

Weathering performance of aspen-polypropylene composites

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Abstract

Natural fiber-thermoplastic composites were made using aspen fiber and polypropylene. Different levels of fiber were used with and without the addition of a compatibilizer. For composites containing 30 percent aspen fiber and either 70 percent polypropylene or 66 percent polypropylene/2 percent maleic anhydride grafted polypropylene, cyclic humidity testing between 30 percent and 90 percent relative humidity showed that there was a small but steady increase in moisture sorption with each humidity cycle. Weathering of both composites under accelerated weathering conditions (water sprayed for 28 min. followed by 102 min. without water spray of ultraviolet radiation produced by a 6,500-watt xenon arc light source) was restricted to the outer 0.5 mm of the surface. Weathering gave rise to the development of a white chalky surface layer after about 600 hours of weathering, and after 1,400 hours there was a loss in surface smoothness. Af-

ter 2,000 hours of accelerated weathering, the specimens without compatibilizer lost 3.9 percent weight, while the specimens with compatibilizer lost 2.9 percent weight. It is well known that polypropylene is not stable to ultraviolet radiation. With a large number of tertiary carbon sites, polypropylene is very sensitive to free radical formation and decomposition by chain scission, resulting in the formation of lower molecular weight polymers on the surface. Agro-based fibers also undergo ultraviolet degradation through free radical reactions with the decomposition of the lignin polymer in the cell wall. Swelling of the composites by moisture results in an increase in ultraviolet degradation as swelling develops new surfaces, exposing more polymers to degradation. Composites were also made using 30, 40, 50, and 60 percent aspen fiber in combination with polypropylene alone or with 2 percent maleic anhydride grafted polypropylene. These composites were exposed to both cyclic liquid water and humidity tests and evaluated in an accelerated weathering test for 2,000 hours. Results of these tests were presented.

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