

# Chapter 11

## Bamboo Fiber– Reinforced Composites

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### **ABSTRACT**

*Nowadays, there has been an increased interest in the applications of bio-composites based on natural fibers, with the increasing emphasis on materials and processes which are environmental friendly and sustainable. Environmental friendly, fully biodegradable reinforced polymers or ‘green’ composite materials will play a major role in making the products of the future to protect our environment. The use of biodegradable and environment-friendly plant-based natural fibers has been a promising choice for polymers to make them ‘greener’. In addition to being obtained from renewable sources, natural fibers suitable for composites are biodegradable and have enhanced properties. Bamboo is an excellent example for the development of sustainable natural fibers, since it can grow very fast per day, and the fibers of bamboo have excellent mechanical performance. Additionally, research in the development of bamboo-reinforced composites should be increased in the future, considering their enhanced properties, economical benefits and environmental friendly nature.*

### **INTRODUCTION**

Nowadays, the concept of “environmental friendly materials” has become very important due to the need to protect our environment. The definition of “environmental friendly materials” should include “safe” materials for human and other

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life forms as well. Longer-term use of materials should not result in the emission of toxicities, which are highly damaging for both environment and for all living organisms, especially us, human. Both short and long-term utilization of materials should be needed to be characterized carefully; safer and more environmental friendly materials should be selected for applications. Contamination of wasted materials after expiration of their useful lives is utmost importance. However, the long-term characteristics of many kinds of materials are not well understood, especially their effects on environment.

Considering these, the most suitable material selection should be composite material. The main reason for choosing composite materials is that, using a sole material will not be sufficient, in order to satisfy a wide range of requirements such as, being environmentally friendly, human friendly and biodegradable. Throughout the various combinations of different composite materials, the most appropriate fiber-matrix pair to be considered an “environmental friendly material” is the combination of natural fibers and biodegradable polymer matrix. Biodegradable polymers have been developed in recent years and many kinds have appeared.

Among the natural fibers, special attention should be paid to bamboo fibers due to their environmental sustainability, mechanical properties, and recyclability have been utilized as reinforced polymer matrix composite in construction industries. (Zakikhani et al 2014)

Polymer composite materials have been used throughout very different application areas such as aircraft, automotive and submarine due to their enhanced mechanical and thermal properties when compared to other materials. However, the production and processing procedures of these materials will cause harm on the environment. Whereas, natural fibers are environmentally friendly and restorable materials. Natural fibers usually have low density and reasonable properties, in terms of mechanical performance, apart from being more economical. Therefore, usage of synthetic fibers is considered to be replaced with natural fibers, to conserve the economy and environment.

Natural fibers are divided into three categories basically, in terms of their origin:

1. Plant fibers (sisal, hemp, flax, bamboo, etc.),
2. Animals parts involving protein (silk, hair, wool, etc.)
3. Minerals

Out of other natural fibers, bamboo fiber is a good candidate for natural fibers in composite materials. Bamboo is economically advantageous with high growth rate, besides it helps reduction of carbon dioxide emission in atmosphere, making it one of the most important natural fiber. Bamboo has several advantages in terms of light weight, high strength, stiffness, biodegradability, and even its roots and leaves keep

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