

# Super Bamboo – Sustainable Structural Bamboo Materials with High Strength and Multi-function

## Manufacturing

Buildings and Construction Technology

Nanotechnology and New Materials

### I. TRADITIONAL BAMBOO TREATMENT

Department of Mechanical Engineering

#### Traditional bamboo treatment

After Regular hot pressing:

Current issue:

- Incomplete densification
- Initial microcrack

#### Remarks

1. Inventions Geneva Evaluation Days (IGED) 2021 - Gold Medal
2. 3rd Asia Exhibition of Innovations & Inventions Hong Kong (AEII) (2023) - Silver Award

#### IP Status

Patent granted



Technology Readiness Level (TRL) ?

5

Inventor(s)

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### II. STRATEGY TO PRODUCE NEW TYPE OF BAMBOO

Department of Mechanical Engineering

#### Strategy to produce new type of bamboo

Regular bamboo → Chemical treatment → Hot-pressing

(Remove lignin/hemicellulose) (densification process, reduction in thickness)

**“Super Bamboo”** (US patent application)

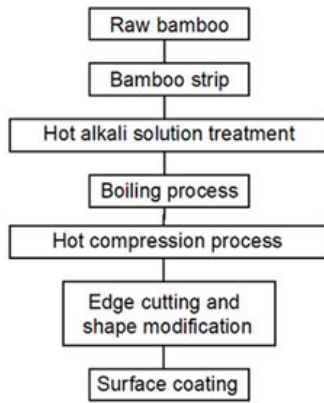
**Density (average):**  
718 Kg/m<sup>3</sup> → 1339 Kg/m<sup>3</sup>

**Thickness :**

7.29 mm	→	1.66 mm	(22.77%)
6.64 mm	→	1.64 mm	(24.70%)
8.43 mm	→	1.82 mm	(21.59%)
6.76 mm	→	1.64 mm	(24.26%)



### III. SUPER BAMBOO FABRICATION PROCEDURE



## “Super Bamboo”

ECO-FRIENDLY RENEWABLE  
100% BIODEGRADABLE  
SUPER FAST GROWING SPEED

### 1. BOILING PROCESS

STEPS TO “SUPER”

### 2. HOT PRESSING

PARTIAL REMOVAL OF LIGNIN AND HEMICELLULOSE

“Super” Offers:

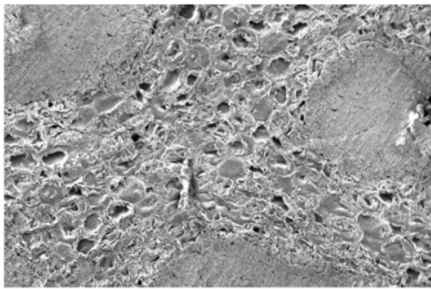
- Stronger Strength
- Better Stiffness
- Higher Toughness
- Greater Dimensional Stability

### CONSTRUCTION APPLICATIONS

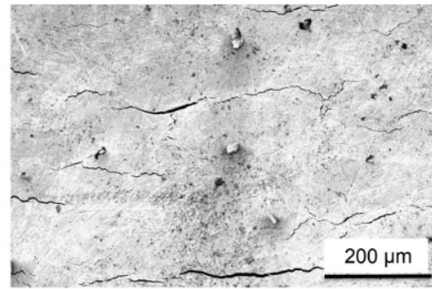


#### IV. SEM IMAGES OF NATURAL BAMBOO AND DENSIFIED BAMBOO

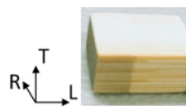
### SEM images in the RT plane



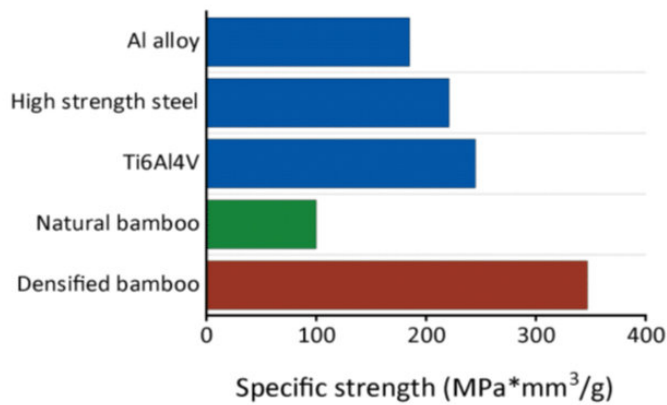
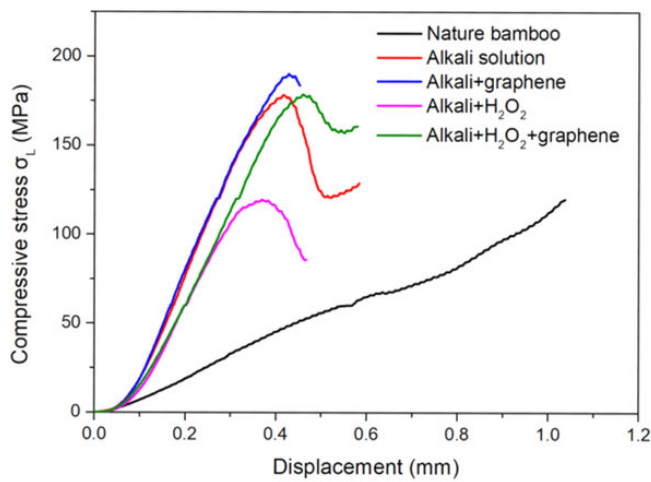
Nature bamboo sample



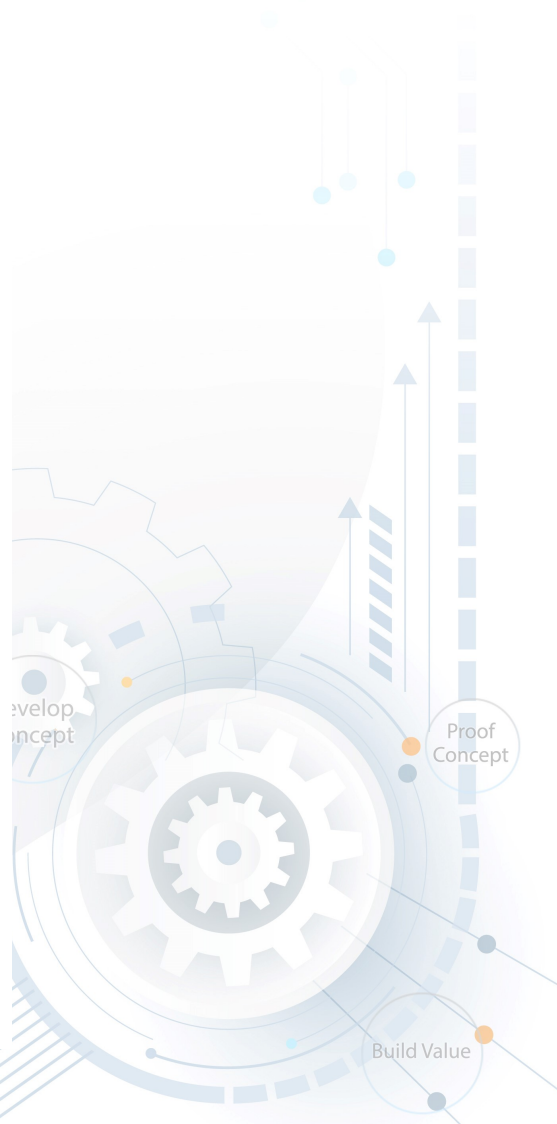
Densified bamboo



#### V. MECHANICAL PERFORMANCE OF SUPER BAMBOO



The specific strength of densified bamboo and other metal materials



## Opportunity

There has been an increasing interest in using sustainable material, such as wood and bamboo, to replace the current highly-polluted material, such as plastic and low carbon steel. In particular, natural culm bamboo has been used in scaffolding and corridor vaults. The mechanical performance of natural culm bamboo, however, is not strong enough to be widely used in building construction in general, limiting its applicability. How to design sustainable bamboo-based materials with satisfactory mechanical properties for construction applications is a long-standing challenge for both researchers and engineers in the field. As compared to the existing materials or products (metals/ wood and plastic composites) on the market, our bamboo-based prototypes have excellent mechanical properties. Because of its densified microstructure, this prototype also has the advantage of excellent service properties, including waterproof and fireproof properties.

## Technology

Our work aims to strengthen natural bamboo by optimizing its internal structures, by using chemical and mechanical treatment. We also aim to manufacture eco-friendly 'super bamboo' product with optimized performance. In this project, we will develop a novel bamboo-processing technique, including both mechanical and chemical treatments, to densify natural bamboo without destroying key internal structure critical for superior mechanical performance. We will apply our technique to design new bamboo-based materials, called "super bamboo", with excellent mechanical properties for wide applications. Its stiffness is above 5x of those of the untreated bamboo and its specific strength (strength-weight ratio) can be above 5x of that of low carbon steel.

## Advantages

- 100% eco-friendly, with no formaldehyde emission.
- Excellent mechanical properties.
- Good dimension stability.
- Excellent service properties, including excellent waterproof, fireproof and anti-moth-eaten property.

## Applications

- Application in replacing conventional wood, plastic, and low carbon steel.
- Load-bearing structure parts, such as the outdoor floor and interior floor/wall.
- Interior and exterior decoration as well as high-quality furniture.

