

29	30	31	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1

INSIDE VT WOOD

Reminder...

Remember to submit department news items by Friday 3 p.m. of each week to Will Pfeil at wpfeil@vt.edu for inclusion in Inside VT WOOD each Monday morning. All past issues of Inside VT Wood reside on our department website under the publications link.

News From Paul Winistorfer

- Thanks to Drs. Maren Roman, Kevin Edgar, and Brian Bond for their recent contributions to 'Building Our Future'. Gifts from our own faculty are an important demonstration of personal investment in our future. Our goal is to demonstrate to our supporters that we are vested personally in our own future. Won't you make your contribution today?
- NASCAR Driver Ward Burton currently driving the #4 State Water Heaters Chevrolet for Morgan-McClure Motorsports will participate in our Career Fair on Thursday September 6! We thank Ken Morgan of Morgan Lumber Company for extending the invitation to Ward. Burton has won some of NASCAR's most prestigious events, including the 2002 Daytona 500 and the Southern 500. Burton has visited Virginia Tech before, and is engaged in research projects with the Conservation Management Institute (CMI) through the Ward Burton Wildlife Foundation. Make sure you find time to visit with Ward at the Career Fair.
- The Career Fair is full. We have flyers for you to distribute in class beginning this week and next week — about all Wood Week activities.
- Soon we need your RSVP on the following:
 1. Welcome Back Picnic Wednesday September 5th
 2. Scholarship Reception Friday September 7th
 3. Your registration form for the VFPA-VT Conference on Saturday September 8th.
- The Wood Enterprise Institute and Wood Week are now featured on the VT homepage. Don't miss it. This is great visibility for our program on this campus. Thanks to Lynn Davis for making this happen for us.



- I enthusiastically encourage you all to register for upcoming VFPA-VT Industry Technology Conference scheduled for Saturday 8th at the Inn at Virginia Tech. The department will orchestrate registration for the event with VFPA in the coming days. All faculty, graduate students and undergraduate students are encouraged to attend this important event.

Summary of Wood Week 2007 Events

Tuesday, September 4th — Public keynote by Asa Christiana, editor, Fine Woodworking Magazine

Wednesday, September 5th — Wood Magic Show at Brooks Forest Products Center; Department Welcome Back Picnic

Thursday, September 6th — Career Fair on the Drillfield

Friday, September 7th — Forest Products Marketing and Management Advisory Board meeting; Student Scholarship and Awards Recognition Reception

Saturday, September 8th — Virginia Forest Products Association – Virginia Tech Forest Products Industry Technology Conference

Department Welcome Back Picnic September 5th at the Duck Pond

Join us on September 5th from 5:30 pm to 7:00 pm at the Duck Pond for a department 'Welcome Back and Welcome New Students' picnic. Watch for RSVP information in the coming week. Food and refreshments will be provided. Department faculty and staff will be introduced, as well as new students.

Fall Wood Science Course Offerings and Enrollment

We are offering 16 courses this fall semester, serving approximately 269 students.

WOOD 1234 Introduction to Wood Science and Forest Products – enrollment 20

WOOD 2104 Principles of Packaging – enrollment 6

WOOD 2124 Wood Structure and Properties - enrollment 28

WOOD 2784 World Forestry and Forest Products - enrollment 36

WOOD 3224 Packaging & Material Handling - enrollment 6

WOOD 3334 Non-timber Forest Products - enrollment 15

WOOD 3534 Lumber Manufacturing and Drying – enrollment 12

WOOD 4154 Computers in Forest Products - enrollment 13

WOOD 4445 Wood Adhesion and Composites - enrollment 17

WOOD 4624 Wood Products Operations Management – enrollment 15

WOOD 4634 Forest Products Business Management – enrollment 15

WOOD 5004 Graduate Seminar in Wood Science – enrollment 14

WOOD 5424 Polysaccharide Chemistry - enrollment 13

WOOD 5984 Special Study: Fundamentals of Wood Material Science - enrollment 5

WOOD 2784 World Forestry and Forest Products - enrollment 36

NR 5114 Global Issues in Natural Resources - enrollment 18

Editor of Fine Woodworking Magazine to Present the Science and Artistry of Fine Furniture in Lecture at Virginia Tech



Asa Christiana

Asa Christiana, editor, Fine Woodworking magazine (Taunton Press) will kick-off Wood Week 2007 activities at Virginia Tech with an open public lecture titled The Science and Artistry of Fine Furniture. Wood Week 2007 is a series of events on the Blacksburg campus sponsored by the department of Wood Science and Forest Products in the College of Natural Resources to bring focus and attention to the role of wood and renewable materials in society, and the contribution of department faculty and students enrolled in the program. Christiana notes "Wood is the perfect material for furniture: It is lightweight yet strong, it cuts and polishes beautifully with relatively simple tools, and it is widely available in a magnificent palette of colors and grain patterns. To make the most of this material, custom furniture makers master a rare blend of engineering and aesthetics, crafting pieces that are more beautiful, functional, and durable than their cheap, factory-made counterparts." As editor of the world's leading magazine for the craft of furniture making, Christiana will use recent articles, and the makers featured within,

to illustrate how the best pieces marry form and function. He'll demonstrate how wood science leads to solid joinery, and how classic design principles are applied to the most beautiful furniture and home interiors. In this age of disposable goods, the audience is sure to leave with an appreciation for things built to last.

Asa Christiana is the editor of Fine Woodworking magazine. A winding path led him to the Taunton Press, beginning at a technical high school, where he learned the machinist trade. In college Asa started in the engineering school and then migrated to the English department. After college he took a number of teaching jobs, first in the Peace Corps in Africa (teaching math in French) and then, back home, as a high-school and college English teacher. He eventually fled the classroom for the relative safety of the newsroom, becoming an editor at a daily paper and later at Woodshop News. About that time he set up his first woodworking shop. In retrospect, his left-brain/right-brain background was good preparation for his career at Fine Woodworking, which he began in 2000 as an associate editor. Asa lives with his wife and two girls in the Connecticut woods, in a house he helped design and build.

Christiana's lecture will be Tuesday, September 4th at 7:00 p.m. in the Auditorium of the Graduate Life Center at Donaldson Brown (<http://www.glc.vt.edu/>) on the Virginia Tech campus. The public is invited to attend. Wood Week 2007 also includes a career fair with 40 participating companies from the industry, a student scholarship reception awards program, and a technical conference on Saturday September 8 focusing on competitiveness of the industry with topics covering workforce development, globalization, and biofuels and biomaterials.

The department of wood science and forest products (www.woodscience.vt.edu) in the College of Natural Resources is the leading program in North America engaged in wood and renewable materials utilization. Faculty focus on the science and business of wood and renewable materials utilization through learning, discovery, and engagement. The department is home to the Center for Forest Products Marketing and Management, the Center for Unit Load Design, the Wood-Based Composites Center, the Sustainable Engineered Materials Institute and the award winning Wood Magic Show for 4th and 5th grade children and their teachers. Through cooperation with the department of marketing in the Pamplin College of Business, the department co-directs the Alfred P. Sloan Forest Industries Center. Students learn from the leading wood and renewable materials scientists in the world, who bring the latest science and application of principles to the classroom.

For More Information Contact:

Dr. Paul Winistorfer
Professor and Department Head
Department of Wood Science and
Forest Products

230 Cheatham Hall (0323)
Virginia Tech
Blacksburg, VA 24061
p: 540.231.8853
e: pstorfer@vt.edu

The Department of
Wood Science & Forest Products
at Virginia Tech

KEYNOTE
SPEAKER



Wood Magic at Virginia Tech — Wednesday, September 5th

WOOD is truly a magical material. It has supplied our needs since the beginning of time. You probably ate some today and did not even realize it. Did you take an aspirin, eat some ice cream, take a vitamin, drink instant hot chocolate, or eat an Oreo? Not only do we eat wood just about every day, we wear it in the form of rayon and tencel, it's in our cleansers, photographic film, adhesives, shampoos, cologne, toothpaste, and hundreds of other products. From food to shelter, we use items every day that come from wood and forest products. Learning the



Caitlin's favorite part is making paper, in fact, she said "It was fun. I never knew that making paper was so hard to make. We really liked it."

magic, science, and importance of wood and forest products in our lives is what Wood Magic is all about.

Wood Magic at Virginia Tech is an award-winning natural resource education program for youth and educators. Materials and activities are designed around Virginia's Standards of Learning and are intended to assist educators with teaching children about environmental science, particularly wood science and forestry.

Studies of environmental education determined that young students do not lack concern for the environment, they lack knowledge. Wood Magic provides an opportunity to learn first hand the uses and prevalence of wood in everyday life and the role of natural resource science in a sustainable future. Our activities engage the students in doing, reflecting and applying wood science to their daily world.

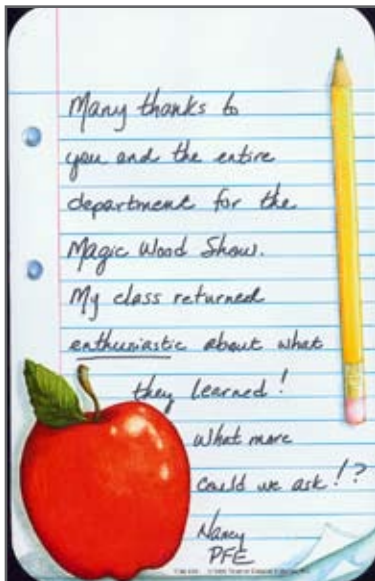
There are three components to Wood Magic at VT: the annual on-campus program, the interactive learning website <http://www.woodmagic.vt.edu>, and our Wood Magic 4-H Curriculum Booklets.

The curriculum booklets are

designed as instructor guides for conducting Wood Magic and related wood science activities. They have been approved for Virginia's Cooperative Extension 4-H program and can be found at <http://www.ext.vt.edu/vce/publications/pod/> The guide for 9 – 11 years is VCE publication # 388 – 807. Look for the curriculum guide for 13 – 18 year olds Fall 2007 under VCE publication #388-809.



Nathan was glad to learn some "good things about our environment" and concluded his letter with "VT Rocks"



Our 10th annual on-campus program is designed for 4th and 5th grade classrooms and will be held early in Wood Week '07 on September 5th, 2007. Classes from Gilbert Linkous Elementary and Harding Avenue Elementary are scheduled to participate. An on-campus programs lasts 3 hours and includes several different activities such as Caitlin's favorite — Making Paper.

In addition to making paper, students learn the connection between forest and wood resources and their daily lives, they participate in determining the strength of wood sticks, they get a microscopic view of "the little holes in it", they get to make a wood sandwich with veneer (bread) and adhesive (cheese), they get to put together a wooden puzzle made from recycled wood flooring, they race termites and blow bubbles through oak sticks, and they get to plant a white oak acorn in a cup of sand and peat moss and take it home with them so they, too, can help reforest our environment. And, they just have an all-around good day with us.

Wood Magic is popular with educators also. Every year since the first program was offered in 1998, we have more requests for attendance than we can fill.

Department of Wood Science and Forest Products Welcome Back Picnic – Wednesday, September 5th

Faculty, Graduate Students and Undergraduate Students join us for a catered picnic at the Duck Pond!

When: Wednesday, September 5th, 5:30 – 7:30 p.m.

Where: The Duck Pond on the West Campus Drive side

What: Welcome Back Picnic, meet the faculty and new students, mix with our Career Fair Industry guests

HOW: RSVP today by:

calling Angie at 231-7107

or email Angie at ariegel@vt.edu

or drop off this form with your name to:

Angie at Brooks or Debbie in Cheatham



I will attend the Welcome Back Picnic on September 5th at the Duck Pond.

Name: _____

RSVP:

Angela Riegel
Department of Wood Science and
Forest Products

1650 Ramble Road
Virginia Tech
Blacksburg, VA 24061
p: 540.231.7107
e: ariegel@vt.edu

The Department of
Wood Science & Forest Products
at Virginia Tech

WELCOME BACK PICNIC





VT Students... our industry needs **You.**

Career Fair on the Drill Field
 50 companies, NASCAR's Ward Burton and the #4 Chevrolet
 Thursday, September 6th 9:00AM-4:00PM
www.woodscience.vt.edu

Look Who's Coming to Our Career Fair — Thursday, September 6th

The response has been great! Help us get the word out to students in your classes!

Susan Day	VT-Dept. of Forestry
Bob Smith Brian Perkins Tom Hammett	VT-Marketing Center
Bonnie Maccubbin	VT-Center for Unit Load Design
Judith Johnson	Danzer, Edinburgh, Indiana
Steve Franklin	Columbia Forest Products, Old Fort, NC
Mike Gaudreau Aaron Vaughan Janice Ketchum	Dreaming Creek Timber Frames Homes Powhatan, VA
Linda Caudill Charles Frazier	WBC—Wood-Based Composites Center
Terry Campbell Glenn Knowles	Augusta Lumber Waynesboro VA
Mike McCarthy Allison Perry	Rocky Top Building Products Rocky Mount, VA
Caroline Zito	MeadWestvaco, Glen Allen VA
Earl Kline WEI Students	WEI—Wood Enterprise Institute, VT
Timothy Hinkle	Coastal Lumber Co, Buckhannon WV
Robert Youngs	SWST—Society of Wood Science and Technology
Greg Heuer Bruce Cody	Architectural Woodwork Inst Nellysford, VA
Jan Canepari	Louisiana Pacific, Nashville, TN
Greg Lutter	Mann and Parker Lumber, New Freedom, PA
Casey Mickelson Paul McDaniel Brian Shepley	Richmond International, Glen Allen, VA
Larry Turner Christy Landon Jennie Greytak	Stanley Furniture Co Stanleytown, VA
Jeff Kern	Fortress Wood Products, Martinsville, VA
Stephanie Casen Denise Johnson George Pattmore	Swedwood Danville Danville, VA
Bob Browder Terry Roberts	Southern Pine Inspection Bureau Pensacola, FL
Lance Johnson	ISK Biocides, Inc. Roanoke, VA, Memphis, TN

Hank Goldberg Marilyn Newsome	Weyerhaeuser Heaters, WV
Paul Winistorfer	Dept. of Wood Science & Forest Products
Ashley Wright	Georgia Pacific Wood Products, Roxboro, NC
Eddie Cartee Debbie Brower	Huber Engineered Woods Commerce, GA
Mike Couture Howard Hughes	Hardwoods Specialty Products Livermore, CA
Jason Sweedyk Stuart Clontz Dana Rector	Universal Forest Products Grand Rapids, MI
James Green	VA Dept of Agriculture and Consumer Services, Richmond, VA
Judy Cisler Owen McGee	Stiles Machinery, High Point, NC
Johnette Snyder Candy Gerace Donna Bailey	Roy O. Martin Alexandria, LA
Carol Lewis	Forest Products Society, Madison, WI
Judith Araman	VT-College of Natural Resources
Janis Conklin	JELD-WEN Windows & Doors, Columbia, SC
Michelle Tuohy	Georgia Pacific, Atlanta, GA
Randy Bush	Virginia Forest Products Association
Brannon Smith Jon Frey Jim Keane	American Woodmark Corp Winchester, VA
George Thomson	Baillie Lumber Company
Randy Faulconer Bruce Kulzer Hal Tester	Hood Distribution Hattiesburg, Mississipp
Steven Bowman	Woodgrain Millwork Inc, Marion VA
Mark Vann Hal Mitchell	Atlanta Hardwood Corporation Cleveland, Georgia
Al Breland Ken Panitt	Cox Industries Orangeburg, SC
Earl Kline Anne-Collins Albimino	VT-Sloan Foundation Forest Industries
Scott Gutshall Shawna Perrin Kyle Wright	Timber Truss Housing Systems Inc Salem, VA
Bob Carter	Potomac Supply Corporation, Kinsale VA



Student Recognition and Scholarship Reception

Friday, September 7th, 2007

6:00 p.m. – 9:00 p.m.

The Inn at Virginia Tech

We invite you to join us on Friday, September 7th for a wonderful evening of recognition for our students. Scholarships and recognition of awards for the 2007–2008 academic year will be presented. Many of our scholarship sponsors and donors will be joining us for this celebration event.

The reception begins at 6:00 p.m. The scholarship and awards recognition portion of the evening will be from 6:30 – 7:00 p.m. The reception will continue until 9:00 p.m.

This event is one of many events being held during Wood Week 2007 at Virginia Tech, September 3-8, 2007. You can find a complete calendar of events for the week on-line at www.woodscience.vt.edu/woodweek that includes information on:



- Wood Magic Show
- Forest Products Career Awareness Fair
- Center for Forest Products Marketing and Management Advisory Board Meeting
- Social and Recreational Events
- Student Recognition and Scholarship Reception
- Virginia Forest products Association-Virginia Tech Forest Products Industry Technology Conference

We hope you can join us for this grand event to kick-off the academic year. Help us recognize the accomplishments of our students! These high-achieving and deserving students are the future of our industry. We look forward to seeing you at the reception.

We thank you for your continued support of our program and our students.

Warmest Regards,

Dr. Paul Winistorfer
Department Head

RSVP by August 31st to Angela Riegel
ariegel@vt.edu or 540.231.7107
www.woodscience.vt.edu/woodweek/



Virginia Forest Products Association - Virginia Tech Forest Products Industry Technology Conference September 7 - 8, 2007



The Inn at Virginia Tech • Blacksburg, VA

Preliminary Program

Friday, September 7, 2007

- 5:00 p.m. **Registration opens - Latham Ballroom Foyer**
6:00 p.m. **VFPA Reception - Wood Week at Virginia Tech Student Awards Recognition - Latham Ballroom**
Dinner - You're On Your Own . . .
Dine in the elegant Preston's Restaurant in the hotel or in one of Blacksburg's many restaurants.

Saturday, September 8, 2007 - All seminars are in the Alumni Assembly Hall

- 7:15 a.m. **Registration opens, coffee service available**
7:45 a.m. **Welcome to the Technology Conference**
Randy Bush, VFPA President, and Dr. Paul Winistorfer, Head, Dept. of Wood Science and Forest Products, VA Tech.
8:00 a.m. **Globalization of the Forest Product Industries**
8:00-8:30 a.m.: Globalization Trends and Housing: Impacts on the Forest Products Industry. (Dr. Al Schuler, Research Scientist, U.S. Forest Service, Princeton WV)
8:30-9:00 a.m.: Issues and Answers to the Impact of Transportation on the Competitiveness of the Appalachian Forest Products Industry. (Dr. Bob Smith, Professor and Interim Associate Dean for Engagement, College of Natural Resources, Virginia Tech)
9:00-9:30 a.m.: The Ins and Outs of the Port of Norfolk - What Does it Tell Us? (James Davis, Mid-Atlantic Regional Manager, Virginia Inland Port, Virginia Port Authority, Front Royal, VA)
9:30 a.m. **Question and answer session for all speakers, coffee break**
10:00 a.m. **Biofuels-Biomaterials: The Role of Renewable Energy in Our Future**
10:00-10:30 a.m.: Cellulosic Ethanol: Challenges and Opportunities. (Dr. Kevin Edgar, Professor, Department of Wood Science and Forest Products, Virginia Tech)
10:30-11:00 a.m.: Bioenergy and Biofuels Research at Virginia Tech. (Dr. Craig Nessler, Associate Dean and Director, Virginia Agricultural Experiment Station, Virginia Tech)
11:00-11:30 a.m.: The Federally Sponsored Sun Grant Initiative and Biofuels Initiative at the University of Tennessee (Dr. Tim Rials, Director of the Sun Grant and the University of Tennessee Forest Products Center)
11:30 a.m. **Question and answer period for all morning speakers**
12:00 p.m. **Lunch, Posters, VFPA Round Table Discussions - Latham Ballroom**
1:30 p.m. **Workforce Development: Human Capital for Our Industry**
1:30-2:00 p.m.: National Association of Manufacturers (NAM) Perspectives on Manufacturing. (Speaker TBA)
2:00-2:35 p.m.: Crafting a New Workforce Development Initiative in Wood Products Manufacturing at Danville Community College. (Gerald Sexton, Coordinator, Center for Advanced Manufacturing in Wood Products Technology, Danville Community College, Danville, VA)
2:35-3:10 p.m.: Developing a Workforce: Lessons from the Apprentice School in Newport News. (Dr. Robert P. Leber, Director, Education and Workforce Development, Northrop Grumman Corporation, Newport News Sector, Chairman of the Peninsula Council for Workforce Development and the Greater Peninsula Workforce Investment Board)
3:10-3:40 p.m.: The Wood Enterprise Institute at Virginia Tech: An Experimental "Concept-to-Market" Wood Products Business Start-Up by Virginia Tech Students. (Wood Enterprise students from the Department of Wood Science and Forest Products and Dr. Earl Kline, Professor and Lead Advisor to the Wood Enterprise Institute)
3:45 p.m. **Conference Wrap-Up and Adjournment**

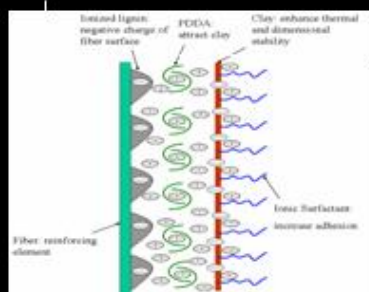
Self-Assembled Wood Macromolecule Interface Lab

Rennekar Research Group



Nanoscale Coatings on Lignocellulosic Fibers

- **Zhiyuan Lin**, PhD student
- Determined conditions to build a layered clay film on a fiber surface that serves as a "suite of armor"
- Clay film increases the thermal stability of fiber
- Next, use fiber in thermoplastic composites



Nanoscale Coatings on Wood

- **Zhou "Angela" Yu**, MS student
- Quantified amount of positively charged polymer "irreversibly adsorbed" to wood surface
- Currently, determining parameters that control coating thickness
- Next, use nanoscale coatings as adhesives



Dictating macroscopic properties of biobased materials based on the design of nanoscale structures and interfaces created through the process of adsorption and self-assembly.

Functionalized Wood

- **Li Qingqing**, PhD student
- Using self-assembled films to give wood unusual properties
- Possible areas of applications for the self-assembled films on wood: magnetism and electrical conductivity, light emitting ability, or super hydrophobicity



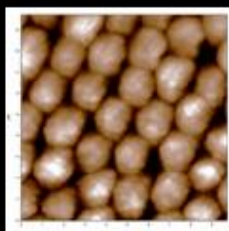
Biomimetic Wood

- **Karthik Pillai**, PhD student
- Quantified adsorption of lignin to positively charged surfaces in real time.
- Demonstrated control of isolated lignin structures at surfaces based on solution conditions
- Next, implement knowledge to create hybrid multilayer films combining lignin and nanocellulose



In development

- **Darren Riedlinger**, part-time help, Wood Adhesion Group, MS candidate
- Studying the crystallization of xylan isolated from esparto grass to form nanoparticles



Xylan Building Blocks

- **William "Travis" Church**, part-time help, MSE, undergraduate
- Developing robotic apparatus for automated film formation
- Investigating novel substrates for hybrid multilayer films

ORGANIC MATERIALS

Wood, trees and nanotechnology

The cellulose nanofibrils that are found in wood and other natural materials are similar to carbon nanotubes in many ways and could be used to strengthen composites for manufacturing.

James F. Beecher

is in the USDA Forest Service, Madison, Wisconsin
53726-2398, USA.

e-mail: jbeecher@fs.fed.us

Although the prefix 'nano' has been added to almost every contemporary concept and device, it will probably come as a surprise to readers to learn that the second International Conference on Nanotechnology for the Forest Products Industry¹ took place in June. Nearly 200 researchers from the paper- and wood-products communities gathered at the conference to discuss ways of addressing the challenges facing these industries, including overcapacity and the need for national industries to remain competitive in an international environment. Having a history of seeking technological solutions to manufacturing problems, researchers are exploring nanotechnology to solve problems that limit efficiency and to seek new value streams from forest resources.

Wood has important advantages that match current needs. It is a renewable, sustainable and carbon-neutral resource that has the potential to displace part of our petroleum-based economy with a carbohydrate-based economy. Over two-thirds of the biomass in wood could be transformed by fermentation or gasification into liquid biofuels or monomers (most commercially used monomers are presently derived from unrenowned resources). The rest consists of domains of crystalline cellulose — a glucose-based polymer that is the most abundant organic polymer on earth. These domains are made of cellulose nanofibrils that are roughly 5–20 nm in diameter and hundreds of nanometres in length² (Fig. 1). This remaining third is more resistant to being broken down, but could prove to be a useful nanomaterial.

The most common theme at the conference, which took place at Knoxville, near the Oak Ridge National Laboratory in Tennessee, involved the incorporation of various types of cellulose nanofibrils — nanocrystals, cellulose whiskers and

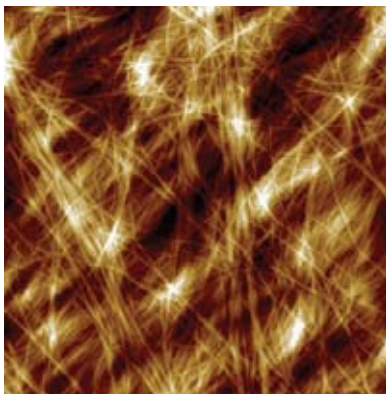


Figure 1 The cellulose nanofibrils found in wood and other organic matter could be used to strengthen nanocomposites. This atomic force microscope image² of cellulose nanofibrils in maize measures $2 \times 2 \mu\text{m}$.

nanocellulose — into polymer matrices to produce reinforced composites for manufacturing. The stiffness (145 GPa) and tensile strength (7.5 GPa) of these nanofibrils approach those of the carbon nanotubes that are currently used to reinforce materials and should also, one expects, be much cheaper to produce.

Two steps must be mastered before cellulose nanofibrils are ready for real-world applications: isolation of the nanofibrils, and their dispersion in the material to be reinforced. Most research reported at the conference used nanofibrils that had been isolated by hydrolysis of the starting materials with strong acids — which does not appear to be an environmentally or economically friendly process — or ultrasonic disintegration, which achieved only partial success. Isolation of the nanofibrils therefore remains an important area for research and development. One possible approach, suggested by William Winters (State University of New York College of Environmental Science and Forestry)

during a brainstorming session, is the use of enzymes known as cellulases, perhaps genetically modified, to isolate the nanofibrils.

Cellulose nanofibrils have hydrophilic surfaces, so they disperse most readily in water-soluble polymers such as poly(vinyl alcohol) and poly(lactic acid). However, the composites produced from these starting materials are not suitable for many applications because they are water sensitive. In hydrophobic environments, such as polypropylene, cellulose nanofibrils prefer to agglomerate rather than disperse.

Perhaps the best example was reported by John Simonsen (Oregon State) who incorporated 10% cellulose nanofibrils in poly(vinyl alcohol) and crosslinked the matrix with poly(acrylic acid). The resulting film exhibited enhanced barrier properties towards the diffusion of hydrophobic molecules (trichloroethylene vapour in this 'proof-of-concept' demonstration) plus high tensile strength, toughness and thermal stability.

The increase in the strength of the nanocomposites is due to the formation of a percolating fibre network that spans the length of the material, as explained by Alain Dufresne (Ecole Française de Papeterie et des Industries Graphiques). Dufresne and others also reported that chemical modification of the cellulose surface can, in some cases, lead to better compatibility with the hydrophobic polymers that are widely used in engineering composites. Meanwhile, Jeffrey Catchmark (Penn State) used finite-element calculations to demonstrate that the rigidity of connections between fibrils greatly affects network strength.

The structure and organization of materials at the nanoscale was another common theme at the conference, with natural composites (for example, nacre, bone and wood) often providing the inspiration³. Benny Hallam (Imerys Minerals) described how the brightly coloured wings of some butterflies are not due to pigments but to optical

effects such as interference, which are caused by the wing surface having detailed structure on length scales of the order of the wavelength of visible light. Hallam suggested ways of organizing nanomaterials to mimic these effects and produce intense colours that are difficult to achieve with pigments⁴. This could lead to very thin opaque paper coatings that could be used in lightweight paper.

Optical properties of cellulose nanofibril films were extensively described by Maren Roman (Virginia Tech). Cellulose is chiral on molecular and supermolecular levels, so these condensed films behave like liquid crystals⁵, a property that could be exploited in security features, decorative coatings, automotive windows, information storage and laser optics.

The application of nanoscale materials depends on our ability to measure and characterize them, as is the case in most manufacturing, so it is essential to develop techniques and tools that work at the nanometre scale. Two sessions at the conference were devoted to measurement techniques, and the use of nanoindentation to measure hardness and stiffness was described by five different groups. Joseph Pickel (Oak Ridge National Laboratory) elaborated on the tools and services that are available at the Center for Nanophase Material Sciences at Oak Ridge, and Altaf Carim (Department of Energy) described the user facilities provided by the Department of Energy at five national laboratories, including Oak Ridge. For example, neutron scattering could be a valuable tool for determining the distribution of fibrils in polymers.

This conference was the third major event to promote nanotechnology for the forest products industry. The ball started rolling at a workshop held near Washington DC in October 2004, which resulted in a technology roadmap⁶. The first conference was held in Atlanta, Georgia, in April 2006, and the enthusiasm of the participants at the Knoxville conference — where 16% of the delegates were from outside the US — means that a fourth event will take place next year.

References

1. www.nanotechforest.org
2. Ding, S.-Y. & Himmel, M. E. *J. Agric. Food Chem.* **54**, 597–606 (2006).
3. Parker, A. R. & Townley, H. E. *Nature Nanotech.* **2**, 347–353 (2007).
4. Vukusic, P., Hallam, B. & Noyes, J. *Science* **315**, 348 (2007).
5. Roman, M. & Gray, D. G., *Langmuir* **21**, 5555–5561 (2005).
6. *Nanotechnology for the Forest Products Industry: Vision and Technology Roadmap* (2005); www.fpl.fs.fed.us/research-highlights/nanotechnology/forest-products-nanotechnology.pdf

NANOMEDICINE

Magnetic nanoparticles hit the target

The indiscriminate inhalation of drugs during cancer treatment can adversely affect healthy tissues that surround the tumour. New studies in mice show that tiny aerosol droplets can be guided to the right spot in the lung with an external magnet.

Alidad Amirfazli

is at the Department of Mechanical Engineering, University of Alberta, Edmonton, Alberta, T6G 2G8, Canada.

e-mail: a.amirfazli@ualberta.ca

Lung cancer is one of the most common types of cancer and the number of people affected by it is on the rise worldwide. One of the main causes is the inhalation of tiny carcinogenic particles found in burning cigarettes and pollution in urban areas. Although it seems odd at first, treating lung cancer by inhaling something else — an aerosol that contains a drug — can reduce side effects associated with powerful drugs in animals¹ and humans². Although this strategy works well, drugs delivered this way can also adversely affect the surrounding healthy tissue in the lungs. Delivery methods that go straight to where they are needed are therefore much more effective, particularly for region-specific diseases like cancer. Finding new treatments is crucial because lung cancer is still difficult to diagnose and its

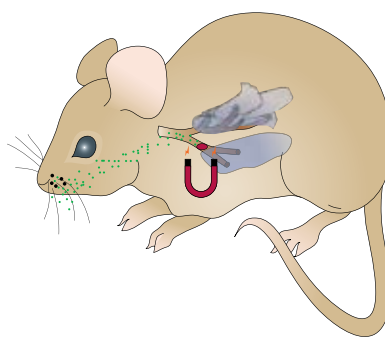


Figure 1 Magnetic-field guided drug delivery with magnetic aerosols. Superparamagnetic nanoparticles are placed in microdroplet aerosols (green) and delivered along the airways (brown) toward the lungs (grey). A localized magnetic field causes large numbers of nanoparticles to accumulate in a specific region, shown here in red.

five-year patient survival rate is among the lowest for any type of cancer.

On page 495 of this issue, Carsten Rudolph and colleagues³ at the Ludwig-Maximilians University and elsewhere in Germany show that aerosols containing magnetic nanoparticles can be guided to specific regions in the lungs of mice with an external magnetic field (Fig. 1). With this technique, higher doses of drugs can be delivered to the cancerous region without increasing side effects.

The idea of using a magnetic field to target aerosol particles to specific regions in the airways system has been demonstrated previously *in vitro* (with an analogue of the human airway system)⁴ and *ex vivo* (with an excised frog palate model)⁵. But now the feasibility of this strategy for drug delivery is demonstrated for the first time in an intact animal model. Rudolph and colleagues showed that the lung lobe subjected to the magnetic field contained 250% more particles than the lobe without the field. Furthermore, standard measures of lung health such as compliance (stiffness) and resistance remained normal when the aerosols were introduced into the lungs.

New Field for Earmarks in U.S. Goals on Energy

By JOHN M. BRODER

Published: August 18, 2007

WASHINGTON, Aug. 17 — Tucked away among the \$3.2 billion in Congressional earmarks in the recently passed energy and water spending bill is a \$4 million grant to a small company in suburban Chicago that is trying to solve the problem of capturing and storing carbon dioxide emissions.

The company, Jupiter Oxygen, which is run out of an office park near O'Hare airport, holds potentially valuable patents for burning coal cleanly but has fewer than 10 employees and sparse revenue. As a speculative venture in an embryonic field, it has little access to capital markets, traditional bank loans or federal grants.

It does, however, have powerful friends in Congress, including Representatives Peter J. Visclosky, Democrat of Indiana, and Joe L. Barton, Republican of Texas, who sponsored the earmark and who together have received more than \$41,000 in campaign donations from Jupiter Oxygen executives. In all, company officials and family members have given political donations of at least \$150,000 in recent years.

The case of Jupiter Oxygen is an example of how companies in a variety of energy-related businesses, solar, biofuels and wind power, are lining up at the federal trough as the government shovels out billions of new dollars to reduce the nation's dependence on foreign oil and combat global warming.



Mark Schoenfield of Jupiter Oxygen says earmarks play a vital role in financing.

Enthusiasts call it cutting-edge research on a crucial national priority. Critics of this new genre of federal spending call it “green pork.”

Republicans who opposed the House energy and tax bills that passed 12 days ago say they are larded with giveaways for pet projects in the form of new bonding authority, grants, loan guarantees, tax subsidies and public-private partnerships. When Republicans ran Congress, Democrats accused them of showering billions of dollars on their own favored industries, chiefly oil, gas, utilities and farm-belt ethanol projects.

The new emphasis on renewable and clean energy means a bonanza for windmill builders, energy auditors, cellulosic ethanol distillers, makers of photovoltaic cells and clean coal entrepreneurs.

“All these new technologies are being moved up to the front of the line,” said Frank Maisano, an energy lobbyist with the law firm Bracewell & Giuliani who has represented utilities, wind power firms, oil companies and automakers. “Nobody knows who's going to benefit completely and there's a lot of uncertainty about whether this stuff will make it to the finish line at all.”

The federal government has financed research and development of energy technology and alternative fuels for decades, often focusing on basic science, and has a mixed record of incubating winners, including some widely used technologies. Today, because of the growing consensus that the nation must wean itself from imported oil and sharply curb climate-altering carbon emissions, new energy options are in vogue.

Earlier this year, Poet, an ethanol producer based in South Dakota, received a grant from the Department of Energy of up to \$80 million to produce cellulosic ethanol fuel from corn cobs and other corn fibers in Emmetsburg, Iowa. The company, the nation's second-largest ethanol producer (after Archer Daniels Midland, the agribusiness giant), included hundreds of pages of technical and financial information in its application — plus letters of support from 38 members of Congress and dozens of local officials.

“Ethanol is an opportunity for rural development and reducing our dependency on foreign oil,” said Mark Stowers, vice president for research and development at Poet, which used to be known as Broin Companies. “That's the real reason people wanted to write letters to support the project.”

The SunPower Corporation, a leading solar power company in San Jose, Calif., recently received a \$20 million grant under the federal government's new Solar America Initiative to try to cut in half within five years the cost of installing residential solar power.

Competing against titans like BP Solar, General Electric and Boeing, SunPower received the largest single grant, said Julie Blunden, vice president for public policy. Ms. Blunden estimated the company's total revenues at \$750 million this year.

Jupiter Oxygen, for its part, is trying to show that burning coal at ultrahigh temperatures using nearly pure oxygen can play a major role in reducing the carbon emissions that scientists say are the chief culprit in the warming of the planet.

The company is building a five-megawatt facility to test whether its largely unproven technology can work on a commercial scale.

Mark Schoenfield, Jupiter Oxygen's senior vice president and general counsel, said the company held patents on parts of the process and had been working with the Department of Energy's National Energy Technology Laboratory to advance its work.

Mr. Schoenfield said that most of the money for the company's work had come either from the Congressional earmarks or from its founder, Dietrich Gross, who uses the oxygen fuel technology at an aluminum recycling facility he owns in Hammond, Ind., (which is in Mr. Visclosky's Congressional district). He said there was little money available from banks or venture capitalists for work that, at this point, is speculative.

"Traditional private financing sources are not interested in the extent of funding necessary," Mr. Schoenfield said in an e-mail message.

The \$4 million earmark for Jupiter Oxygen's project in the current budget is its third helping of federal assistance, company officials said. In 2005, it received \$600,000 for research on retrofitting a coal plant in Ohio. Last year, the company got \$7.8 million for work on high-temperature combustion of coal in Indiana and lignite, a form of dirty-burning coal, in Texas. Two Ohio Republicans, Representatives Ralph Regula and David L. Hobson, wrote those earmarks.

Harold Green, Jupiter Oxygen's chief spokesman, said the company had had little success in winning Department of Energy grants because, he said, the agency preferred dealing with larger, established companies.

"We don't have the resources the big companies have," Mr. Green said. "The only place we have to go is Congress. It's easy to talk to members of Congress."

The company employs two lobbyists. One of them, Andrew Quinn, a former aide to Representative Steny H. Hoyer, Democrat of Maryland and the House majority leader, says his expertise is in securing federal money for clients. The other, Thomas J. Corcoran, is a former Republican congressman from Illinois who served on the House Energy and Commerce Committee.

Mr. Schoenfield said his company's campaign contributions were "absolutely not" an incentive or reward for the earmarks. "You support the people who support the projects you believe in," he said.

An aide said Mr. Barton was traveling and could not be reached to comment. Mr. Visclosky's office did not return repeated calls seeking comment.

Mr. Regula claimed credit for his role in steering money to Jupiter Oxygen in a 2006 company press release. "I am pleased to have been in a position to help secure the initial funding for this project," he said.

Thomas Feeley, a manager at the Department of Energy's technology laboratory, has worked with Jupiter Oxygen and other companies using oxygen technology to reduce power plant emissions. Mr. Feeley said that the approach was one of several the agency was exploring. He said that Jupiter went through the same scrutiny as any firm competing for federal money. He said that Jupiter's work was promising, but that there was no assurance it would bear fruit.

"Many carbon capture technologies are at a very early stage," Mr. Feeley said. "It's way too early to pick winners at this point in time. We are trying to keep a broad portfolio of options."

Opening of New Bio-PDOTM Facility in Tennessee Continues Biotech Revolution

By Carl Wolf, BCS, Incorporated

DuPont Tate & Lyle Bio Products opened a 100 million dollar facility on June 8, 2007 in Loudon, Tennessee, currently one of the largest renewable materials facilities in the world. It is the first facility of its kind that produces propanediol (Bio-PDO™) from corn sugar, rather than from the traditional petroleum-based feedstocks. In its traditional form, PDOTM is a skin irritant, has unknown toxicity in several situations, and has the potential to contaminate groundwater. In its biomass incarnation, Bio-PDOTM is not toxic, and environmentally friendly. The American Chemistry Society recognized this tremendous achievement by awarding the 2007 Heroes of Chemistry Award to the scientists involved in the research and development of Bio-PDO™ – Charlie Nakamura and Cathy Babowitz of DuPont, Dennis Adkesson of Tate & Lyle, and Gregg Whited of Genencor International. The award recognizes the vital role industrial chemical scientists have in improving human welfare through successful commercial innovations and products. Secretary of Energy Samuel Bodman commended this accomplishment further and said, “It’s encouraging to see industry team up to make incredible advances in bio-based technology, building upon the Department of Energy’s efforts to reduce our reliance on imported oil, aggressively confront climate change, and help maintain our nation’s competitive !! edge in the global marketplace.”

Together, DuPont and Tate & Lyle were able to create a unique proprietary fermentation and purification process to produce propanediol that is useful while environmentally friendly. Comparison of life cycle assessment of chemically derived propanediol versus renewably sourced Bio-PDO™ showed significant environmental benefits. The production of propanediol from corn sugar consumes about 40 percent less energy and reduces greenhouse gas emissions by about 20 percent versus petroleum-based feedstock. This means that if the plant is able to meet its projected annual output of 100 million pounds of Bio-PDO™, it will save the energy equivalent of ~10 million gallons of gasoline per year, enough to fuel 22,000 cars annually. As DuPont Tate & Lyle Bio Products President Steven Mirshak puts it, “the Loudon Bio-PDO™ production process is on the leading edge of industrial biotechnology.” Mirshak adds that the facility is quickly growing into a business that delivers high performing, renewable products to diverse markets globally – the goal and vision of its parent companies.

Bio-PDO™ is available in two grades, both of which are biodegradable: Zemea™ and Susterra™. Zemea™ is a colorless glycol derived from sustained, renewable corn sugar fermentation. It can be used in cosmetic and personal care formulations to replace glycols such as propylene glycol and butylene glycol. It has a higher purity level and lower irritation than other competitive personal care and cosmetics products. According to DuPont Tate & Lyle, “clear shampoo formulations have very low cloud points, excellent stability, improved foaming, and require less salt to adjust the viscosity as compared to other glycols.” Susterra™ is a glycol used for industrial applications such as de-icing fluids, anti-freeze and heat transfer fluids. DuPont Tate & Lyle recently announced it was partnering with Cryotech Deicing Technology to launch a new de-icing product that will be 100 percent renewable and will immediately be marketed to the aviation industry. When used in polymer applications, Susterra™ propanediol is used for the manufacture of polyester-based resins and as a cross linker in urethane chemistries. Other grades of Bio-PDO™ that utilize the unique properties of Susterra™ propanediol are DuPont™ Sorona® and DuPont™ Cerenol™. According to DuPont Tate & Lyle, these products are currently being used in a wide variety of segments such as automotive, engineering polymers, fibers and coatings. Mirshak said, “We are seeing strong demand for all of our grades of Bio-PDO™ due to its performance, biodegradable nature, and ability to replace petroleum-derived products. Wherever a glycol is being used today, businesses should consider replacing it with our new renewable ingredient.”

Bio-PDO™ is just one example of the innovative efforts undertaken by industry to develop new products from non-petroleum sources such as plants. Federal and state governments, along with the private sector, are not only realizing the ways to use biobased products in an efficient manner, but are utilizing new technology to create more diverse, energy-efficient products. Brent Erickson, an executive vice president at the Biotechnology Industry Organization in Washington, D.C., stated that while DuPont and Tate & Lyle are not alone in the effort to create more energy-efficient products, the commercialization of their Loudon plant is a significant development in the biotech revolution that began 20 years ago in medicine and then agriculture about a decade ago. “It has gone beyond the doctor’s office into consumer goods and other products that we never imagined,” he said.

Biomass Gas & Electric to Build Largest Wood-Fired Power Generating Plant in U.S.

Biomass Gas & Electric Company LLC (BG&E), an Atlanta-based renewable energy company, announces plans to build the largest waste wood-fired power generating plant in the U.S. using advanced gasification. BG&E has signed a power purchase agreement to provide Progress Energy Florida with 75 megawatts of electricity. This will be produced in an environmentally friendly plant using advanced technology to convert a wide range of woody biomass and wood wastes to electric power in an oxygen-free environment.

Atlanta, GA (PRWEB) August 20, 2007 -- Biomass Gas & Electric Company announces plans to build the largest waste wood-fired power-generating plant in the U.S. BG&E recently signed a 20-year Power Purchase Agreement (PPA) with Progress Energy Florida to provide the utility with electric power. A 75-megawatt renewable energy plant will be built on a Florida site to be determined.

BG&E's advanced technology uses a two-step process. First, the wood biomass is superheated in an oxygen-free environment to produce a synthetic gas. The gas powers a turbine to generate electricity.

Heat from that process is captured in a second system, which uses the steam to run a generator and produce additional power. This highly efficient and extremely low-emission process, called combined cycle, offers a significant power production alternative that is both cost-competitive and environmentally friendly.

In a joint announcement with BG&E and Progress Energy, Florida Governor Charlie Crist hailed the agreement saying, "This partnership is another example of the tremendous opportunities that are available in going green."

"We have a long history of supporting innovative technologies and promoting cost-effective, cleaner energy sources," said Jeff Lyash, president and CEO of Progress Energy Florida. "Renewable energy sources, such as this one, play a vital role in our balanced approach to managing Florida's growing energy needs."

"We are excited about this opportunity. The southeast is the most biomass-rich area of the United States. Any comprehensive plan for energy production should include renewable energy, and biomass must be an integral part of that plan," said Glenn Farris (photo on right), president and CEO of Biomass Gas & Electric. "It has been a pleasure to work with an industry leader such as Progress Energy Florida, providing clean and sustainable energy resources to assist with the state's future power needs."

The Progress Energy contract is the third signed by BG&E. Previous agreements were signed with the city of Tallahassee, Fla. and Georgia Power Company.

BG&E is a 6-year-old Atlanta based company managed by some of the most experienced personnel in the country in biomass energy production. BG&E is recognized as a national leader in biomass power production.

For more information about BG&E, see www.biggreenenergy.com

For more information about Progress see www.progress-energy.com

For further information or to schedule an interview with Glenn Farris, BG&E CEO, contact Harry Nolan at (404) 202-5109.

