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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Edited by: H. Michael Barnes and Victoria L. Herian

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Current Trends in Furniture Trade .................................................................533

Daniel Way, Oregon State University, USA
Manufacturing and Mechanical Characterization of a 3D Molded Core Strand Panel .................534

Changlei Xia, University of North Texas, USA
Self-Activation Process for Biomass Based Activated Carbon .......................................................535

Tuhua Zhong, West Virginia University, USA
Hybrids of TEMPO Nanofibrillated Cellulose and Copper Nanoparticles Embedded in Polyvinyl Alcohol Films for Antimicrobial Applications .................................................................536

Nano to Macro Scale Wooden Composites
Session Moderator: Levente Dénes, University of West Hungary, Hungary

Armando McDonald, University of Idaho, USA
Grafted ß-cellulose - poly(3-hydroxybutyrate-co-3-hydroxyvalerate) Biocomposites ......................537

Changle Jiang, West Virginia University, USA
Synthesis of TEMPO Cellulose Nanofibrils Stabilized Copper Nanoparticles and its Release from Antimicrobial Polyvinyl Alcohol Film.................................................................538

Levente Dénes, University of West Hungary, Hungary
Hierarchical PLA Structures Used for Wooden Sandwich Panel’s Core Fortification ..........................544

Todd Shupe, Louisiana State University, USA
Development of Wood Fiber-Polypropylene Laminates with Layer-By-Layer Assembly of KraftPulp Hand-Sheets and Polypropylene Films .....................................................................................545

Blake Larkin, Oregon State University, USA
Effective Adhesive Systems and Optimal Bonding Parameters for Hybrid CLT ...............................546

Frederick Kamke, Oregon State University, USA
Micro X-Ray Computed Tomography Study of Adhesive Bonds in Wood ....................................547

Bryan Dick, North Carolina State University, USA
Continued Research into Fire Performance of Varying Adhesives in CLT Panels Constructed from Southern Yellow Pine .................................................................................................................................548

Pamela Rebolledo-Valenzuela, Université Laval, Canada
Gas Permeability and Porosity of Fiberboard Mats as a Function of Density .................................549

Min Niu, Fujian Agriculture and Forestry University, China
Pyrolysis of Si-Al Compounds and Plant Fiber in Burned Ultra-low Density Fiberboard ............558

Xiaomei Liu, Mississippi State University, USA
Characterization of Polymerization of Isocyanate Resin and Phenolic Resins of Different Molecular Weights. Part I: Morphology and Structure Analysis ..................................................567

Timber Physics from 1 μm to 10 μm
Session Moderator: Samuel Zelinka, US Forest Products Laboratory, USA