



Stiff and Durable Wood-Filled Plastics for Building Applications

By Rakesh Gupta, WVU, George B. and Carolyn A. Berry Chair, Professor of Chemical Engineering

Wood-plastic composites (WPCs), made by combining wood particulates with polyolefin plastics, are commercial materials used in the construction industry. WPCs were initially developed as a way to reuse polyethylene (PE) milk containers; however, growth has also been promoted recently by the phasing out of chromated copper arsenate as a wood preservative for residential decking and other external lumber uses.

WPCs have advantages over both natural wood and resin-bonded wood products in that WPCs allow faster and continuous production. They are also easier to form into complex shapes, and there is a perception that they are durable and require less maintenance as compared to wood. Expanded WPC markets provide important societal benefits by reducing the amount of plastic scrap that ends up in landfills.

Decking represents about 60% of the total WPC market and is projected to grow at 20-25% per year; however, market penetration is only about 5%. Improving mechanical performance to enable structural as well as non-structural applications could potentially increase market penetration for WPCs. For example, stiffness, impact strength, and creep resistance of WPCs may be less than that of wood. WPCs also tend to absorb moisture resulting in cracking, fungus growth and dimensional change.

Research currently underway at WVU aims to develop and optimize new WPCs with improved performance while maintaining low cost. An immediate goal is to significantly enhance the stiffness of WPCs relative to the stiffness of

polyolefin-based WPCs and also to reduce moisture absorption and fungus growth.

Stiffness improvements can result from using plastics other than the PE and polypropylene (PP), using better coupling agents for bonding of wood to plastic, and incorporating “stiff” additives such as nanoclays. Costs can be controlled and production rates increased by eliminating processing instabilities and by changing equipment design.

Our preliminary work shows that by using acrylonitrile-butadiene-styrene (ABS) whose stiffness is about twice that of PP, it is possible to obtain a 35% to 50% enhancement in stiffness as compared to PP-based WPCs at equivalent wood content. Once the maximum enhancement in mechanical properties of ABS-based WPCs is determined, it will be possible to develop wood-plastic composites that can be tailored to specific applications such as furniture, windows, doors, railing, siding and fencing, in addition to decking. Costs can be reduced by using recycled ABS, which is available from discarded computers and cell phones.

Excellent extrusion-compounding facilities are available at West Virginia University along with equipment for flow, structural, thermal and mechanical characterization of WPCs; unique capabilities include electron and atomic force microscopy of polymers and polymer composites.

The WPC research program includes the following three goals:

- (i) Establish extrusion conditions that give good dispersion of wood particulates in ABS;
- (ii) Identify coupling agents that give good adhesion between wood and ABS since tighter encapsulation will reduce moisture absorption.
- (iii) Identify biocides that reduce fungus growth.

For questions or additional information please contact Dr. Gupta at (304) 293-2111 ext. 2427 or Rakesh.Gupta@mail.wvu.edu.

EVENTS

Creating a Sustainable Energy Plan Online Seminar, sponsored by The Association of Energy Engineers will be held March 13, 2006 at 2:00 pm EST. This seminar will be presented in 3 live, 2-hour sessions. For more information, please log on to <http://www.aeecenter.org/realtime/sep/>.

Measuring and Improving Boiler Efficiency webcast, sponsored by the US DOE “Save Energy Now” Initiative, will be held on March 16, 2006 at 12:00 pm EST. To register, please log on the <http://iac.rutgers.edu/lectures2006>.

Tri-State SBIR Forum - VA, NC, WV: Research, Development and Funding Opportunities for Entrepreneurs and Innovators will be held March 21-23, 2006 at the Wyndham Hotel - Roanoke Airport, Roanoke, VA. For more information contact WV Small Business Development Center at (304) 558-2960 or visit www.sw.edu/ptac.

Business Management for Loggers Workshop sponsored by the West Virginia Forestry Association will be held March 29, 2006 at New River Community and Technical College, Summersville, WV. Log on to www.wvfa.org/events.htm to learn more or to register.

Combined Heat and Power webcast, sponsored by the US DOE “Save Energy Now” Initiative, will be held on April 12, 2006 at 12:00 pm EDT. To register, please log on the <http://iac.rutgers.edu/lectures2006>.

IOF-WV Contacts

Kathleen Cullen
WVUNRCCE
(304) 293-2867 ext. 5426
Kathleen.Cullen@mail.wvu.edu

Jeff Herholdt
WV Development Office
(304) 558-2234
jherholdt@wvdo.org

Mike Carr
WVUNRCCE
(304) 293-2867 ext. 5408
Mike.Carr@mail.wvu.edu

Carl Irwin
WVUNRCCE
(304) 293-2867 ext. 5403
Carl.Irwin@mail.wvu.edu

Co-Funding Opportunities for IOF-WV Research Teams

Announcement	Due Dates	Funding
U.S. Department of Energy Office of FreedomCAR & Vehicle Technologies FY06 Funding Opportunity Announcement http://e-center.doe.gov	Now Open (Request for Proposals) March 16, 2006 (Proposals Due)	\$2,000,000 in total funding anticipated
U.S. Department of Energy High Temperature, High Pressure Drilling Program http://e-center.doe.gov	Now Open (Request for Proposals) March 21, 2006 (Proposals Due)	\$2,600,000 in total funding anticipated for 3 to 5 awards
U.S. Department of Energy Research and Development of Fuel Cell Technology for the Hydrogen Economy and Research and Development of Fuel Cell Technology for the Hydrogen Economy Lab Call http://e-center.doe.gov	Now Open (Request for Proposals) February 28, 2006 (Letter of Intent Due) April 5, 2006 (Proposals Due)	\$100,000,000 in total funding anticipated for both general solicitation and lab call for up to 25 awards
U.S. Department of Energy Advanced Diagnostics and Imaging (Low Permeability Gas Formations) http://e-center.doe.gov	Now Open (Request for Proposals) April 17, 2006 (Proposals Due)	\$1,200,000 in total funding anticipated for 2 to 4 awards
U.S. Department of Transportation SBIR http://sbirworld.com	Now Open (Request for Proposals) May 2, 2006 (Proposals Due)	\$100,000 for phase I awards \$100,000 to \$750,00 for Phase II Awards
U.S. Department of Energy Enhanced Oil and Natural Gas Production through Carbon Dioxide Injection http://e-center.doe.gov	Now Open (Request for Proposals) May 5, 2006 (Proposals Due)	\$7,000,000 to \$8,000,000 in total funding anticipated for 2 to 4 awards
U.S. Environmental Protection Agency SBIR http://sbirworld.com	March 23, 2006 (Request for Proposals) May 24, 2006 (Proposals Due)	\$100,000 for phase I awards \$100,000 to \$750,00 for Phase II Awards
U.S. Department of Energy Commercial Demonstration of an Integrated Biorefinery System for Production of Liquid Transportation Biofuels, Biobased Chemicals, Substitutes for Petroleum-based Feedstocks and Products, and Biomass-based Heat/Power http://e-center.doe.gov	Now Open (Request for Proposals) March 30, 2006 (Letter of Intent Due) August 10, 2006 (Proposals Due)	\$53,000,000 in total funding anticipated for up to 3 awards

How Will Your Organization Deal with Soaring Energy Costs?

National Satellite Teleconference entitled "Industrial Efficiency Initiative: Save Energy, Maximize Profits" will be held March 9, 2006, at the WVU National Research Center for Coal & Energy. To register online, go to www.nwfpa.org and select WVU-NRCCE as the location you want to attend. For local information contact Mike Carr at (304) 293-2867 ext. 5408 or Mike.Carr@mail.wvu.edu.



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