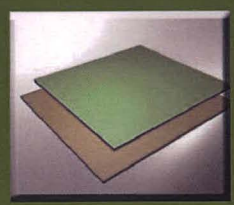
ADVANCES IN COMPOSITE MATERIALS



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Chapter 019

Properties of Wood Fiber Reinforced Polypropylene Composites

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Keywords: Wood plastic composite, Coupling agent, Strength, Accelerated marine test

Abstract: Wood fiber reinforced polypropylene composite samples have been fabricated using 50 wt% fiber of 250 μm and 100 μm sizes by extrusion and injection molding method. Chemically treated fibers with maleic anhydride polypropylene (MAH-PP) coupling agent were equally used to fabricate composite samples. The effect of the coupling agent on the characteristics of the composites is investigated by assessing their properties in terms of tensile strength, hardness and water absorption. As water absorption has a harmful effect on the mechanical properties of the samples accelerated marine test was conducted to study the water absorption capabilities. The water absorption gives significantly reduction in sample processed with the chemically treated fibers. It is presumed that the coupling agent creates a surface layer on wood fibers which diminishes water permeability in to the fibers. However the 100 μm sized fiber filled samples shows higher water absorption compared to those samples fabricated with 250 μm size fibers.

Introduction

Natural fibers are promising reinforcements for thermoplastic composite due to their low weight and cost. Moreover the natural fibers are obtained from post industrial sources. Since price for plastic has risen sharply over the past few years, adding a natural fiber to plastic provides cost reduction and in some cases increases performance of fiber filled plastic products. For this reason the scopes of fiber reinforced composites with natural fillers are increasing compared to inorganic fiber [1]. The addition of 10 parts per hundred by weight of oil palm wood fiber in the glass fiber reinforced composite is reported to reduce weight by 10%, without changing the specific energy absorption and impact strength [2]. It has been suggested that fiber orientation and moisture content of fiber have an effect on the mechanical properties of the rubber wood fiber filled polypropylene composites [3]. The fibers are shown to be in close proximity with each other in the samples, preventing the plastic matrix to properly encapsulate them which generates larger voids in the composite system and thus weakening the wood plastic composite.

The major usage of plastic composites is in transportation followed by the combined usage in marine and corrosive environment [1]. However, corrosion and marine environment stability of wood plastic composite has not been thoroughly investigated. Manufacturers mostly rely upon some limited laboratory tests whose methodologies are useful for simulations but not to predict the service properties. Stark [4] investigated polymer composites filled with 20 and 40% wood fiber at varying relative humidity of 30, 65 and 90% respectively and observed that the 20% wood fiber composite absorbed just above 1.4% moisture. Whereas 9.0% moisture absorption was obtained with 40% wood fiber reinforced composite. Bledzki and Faruk [5] found that the wood fiber in plastic composite can easily allow the absorption of water. However, in case of MAH-PP treated fiber sample, water absorption decreased by 75% due to the encapsulation of the fiber with MAH-PP. They suggested that during mixing, MAH-PP reacts with the hydroxyl group of the wood fibers to form covalent bond which is more resistant to water penetration. The effect of MAH-PP coupling agent on hardness and water absorption of natural fiber filled plastic composites has been studied by Patil et al [6]. They observed that MAH-PP treated fiber composite samples swelled less water and the sample was twice harder than that with untreated fibers.