

Sustainable Biomaterials Newsletter

Season's Greetings from the Department of Sustainable Biomaterials,

It is hard to believe that the semester is about over and students are studying for final exams. We have had a beautiful fall in Blacksburg and now it is starting to feel like winter will be coming just in time for the holidays. This is always a great time of the year to reflect on how fortunate we are to work and live in this great country. Every one of us has the potential to be successful and benefit from our individual efforts. And that is what our department and its faculty try to instill in our students. It has been said many times and many ways, the future is in the hands of our young people. We know with a good education in the wise management and use of our natural resources we all will have a great future.

The department had some changes this semester. I have been asked by Dean Winistorfer to be interim department head after Dr. Barry Goodell stepped down early last fall. I have served the college for six years as the associate dean for engagement and prior to that was in the department of Wood Science and Forest Products (now SBIO) for 13 years as extension specialist in forest products business/marketing. It is a great pleasure to be able to work with my colleagues again on a regular basis. The breadth of our teaching and research efforts has always amazed me. Our faculty work ranges from traditional wood science issues of moisture and manufacturing to nanoparticles from cellulose for new plastics/polymers or chemicals that assist in drug delivery.

The department is growing on many fronts. We have 70 students in the program and we are moving forward with two new degree platforms in the department. The Wood Enterprise Institute (WEI) is working on a number of different products this year with its 18 students. These students presented their business plan for their products under Dr. Earl Kline's mentorship this past week. He had them present it as they would to a board of directors. We were fortunate enough to have our university Provost, Dr. Mark McNamee and Dean Paul Winistorfer attend. WEI is a great example of how the university is growing its experiential learning efforts. The Packaging Science Program continues to grow with over 20 students. We have had some major equipment/software gifts that will greatly benefit our students' learning experience. We will have over 25 students looking for full time jobs by the end of spring semester as they graduate in May.

This issue of our newsletter will bring you up to date on a number of exciting items that our faculty and students have been up to this fall. We have visiting scholars from China, we will be building and breaking cross-laminated timbers, and the packaging science program has a number of efforts to expand students learning experiences. If you have any questions about our program or contents of this newsletter, please feel free to contact me at rsmith@vt.edu or 540-231-7679.

Sincerely,

Bob Smith

Interim Head, Department of Sustainable Biomaterials

rsmith@vt.edu

Packaging Partner Expands Business in Virginia

The faculty, staff, and students of the Department of Sustainable Biomaterials congratulate Carded Graphics of Stanton, Virginia on their continued success and recently announced \$7 million, 34 position expansion. Carded Graphics President and CEO Murry Pitts along with Director of Marketing and Sales Services Christine Kelley are valued supporters and partners with the Virginia Tech packaging program. We wish them great success with their expanded business operations.

Photo courtesy of Carded Graphics



Murry Pitts, left, president and CEO of Carded Graphics, gives a tour of the facility in Staunton to Emmett Toms Jr., external affairs manager for Dominion, Mary Rae Carter, deputy secretary for rural economic development, Jim Cheng, secretary of commerce and trade, and Robert Bush of Virginia Tech.

Students Benefit from a Visit from the Can Manufacturers Institute



A recent visitor from the Can Manufacturers Institute in Washington, D.C. helped students in Dr. Bush's Principles of Packaging course broaden their understand of metal packaging. CMI is a trade association the represents aluminum and steel can makers as well as metal and coating suppliers. According to the CMI website (<http://www.cancentral.com/aboutCMI.cfm>), "CMI members account for over 81% of annual domestic production of 133 billion cans; together they employ 22,000 people with plants in 33 states, Puerto Rico and American Samoa." Megan Daum, Vice President for Sustainable Packaging with CMI, spoke with the students in the course and explained the changes that manufacturers have and are making in order to reduce the impact of metal cans and increase the value they offer consumers. Topics included light weighting, recycling, and innovation in manufacturing and design. Ms. Daum discussed trends in the can industry as well as how trade associations such as CMI operate. A discussion of career paths in the industry was of interest to students as they look ahead to graduation.

Our sincere thanks to Ms. Daum and the Can Manufacturers Institute for helping our students.

Megan Daum, Vice President for Sustainable Packaging, Can Manufacturers Institute, Washington, D.C.

Sustainable Blacksburg Week – September 18 – 20

Once again, the Department was pleased to highlight many of its' activities to the public during Sustainable Blacksburg Week. "Sustainable Blacksburg" is a non-profit community organization that facilitates effective environmental stewardship in the Blacksburg area. Together with Virginia Tech, they have sponsored a Sustainability Week in the Fall of the year since 2006.

Several students participated in the activities including the set up and take down of the display. On display for the event were:

- A variety of advanced composite wood and bamboo products,
- Biofuel pellets from wood and peanut shell,

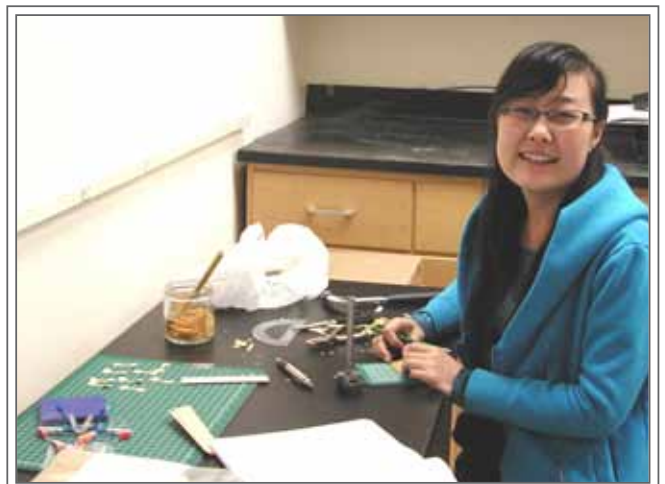


Above Left: Professors Bob Bush (foreground) and Barry Goodell highlight activities in the Sustainable Biomaterials department to interested passers-by at the 7th Annual Sustainable Blacksburg week events. Right: Students in the department Patrick McCampbell and Rosemary Masser help out in setting up and spreading the word about the department at our table during the event.

- Naturally biodegradable plastics made by Professor Kim from sustainable biopolymers,
- Wood Enterprise Institute projects from by students in the department that the WEI sells throughout the year,
- Samples of Lyocell yarn made from cellulose,
- New biomaterial scaffolds produced using a 3-D printer, and being tested experimentally as “bone scaffolds” for the repair of broken bones, produced in Dr. Roman’s lab.

Inner Mongolia Agricultural University Visiting Scholar

Ms. Qin He, has been part of our department as a visiting scholar during the fall semester, 2012. She has been working with Professor Audrey Zink-Sharp while at Virginia Tech. Qin is on leave from her home university, the Inner Mongolia Agricultural University, in Hohhot, China, where she is a Lecturer. While here at Virginia Tech, she has been studying the influence of wood cell structure on the drying properties of wood and is completing a study on the tensile properties of very small, thin specimens of loblolly pine. She has designed a new process for preparing the tension test specimens as well as a testing protocol for the Fullam microtensile stage in Professor Zink-Sharp’s lab. Qin will return home in mid-December to her young son and husband and she will resume research duties at her university and will soon begin teaching wood science courses in English.



Qin He preparing tensile test specimens (several on left side of green mat).

Principles of Packaging Students Tackle a Messy Problem

Students in Dr. Bush’s Principles of Packaging course (SBIO 2104) accepted a potentially messy challenge this semester – use some rather unconventional materials to protect an egg from a 15 foot drop.

Students “won” materials by completing “minute to win it” challenges such as solving a puzzle, moving a cookie from forehead to mouth without hands, or knocking over cans with rubber bands. Challenge winners received first choice of materials such as balloons, straws, paper, toothpicks, string, pipe cleaners, glue, and tape. Using only the materials they won, students designed and constructed packaging for an egg in less than one hour. Some concentrated on

cushioning while others attempted to slow the drop to the concrete floor. Several eggs survived thanks to some clever and imaginative work.

The laboratory reinforced concepts related to the role of packaging in mitigating distribution hazards such as shock.



Students complete the “Forehead to Mouth Cookie Challenge” to win materials for their egg package.



Students discuss how to best use the materials they won.



Dr. Bush watches the fall of an egg protected by balloons, aluminum foil, stickers, and drinking straws. The egg survived.

Multi-State Extension Training Program In Lumber Drying

On October 30 and 31st, Dr. Brian Bond participated in a multi-state effort to provide industrial lumber drying training to lumber drying personnel and managers. The course was sponsored by the Ohio Valley Lumber Drying Association and was held at the Chaney Lumber Company located in London, Kentucky. The course represented the first time in over ten years that that wood products extension specialists from Virginia, Kentucky, Ohio and Tennessee worked together to conduct a drying course. Retired extension specialist and industry consultant Gene Wenger, known as the “Wood Doctor”, also participated. The short course included classroom instruction, laboratory exercises and a facility walk through and discussion. While the weather related to Hurricane Sandy did keep several out of state participants from being able to attend those that were able to attend indicated that the course exceeded their expectations. Sponsors for the course included the Ohio Valley Lumber Drying Association, Kentucky Forest Industries Association, National Hardwood Lumber Association and the Cooperative Extension for Virginia Tech, Ohio State, University of Tennessee.

What Is A CLT?

Cross-Laminated Timber (CLT) is one of the most exciting new structural systems using wood materials. CLT panels can be described as a 'wood sandwich' composed of layers of 1x or 2x material at 90 degree orientations. Panel thickness can vary from 5 to 20 inches thick with panel sizes of up to 10 feet wide by 50 feet long.



CLTs can be used for residential construction, but are also used for commercial and light industrial construction. This building system originated in Europe and has spread to Canada and is beginning to become accepted in the United States. Recently, an issue of *Wood Design Focus*, a timber engineering journal published by the Forest Products Society, featured an issue on CLTs. Currently, the largest residential wood structure in the world is a CLT building called the Stadthaus in London. However, a [10 story CLT residential building in Australia](#), called Forte, is currently in the final stages of construction.

While the use of CLTs may at first seem wasteful, it is important to realize that this product is capable of replacing conventional steel

and concrete construction, which requires even more materials and energy to create. The use of wood creates a carbon negative structural system, where carbon is stored instead of created in the manufacture of these buildings. CLT panels share many similarities with precast concrete panels – but can be connected like wooden structures. Other advantages of CLTs include fewer joints resulting in less air infiltration, and an increase in the speed of construction with few workers needed.

Currently, several residential and some commercial CLT projects have been completed in the United States. One project of note is the bell tower of the [Myers Memorial United Methodist Church](#) in Gastonia, Virginia. The project was completed by MDS 10 Architects and the 70 foot tower was completed in 3 days. Medlock and Associates, the engineering firm for the bell tower, received the 2011 National WoodWorks Wood Engineering Award.



CIT Grant for Commercialization of Southern Yellow Pine CLT Panels in Virginia

The Southern Virginia Higher Education Center (SVHEC) in cooperation with Dr. Daniel Hindman and Dr. Earl Kline from the Department of Sustainable Biomaterials at Virginia Tech have been awarded a grant from the Commonwealth Research Commercialization Fund (CRCF) through the Center for Innovation and Technology (CIT) in the Commonwealth of Virginia. Other partners include the American Wood Council, CLT USA LLC, and Morgan Lumber Company. The project is entitled "Use of Southern Yellow Pine as an Alternative Material for the Manufacture of Cross-Laminated Timber Panels for Use in Commercial Construction". The purpose of this grant is to demonstrate the applicability of southern yellow pine material in the construction of cross-laminated timber (CLT) panels for use as building code compliant materials.

SVHEC currently has a cold press capable of manufacturing CLT panels 5 feet wide and 8 feet long. A series of 5-layer V3 panels will be constructed and subsequent code-compliant evaluations – including mechanical properties, fire, and acoustics – will be conducted. "Our expectation is to produce a 2 hour fire wall that meets current acoustic standards in the International Building Code," says Dr. Hindman. "CLT panels are the only carbon negative structural system and provide many innovations in terms of construction time, energy efficiency and flexibility of design."

USDA Grant for Study of Hardwood CLT Panels in Appalachia

Recently, a team of researchers at Virginia Tech with colleagues from the Southern Virginia Higher Education Center, the University of Tennessee, and West Virginia University received a grant from the National Institute for Food and Agriculture (NIFA) to study the use of low-grade hardwood lumber for production of CLT panels. The Virginia Tech research team was led by Drs. Daniel Hindman and Joseph Loferski, and included Dr. Earl Kline, Dr. Brian Bond, and Dr. Henry Quesada-Pineda. Mr. David Kenealy from the Southern Virginia Higher Education Center, Dr. Timothy Young from the University of Tennessee, and Dr. David DeVallance from West Virginia University were also co-investigators on the project.

Low-grade hardwoods are often difficult materials to sell and market due to lower profits and lack of markets. The composite nature of CLTs will allow these lower quality materials to be incorporated in a higher value product. Currently, there are no CLT manufacturing facilities in the United States, and CLT panels produced in Europe and Canada have used only spruce materials. This research can lead to the use of more wood species in CLT production, leading to regional facilities able to use different wood materials sources depending upon market conditions.

Specific goals of this project are to understand the adhesion needs of hardwood panels cross-laminated, verify current composite construction models to produce CLT mechanical properties, and develop statistical process controls for future CLT manufacturing. Annual conferences for lumber manufacturers, engineers, and future CLT producers are planned in the following years to help build production capacity of CLTs in the United States. Additionally, a set of undergraduate scholarships for research related to CLT production will be awarded by each school.

Buying into Sustainability and Innovation

Associate professor Eva Haviarova (ehaviar@purdue.edu) from Purdue University and assistant professor Henry Quesada from Virginia Tech recently delivered a workshop titled “Buying into Sustainability” in Jasper, IN.

The workshop had as a goal to provide participants with a framework and available tools to pursue and embed sustainability as part of the business strategy of renewable-based companies. Firms in the wood products sector have yet to realize their potential in creating, manufacturing, and delivering sustainable products. Wood continues to be one of the top renewable materials used by society but firms in the wood products sector are doing little to incorporate innovation and sustainability as central elements of their competitive strategies.

The workshop was attended by 32 participants mainly from the furniture industry sector including representatives from Jasper Group, Jasper Chair, Masterbrands, and Kimball International.

Dr. Haviarova provided an update on current uses and trends of wood as raw material. Dr. Quesada introduced the sustainability framework and also included a discussion on the role of innovation in wood products firms. Finally, Dr. Haviarova presented an application of life cycle assessment on a solid wooden chair. Participants rated the workshop as “excellent/responsive to manufacturers needs” and they also indicated that “the presenters were very knowledgeable. It was great to have these high caliber individuals presenting”.

Interested in learning more about the sustainability and innovation framework? Contact Dr. Henry Quesada at quesada@vt.edu. Also, please visit the web page www.woodinnovation.org for more details on similar topics.



Dr. Eva Haviarova from Purdue University addresses the participants during the workshop.

Great-Grand (Doctor) Fatherhood

Major advisors in doctoral programs are considered (pseudo- or substitute-) parents (“doctor fathers” or “doctor mothers”) in some cultures, like the (very traditional) German academic system. Wolfgang G. Glasser, Prof. emeritus of Wood Science at Virginia Tech, who currently holds a Mercator Guest Professorship at the Albert-Ludwig-University Freiburg in Freiburg, Germany, is working with a Ph.D.-student on a project on tannin utilization. Danny Garcia-Marrero’s dissertation deals with the chemical utilization of condensed pine bark tannins in adhesives from sustainable natural resources. The work is carried out at the Institute for Forest Utilization of the University of Freiburg under the directorship of Professor Marie-Pierre Laborie. First results from the dissertation have just been filed for a patent, and an initial publication is in preparation.

Danny is a graduate student from Cuba working on a European bark project that also involves Prof. A. (Tony) Pizzi of the University of Nancy, France, and Prof. Milan Sernek (also a VT-graduate) of the University of Ljubljana, Slovenia.

Prof. Laborie, Danny’s major Ph.D.-advisor, is a former VT-student having graduated with a Ph.D. in wood science under the supervision of Prof. Charles E. (Chip) Frazier. Since Prof. Frazier received his Ph.D. at VT with Prof. W. Glasser in 1992, this gives Glasser at least part of the Great-Grand (Doctor) Parenthood of Danny Garcia-Marrero.and makes him feel real old!!

Biomass Power Plant Supports Efforts in Sustainability at CNRE

The Department of Sustainable Biomaterials (SBIO) at the College of Natural Resources and Environment (CNRE) recently acquired a biomass power plant to support the SBIO Department’s academic and outreach goals. The unit is capable of generating 10 KW (Kilo-Watts) by using biomass feedstocks such as wood chips, nut shells, coconut shells, corn cobs, and manure. The unit is capable of producing 1KWh for every 1.2 kg of biomass.

The unit’s generator is powered by a 3-cylinder combustion engine that uses syngas as fuel. Syngas is produced from carbonaceous materials, such biomass, that reacts with steam or a limited amount of oxygen at temperatures above 750 C to produce mainly carbon monoxide and hydrogen. The gasification process dates back to 1800s where it was used to produce town gas for lighting and cooking. Wood gasifiers were also used to power motor vehicles during World War II fuel shortages. In general the gases produced from the gasification process can be used in other applications such as gas turbines for electrical production, burned for heat generation, or as a source for hydrogen source cells.

The biomass power plant is a great addition to the current and future academic efforts in sustainability at the SBIO Department. There is an increasing interest in the community to learn more about renewable materials and their potential use in energy production and how technology can be integrated in a small-scale system. Also, the SBIO Department’s research efforts will benefit from using the unit to test, characterize, and optimize many of the different type of biomass feedstocks available in the state and beyond. Finally, the undergraduate program at the SBIO Department strives in acquiring and developing systems and technology to support teaching efforts in order to form the best specialists in Sustainable Biomaterials.

If you have questions, or like to see the power plant performing, please contact Dr. Henry Quesada at quesada@vt.edu or 540 231 0978.



Rick Caudill, SBIO Department’s Technician, takes notes from biomass international consultant Yaov Palatnik during the generator’s commissioning process.