STUDY ON HYGROTHERMAL AGING OF SHORT JUTE FIBER/PLA COMPOSITES

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After the biodegradable polylactic acid became commercially available, researchers [1-6] had made a lot of efforts in developing fully biodegradable composite materials by combining the polylactic acid resin with natural fibers. The most promising applications are for manufacturing constructive parts, especially where high strength and stiffness are required, but with low component weight, for example, aerospace and automobiles. More importantly, the fully biodegradability of this material meets the recent strict legislation for waste management after old automobile is discarded. The materials would be completely decomposed in environment in several months to two years.

However, the easily decomposition of these materials in environment is also disadvantageous for components in use, because the degradation of the materials would degrade the mechanical properties.

Due to the inevitable exposure to natural environment where the humidity, sunlight and temperature exist when the composite components are on service, the aging behaviors, weathering resistance and the prevention of the composites component would be a new subject. However, to date, few works on the aging behaviors of natural fiber/PLA composite have been done.

The authors [6] have investigated China jute fiber reinforced polylactic acid. The composite material was fabricated, and the mechanical properties and moisture absorption were tested. In the previous work, the badly aging was found in a steam saturated conditions at elevated temperature of 70°C. The microstructure of the composite after aging is shown in Fig.1.

In this paper, the authors would further investigate the aging behavior and durability in different conditions.

The composite material with fiber volume fraction of 40% was fabricated by film stacking hot press method. They were divided into two groups. Leaving one group as it is, another one was coated by moisture-proof PP film and edge-sealed. The two groups experienced aging conditions which were elaborately selected to simulate the extreme working conditions. After a period of aging, specimens were cut from the composite plates and the residual strengths were tested.

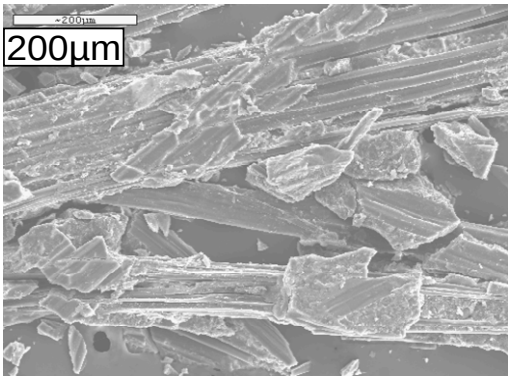

Figure 1. Microstructure after aging

Mass changes of the coated and uncoated samples in different aging stages were also measured. Microstructures of the aged samples were observed by SEM to determine the mechanism of the evolution of the mechanical properties. Accompanied by the mechanical properties degradation, the glass transition temperature T_g of the resin matrix has a significant decrease, which was measured by thermal analysis method.

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