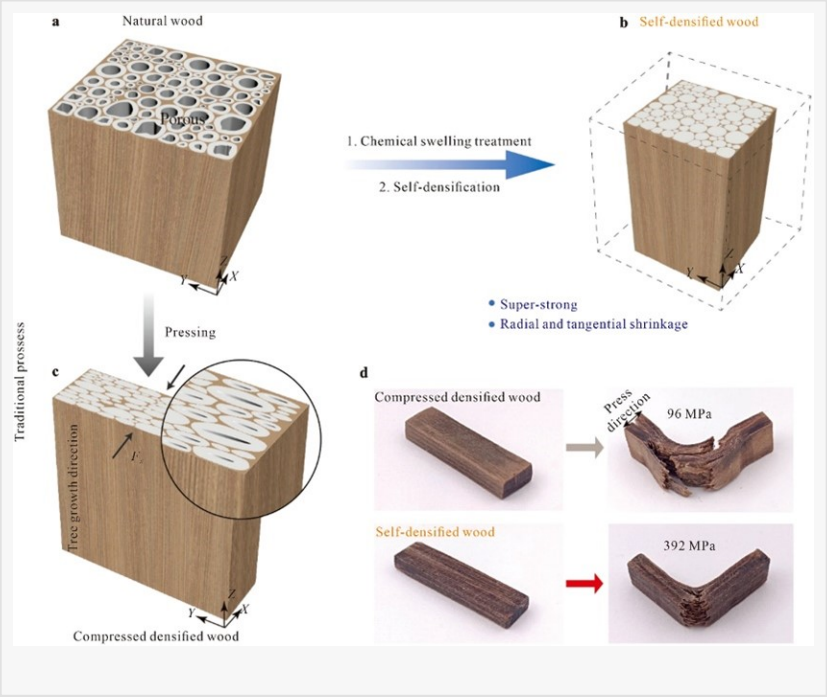
Self-Densified Super-Strong Wood: A Sustainable Alternative to Traditional Structural Materials

Innovative Wood Processing Technique Yields High-Strength, Lightweight Material



NANJING, CHINA, March 25, 2025 /EINPresswire.com/ -- Wood, a traditional and sustainable structural material, has long been used in construction and furniture due to its availability and mechanical properties. However, natural wood's strength is often insufficient for advanced engineering applications. Now, researchers from Nanjing University have developed a novel self-densification strategy to create super-strong wood that could replace metals and alloys.

The team, led by Dafang Huang and Jie Li, used a combination of partial delignification and a LiCl/DMAc swelling process to release and reorganize wood fibers. This method allows the fibers to move inward and fill the cell lumen, followed by air-drying to achieve self-densification. Unlike traditional compressed wood, which relies on unidirectional compression, this self-densified wood exhibits uniform shrinkage in the transverse area, maintaining its longitudinal dimension.

The resulting self-densified wood demonstrates exceptional mechanical properties. It achieves an ultra-high tensile strength of 496.1 MPa, flexural strength of 392.7 MPa, and impact toughness of 75.2 kJ/m², significantly surpassing natural wood and traditional compressed wood. The self-densified wood also exhibits uniform mechanical properties in all directions, making it suitable for complex mechanical environments.

The study's innovation lies in its ability to enhance wood's mechanical properties without the need for hot pressing. This method not only improves the material's strength and toughness but also maintains its lightweight nature. The self-densified wood's uniform microstructure and enhanced hydrogen bonding between cellulose fibers contribute to its superior performance.

The potential applications of this super-strong wood are vast. It could serve as a sustainable alternative to traditional structural materials in construction, furniture, and other industries. The researchers also demonstrated the material's versatility by fabricating a wooden nail that outperformed steel nails in load-bearing tests.

This breakthrough in wood processing offers a sustainable solution to the growing demand for high-performance materials, addressing environmental concerns and resource limitations. The self-densified wood's remarkable properties make it a promising candidate for replacing traditional metals and alloys in various applications.

See the article:

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