

Manufacture Technology and Nondestructive Test of Wood / Waste Styrofoam Composite

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Abstract Manufacture technology of wood / waste styrofoam composite was investigated. The possibility that the dynamic Young's modulus of wood / waste styrofoam composite can be measured by nondestructive testing method was also discussed. The following conclusions have been drawn: Wood / waste styrofoam composite can be manufactured under the hot press condition of 155°C, 1MPa for 7 minutes. The dynamic Young's modulus measured by longitudinal transmission method were bigger than those measured by longitudinal vibration method and flexural vibration test. The dynamic Young's modulus measured by in-plane flexural vibration test were less than those measured by out-plane flexural vibration test.

Key words wood / waste styrofoam composite; manufacture technology; nondestructive test; dynamic Young's modulus

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1 Introduction

Styrofoam is very useful as a packaging material. However, unless it is properly recycled at the end of its usage, it will result in potential environment pollution problem. On the other hand, wood-based panel is an important wood-based composite with many advantages. But formaldehyde released from wood-based panels, especially from urea formaldehyde bonded wood-based panel, has given rise to environment pollution problem. Wood / waste styrofoam composite was made of wood veneer and waste styrofoam. Not only can wood / waste styrofoam composite decrease pollution problem which is caused by styrofoam waste and formaldehyde released from wood-based panel, but also it is economical because there is no special adhesive such as urea formaldehyde resins or phenol formaldehyde resins to be used.

Nondestructive test means to determine characteristic of a material without altering intrinsic properties and shape during the test. Nondestructive test offers some remarkable advantages. It will not destroy original property of material. The results can be obtained in short time so that work personnel estimate the properties of material. It is in favor of continuity of production and raising of efficiency^[1-2].

2 Materials and methods

The experimental composites were made of wood veneer (density 0.372 g/cm³, thickness 2.2 mm) and styrofoam (density 0.009 g/cm³, thickness 10 mm). Styrofoam was inserted between wood veneers. There was no adhesive between wood veneer and styrofoam. The wood / waste styrofoam composites were hot pressed at different manufacture technology (Temperature/°C: 150, 155, 160, 170; Press/MPa: 0.5, 1, 1.5; Time/min: 3, 5, 7, 9). Specimen size was 300×50 mm. The experiment was carried out using nondestructive testing method (longitudinal transmission method, longitudinal vibration method and flexural vibration test)^[3-5].

3 Results and discussion

Wood / waste styrofoam composites were hot pressed at different manufacture technology (temperature, press and time). Experimentation shows that wood / waste styrofoam composites can be manufactured under the hot press condition of 155 °C, 1MPa for 7 minutes. The results of measuring dynamic Young's modulus of wood / waste styrofoam composites by nondestructive testing method (longitudinal transmission method, longitudinal vibration method and flexural vibration test) were shown in Tab 1 and

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Tab 2 It was obvious from Tab 1 and Tab 2 the dynamic Young's modulus measured by longitudinal transmission method were bigger than those measured by longitudinal vibration method and flexural vibration test. The results of measuring dynamic Young's modulus by longitudinal vibration method and in-plane flexural vibration test were almost the same. The dynamic Young's modulus measured by in-plane flexural vibration test were less than those measured by out-plane flexural vibration test.

Tab 1 Dynamic Young's modulus by longitudinal transmission method and longitudinal vibration method		
	E_v	E_p
Mean / GPa	8.162	6.637
SD / GPa	0.827	0.614
COV / %	10.1	9.3
1): E_v —Dynamic Young's modulus by longitudinal transmission method E_p —Dynamic Young's modulus by longitudinal vibration method		

References

[1] ROSS R J, Zerbe J J, Wang X. Stress wave nondestructive evaluation of Douglas fir peeler cores [J]. Forest Products Journal, 2005, 55 (3): 90—94.

Tab 2 Dynamic Young's modulus by flexural vibration test		
	E_1	E_2
Mean / GPa	7.309	6.513
SD / GPa	0.711	0.638
COV / %	9.7	9.8

1): E_1 —Dynamic Young's modulus by out-plane flexural vibration test
 E_2 —Dynamic Young's modulus by in-plane flexural vibration test

[2] PELLER N R F, ROSS R J. Nondestructive Evaluation of Wood [M]. Forest Products Society, Madison, WI, 2002.

[3] HU Y, WANG F, GU J. Nondestructive test and prediction of modulus of elasticity of veneer overlaid particle board composite [J]. Wood Science and Technology, 2005, 39 (6): 439—447.

[4] DONG Y, NAKAO T, TANAKA C. Dynamic properties of laterally inhomogeneous wood based panels by flexural and longitudinal vibrations [J]. Mokuzai Gakkaishi, 1994, 40 (12): 1302—1309.

[5] DONG Y. Dynamic properties for in-plane inhomogeneous wood based materials [D]. Ph.D. Dissertation of Shijiazhuang University, 1996.

木材—废弃塑料复合材的制造工艺与无损检测

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摘要: 对木材—废弃塑料复合材的制造工艺进行了研究, 并探讨了利用无损检测方法对其动态杨氏模量进行检测的可行性。研究发现, 木材—废弃塑料复合材可以在 155℃、1MPa 和 7min 的热压条件下制得, 其动态杨氏模量可以由无损检测方法测量。利用纵波传播法测得的动态杨氏模量值大于纵向共振法和弯曲振动法测得的结果; 利用面内弯曲振动法测得的动态杨氏模量值小于面外弯曲振动法测得的结果。

关键词: 木材—废弃塑料复合材; 制造工艺; 无损检测; 动态杨氏模量

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