

Selected Properties Of Bamboo Scrimber Flooring Made Of India *Melocanna Baccifera*

Mingjie Guan^{1*} - *Cheng Yong*² - *Lu Wang*³ - *Qisheng Zhang*⁴

¹ Ph.D, Associate Professor, Bamboo Engineering and Research Center,
Nanjing Forestry University, Nanjing, Jiangsu, China

* *Corresponding author*

[*mingjieguan@hotmail.com*](mailto:mingjieguan@hotmail.com)

² Master Candidate, College of Wood Science and Technology, Nanjing
Forestry University, Nanjing, Jiangsu, China

[*yongcheng0520@hotmail.com*](mailto:yongcheng0520@hotmail.com)

³ Master Candidate, College of Wood Science and Technology, Nanjing
Forestry University, Nanjing, Jiangsu, China

[*nfuwanglu@hotmail.com*](mailto:nfuwanglu@hotmail.com)

⁴ Professor, Bamboo Engineering and Research Center, Nanjing Forestry
University, Nanjing, Jiangsu, China

[*Zhang-qs@njfu.com.cn*](mailto:Zhang-qs@njfu.com.cn)

Abstract

Melocanna baccifera (Muli) is difficult to be used for common flooring material for its small-diameter, thin culm wall. To understand technique feasibility to produce bamboo scrimber flooring from *Melocanna baccifera* rolled bundles, we produced three types of the bamboo scrimber flooring, that is, Muli-nature, Muli-carbonized, and Muli-mixed together and properties were tested and compared with those of Moso-nature. The results showed that Muli scrimber flooring had better performance than Moso-nature bamboo scrimber flooring in China. The order of MOR was Muli-nature>Muli-carbonized>Muli-Mixed>Moso-nature and MOE trend was similar. It is supposed that Muli bamboo can be processed into not only scrimber flooring to replace the high-value hardwood flooring, but also other special engineered composite with its high-strength.

Key words: bamboo, scrimber, flooring, rolled bundles

Introduction

Bamboo industry has developed many engineered bamboo based composites such as plybamboo, woven bamboo plywood, bamboo flooring and so on in the world (Liese W. 1987) , especially many bamboo-based engineered products with Moso bamboo in China (Qisheng Zhang et al. 2002). In recent two decades, bamboo scrimber has become popular as a new composite flooring with high density and hardness like hard wood such as teak and oak. Bamboo scrimber is also called recombination or reconstructed lumber in China (Qin.Li et al. 2000), “zephyr board ” in Japan (Naresworo Nugroho. Naoto Ando.2000, 2001) whose relevant researches emerged at the beginning of 1990’s, aiming at using the small-diameter bamboo culms as the raw material to make the reconstructed structure material by the method of wood scrimber (Hutchings BF, Leicester RH. 1988, Jordan BA .1989). By now, Moso bamboo scrimber has been a substitute for solid wood-based material in furniture industry in China with its good properties (Guan M.J and al. 2009, Zhang B.Y. 2008).

In northeast of India, there are so large natural forest of *Melocanna baccifera*(Muli bamboo) distributing in Mizoram, Tripura and other states. Muli bamboo is 3-5mm in thickness of culm wall and 4-8cm in diameter, much thinner than those of Moso bamboo in China. Therefore, it is difficult to be used for common bamboo flooring with strip as unit for its small-diameter and thin wall. Local farmer and government are eager to find a way to use Muli bamboo as raw material for industry product to benefit the local farmer and economy development.

Therefore, this research aims to study the technology feasibility of Muli bamboo being used as raw material of bamboo scrimber flooring by using Chinese Moso bamboo scrimber process and equipment to understand properties of Muli bamboo products totally.

Materials and Methods

Materials

Muli bamboo(*Melocanna baccifera*) sliver was processed in Tripura of India and transported into appointed testing factory in Zhejiang Province, China, cooperating with Bamboo Engineering and Research Center, Nanjing Forestry University.

Muli bamboo sliver : 9 ~ 15mm×2 ~ 3mm×2400mm(width×thickness×length) weight, 700kg; moisture content, 9-12%; bamboo age, 2-2.5 years. Half of Muli bamboo slivers were carbonized and dried together with nature slivers. Then slivers were processed by roll machine into net-like bundles and impregnated with phenol formaldehyde resin(solid content is about 23%) for 15min and drained. Then the glued muli bamboo bundles were dried to 12-15% moisture content to prepare for forming and hotpress.

The slivers were divided into three color, nature, carbonized, mixed(nature and carbonized. See Fig.1) to form three color board in 12mm×1.22m×2.2m.

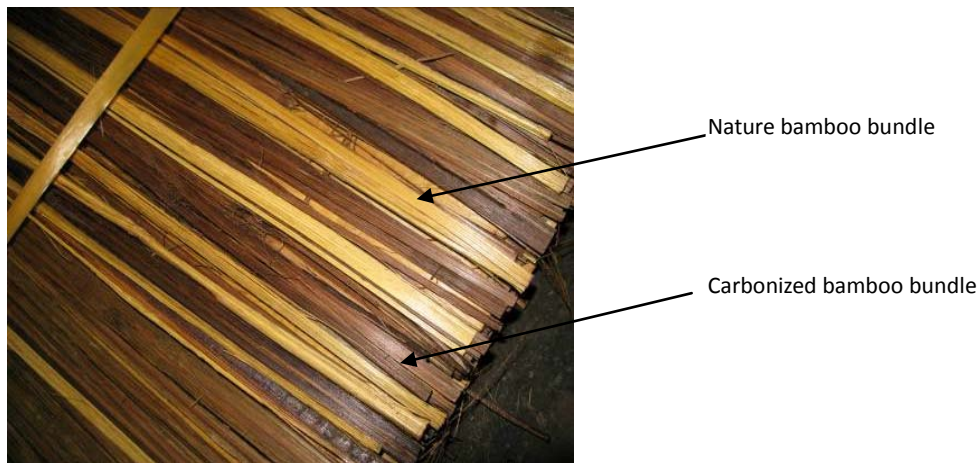


Fig1. Mixed color mat with nature and carbonized bamboo bundles

Hotpress parameters: Temperature, 135°C; Pressure, 60MPa; Press type, cold-hot-cold; Time, 20min. The boards were sawed into 12mm×100mm×2.2m and conditioned +for 21 day to balance the moisture and inner stress and then were processed into the flooring in size of 10mm×1.0m×96mm without paint on the surface by planing and sand machine.

Methods

Basic properties test

Test of Muli bamboo scrimber flooring was mainly based on the method of Chinese national standard, GB/T 17657—1999. The testing items included density, moisture content, modulus of rupture (MOR), modulus of elasticity(MOE) of bamboo scrimber flooring. Ten specimens were prepared for each test. Sizes of samples for density, MC, water absorption were 50mm by 50mm by 10mm, and those of MOR and MOE were 50mm by 220mm by 10mm. During statistic bending test, the span was 200mm, load speed was 6mm/min and loading/supporting blocks' diameter were 30mm. In order to compare with Moso scrimber flooring, nature Moso bamboo scrimber (hereinafter Moso nature) was also tested here.

Hardness test

Muli bamboo scrimber flooring without paint was test by modified Janka ball test as described by ASTM D1037. Each specimen was 75mm in width and 75 mm in length. Because the scrimber board was 10mm in thickness, less than 25mm, three specimen were glued together to achieve the required thickness for hardness test. Ball diameter was 11mm and penetrated into half of it diameter. Speed of test was 6mm/min and maximum load required to embed the “ball” to half of its diameter was recorded. The hardness of all specimens were tested after reaching EMC at 65% RH. In addition, other properties of the materials such as density, MC, and MOR, MOE were also measured under this condition.

Results And Discussion

Density, MC and water absorption

The mean density, MC, and water absorption of Muli bamboo scrimber flooring and Moso scrimber flooring without paint are summarized in Table 1.

Table 1 Density, MC and 24h cold water absorption

Materials	Density(g/cm ³)	MC(%)	24h cold water absorption (%)
Muli-Nature	1.24(0.02)	9.63(0.24)	4.28(0.16)
Muli-Carbonized	1.35(0.01)	7.13(0.9)	3.38 (0.31)
Muli-Mixed	1.29(0.01)	7.72(0.18)	3.27 (0.56)
Moso-nature	1.09(0.05)	8.32(0.21)	3.67(1.36)

Each value is the average of 10 specimens and numbers in parentheses are standard deviation

Dimensional swelling

Fig. 2 showed the results of grain, cross, thickness swelling of Muli bamboo scrimber and Moso nature scrimber flooring. As it showed, the thickness swelling in bamboo scrimber flooring was greater than grain swelling and cross swelling with maximum value is below 5%. Muli-nature had the highest swelling among the four kinds of bamboo scrimber. Carbonized Muli bamboo showed the reduced swelling in cross and thickness direction compared to nature, which indicated the carbonized treatment had certain effect on improving the dimension stability of bamboo scrimber flooring, though grain swelling was a little higher. Three Muli bamboo scrimber showed higher swelling value than that of Moso bamboo scrimber in China, maybe because Muli scrimber has higher density than Moso bamboo does. Muli bamboo is thin in culm wall with higher distribution of vascular bundles than Moso bamboo, which can cause the higher density and higher dimension swelling. After painting on the surface, Muli and Moso bamboo scrimber should have lower dimension swelling.

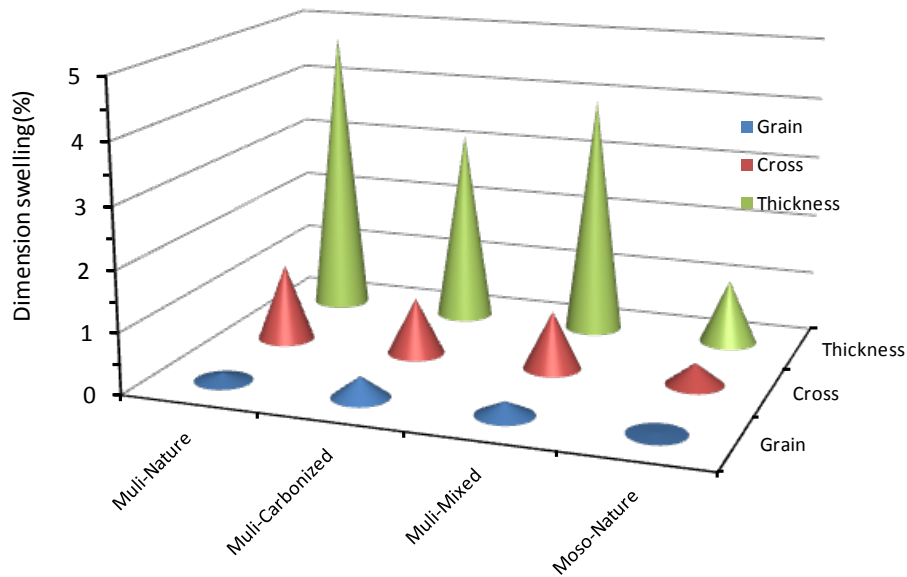


Fig.2 Dimension swelling of Muli bamboo scrimber and Moso scrimber flooring

Static bending property and hardness

Table 2 showed the results of static bending properties and hardness of Muli and Moso bamboo scrimber. As a whole, the static bending properties and hardness of Muli bamboo scrimber were higher than those of Moso-nature bamboo scrimber flooring, partly because the density of Muli-based scribmer is higher than that of Moso bamboo. MOE and MOR decreased accordingly from Muli-nature, carbonized, mixed to Moso-nature. Therefore, carbonized treatment not only changed the nature bamboo to dark coffee-like color, but also reduced its static bending properties. As far as hardness is concerned, carbonized Muli bamboo scrimber flooring performed the maximum value. Static bending properties of Muli bamboo scrimber were about 10% higher than those of Moso bamboo scrimber flooring.

Table 2 Static bending properties and hardness of Muli and Moso bamboo scrimber flooring

Materials	MOR(MPa)	MOE(MPa)	Hardness(KN)
Muli-Nature	265.88(12.66)	15218 (313)	22.8(1.96)
Muli-Carbonized	257.73(7.71)	14085 (136)	24.27(2.85)
Muli-Mixed	229.65(17.19)	13080 (109)	22.57(2.31)
Moso-Nature	202.73(7.66)	11433 (454)	16.06(2.76)

Each value is the average of 10 specimens and numbers in parentheses are standard deviation

Conclusions

Based on the results of the above study, the following conclusions about Muli bamboo scrimber flooring without paint can be drawn. Muli bamboo scrimber flooring showed much higher density, above 1.2g/cm^3 , and their dimension swelling values were higher than those of Moso nature bamboo scrimber flooring. Static bending properties and hardness were about 10% higher than those of Moso nature bamboo scrimber flooring. The order of MOR and MOE was Muli-nature>Muli-carbonized>Muli-Mixed>Moso-nature. In the same manufacturing process parameters of Moso bamboo scrimber, Muli bamboo had very high performance except for dimension swelling values. With so exciting results of Muli bamboo scrimber, it is supposed to be used not only as flooring but as a new high strength engineered composite in future.

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