyrene (EPS) and its thermal conductivity is 0.037W/(m·K)[7].



Surface Coating and Glue Jointing:

- The paint stability of nanowood panels was demonstrated by directly applying commercial six different color oil-based paints. After exposed to sunlight for over 30 days. no color-changing or paint-peeling was visible.

- ~200μm of hydrophobic coating layer (commercial clear acrylic coating) was applied on the nanowood panels. It shows high compatibility between nanowood and acrylic coating.



- Glue compatibility was tested with PVA-based wood glues and was verified nanowood tiles can be jointed strongly to form large-scale. A large nanowod panel was fabricated with a size up to 42in × 96in (W×L)

Conclusion

Based on the various tests from mechanical strength, through thermal conductivity, to surface coatings, we verified that nanowood is a good candidate for wood wall planks bridging the gap between decorative and insulative wall planks.

References

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