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Development of Wood Fiber-Polypropylene Laminates with Layer-By-Layer Assembly of Kraft Pulp Hand-Sheets and Polypropylene Films

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Abstract

This study examined the effects of polypropylene (PP) film thickness, hand-sheet fiber content (FC) in layer, and weight ratio of total fiber content (TFC) on tensile properties and dimensional stability of wood-plastic laminates. Wet-formed Kraft pulp hand-sheets were interleaved with polypropylene films to fabricate laminates of 1/8 in. thick. Experimental results showed that laminates of 0.75-mil film yielded better tensile strength (MORt) than those of 2.25-mil, due to better interpenetration of plastic, as evidenced in SEM observation. The effect of TFC and film thickness on percent elongation at break (ELONG) were not consistent at two higher TFC levels; however, TFC=50 showed the lowest ELONG at all film thickness levels. The interaction between TFC and film thickness had a varying effect on MOEt. At 0.75-mil, better interfacial adhesion in thin hand-sheets contributed to the increase of MOEt with TFC. At 2.25-mil, constitutive hand-sheets were too thick for plastic penetration and poor interfacial adhesion contributed to the reverse relationship in MOEt with nominal fiber content (NOMFC). With proper control of film thickness, wood fiber-polypropylene laminated with fiber loading as high as 70% can be fabricated with favorable mechanical properties.

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