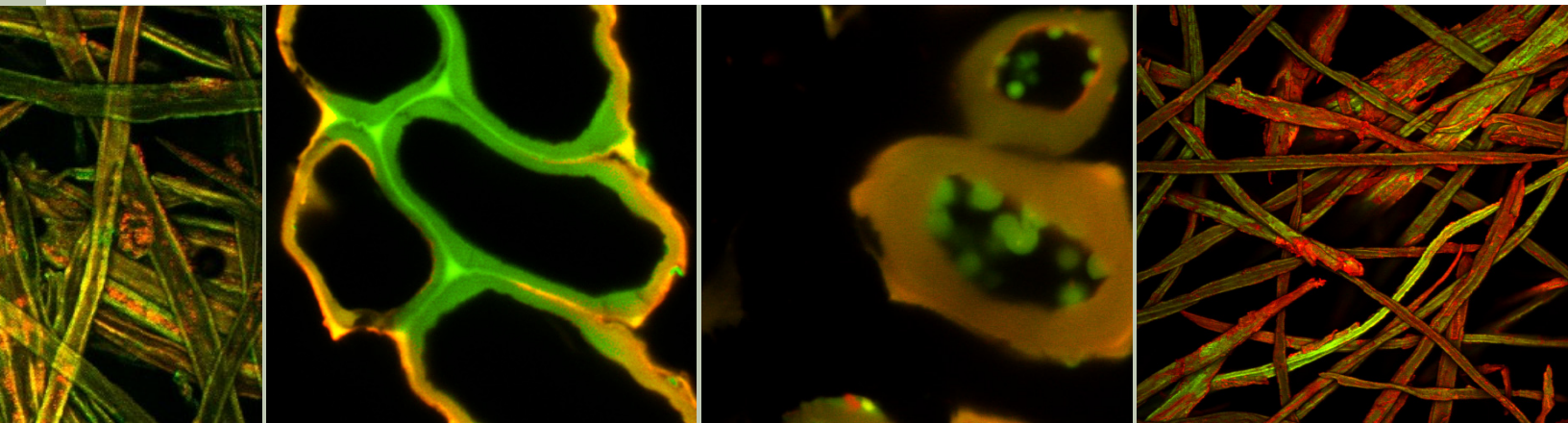




International Conference on  
**Wood Adhesives**

September 28-30, 2009  
Lake Tahoe, Nevada, USA



## Join the discussion about the development and utilization of wood adhesives.

The 9th in a series of conferences dedicated to the exchange of information and ideas about research on wood adhesives, adhesion to wood, and new bonded-wood products. The **2009 International Conference on Wood Adhesives** provides a forum for discussions among researchers, producers, and consumers of wood adhesives and acts as a catalyst for new research on wood adhesives and on new concepts for using adhesives to bond wood to itself and to non-wood materials.

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Register online

[www.WoodAdhesivesConference.org](http://www.WoodAdhesivesConference.org)

# Conference at a Glance

## Monday, September 28

Plenary Session		Perspectives	International Perspective		
8:30 - 8:40	Welcome	11:05 - 11:45	The CARB Rule: Driving Technology to Improve Public Health	2:25 - 2:50	Measurement of Significant Native Formaldehyde Generated During Wood Composite Panel Production
8:40 - 8:45	Introduction by Session Moderators	11:45 - 12:00	Questions & Answers	2:50 - 3:00	Questions & Answers
8:45 - 9:25	Development and Application of Wood Adhesives in China	12:00 - 1:30	Luncheon	3:00 - 3:20	Refreshment Break
9:25 - 10:05	State of the North American Wood Composites and Wood Adhesives Markets	<b>Session 1A: Environmental</b>		3:20 - 3:45	Reduction of Formaldehyde Emission from Particleboard Panels: Evidence for a Threshold Effect due to Remaining UF Resin
10:05 - 10:25	Coffee Break	1:30 - 1:35	Introduction by Session Moderators		
		1:35 - 2:00	Impact of Green Building on Wood Adhesives		
10:25 - 11:05	North American Resin Suppliers' Green	2:00 - 2:25	CARB Formaldehyde Emission Standards: An	3:45 - 4:10	Do Non-Formaldehyde Emitting Products Have to

## Tuesday, September 29

Session 2A: Resin Chemistry I		Resins as Adhesives in MDF Manufacturing			
8:20 - 8:25	Introduction by Session Moderators	9:40 - 9:50	Questions & Answers	11:25 - 11:50	Radiation and Dual Radiation-Thermal Cure Adhesives for Wood Composites
8:25 - 8:50	An Overview on Flame-Retardant Structural Wood Adhesives	9:50 - 10:10	Coffee Break	11:50 - 12:00	Questions & Answers
8:50 - 9:15	Development of Fire-Resistant Polyurethane Structural Wood Adhesives	10:10 - 10:35	Optimization of the Glass Transition Temperature and Cure Regime for Structural Timber Adhesives used for On Site Bonding	12:00 - 1:30	Luncheon
9:15 - 9:40	Effect of Nano-Clay on the Dynamic Mechanical Properties of Resin Film	10:35 - 11:00	Effect of Curing Procedure on pH and Alkalinity or Acidity of Wood Adhesives		
		11:00 - 11:25	Effects of Esters and Resorcinol on Phenolic		
Session 2B: Composites		as an Adhesive for Bagasse Particleboard			
8:20 - 8:25	Introduction by Session Moderators	9:40 - 9:50	Questions & Answers	11:25 - 11:50	Application of Fundamental Fire-Adhesive Interactions in the Manufacture of MDF
8:25 - 8:50	The Evolution of Composite Panel Resin Technology	9:50 - 10:10	Coffee Break	11:50 - 12:00	Questions & Answers
8:50 - 9:15	Soy Containing High Quality CARB II Compliant PB and MDF	10:10 - 10:35	Resins from Soybean Oil-Based Additives for Natural Fiber Sheet Molding Compound (SMC) Composites: Synthesis and Characterization	12:00 - 1:30	Luncheon
9:15 - 9:40	Producing Panels with Formaldehyde Emission at Wood Levels	10:35 - 11:00	Utilization of Plantation Wood in High Performance Wood-Based Structural Composites		
		11:00 - 11:25	Utilization of Chitosan		

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	be Produced with Non-Formaldehyde Adhesives?		Manufacturing and Economical Production with Lot Size One
4:10 - 4:35	Production of Low Formaldehyde Emission UF Resins	3:45 - 4:10	Ultrasonic Atomization of Resins for Bio-Based Composites Industry: Opportunities, Challenges & Limitations
4:35 - 5:00	AsWood™ – Technologies for Composite Boards with Formaldehyde Emissions as Defined by Nature	4:10 - 4:35	Thermal Behavior of Polyurethane Adhesives Bonded to Wood
5:00 - 5:10	Questions & Answers		
<b>Session 1B: Applications I</b>			
3:15 - 3:20	Introduction by Session Moderators	4:35 - 5:00	Temperature Dependent Strength of Adhesively Bonded Timber Joints
3:20 - 3:45	Ultra Fast Structural 2K Adhesives: Continuous	5:00 - 5:10	Questions & Answers

Monday, September 28  
5:00 - 8:00

**Reception with Exhibitors and Poster Presenters**

A Monday evening reception will feature poster presentations and exhibits by suppliers of materials, equipment, products, and technical services related to the wood adhesives industry.

See page 14 for a list of poster presentations.

<b>Session 3A: Resin Chemistry</b>				
1:30 - 1:35	Introduction by Session Moderators	2:50 - 3:00	Prepolymers and Formulated Adhesives	Strength Development Dynamics with the ABES Technique
1:35 - 2:00	Development of Liquefied Bark Phenolic Resin for Composite Wood Product Applications	3:00 - 3:10	Questions & Answers	4:35 - 5:00 High Temperature Performance of Structural Soy Adhesives
2:00 - 2:25	Improved CARB II Compliant Soy Adhesives for Laminates	3:20 - 3:45	Refreshment Break	5:00 - 5:10 Questions & Answers
2:25 - 2:50	Investigation on the Structure-Property Relationships of One Component Polyurethane	3:45 - 4:10	Morphological Properties of Moisture-Cure Polyurethane Wood Adhesives	
		4:10 - 4:35	Performance of 1K Polyurethane in Comparison to Other Wood Adhesives	
			A Standard Protocol for Testing Adhesive Bond	
<b>Session 3B: Modeling</b>		2:50 - 3:00	Questions & Answers	Blending Process: Input Parameters and Verification
1:30 - 1:35	Introduction by Session Moderators	3:00 - 3:20	Refreshment Break	4:35 - 5:00 Mechanical and Dielectric Response of Thermosetting Wood Adhesives During Cure
1:35 - 2:00	Modeling the Bond Strength Development in Particleboard and MDF	3:20 - 3:45	Predicting the Strength of Adhesively Bonded Timber Joints Using a Probabilistic Method	5:00 - 5:10 Questions & Answers
2:00 - 2:25	Mechanistic Modeling of Bonding Characteristics and Properties of Wood Composites	3:45 - 4:10	Numerical Modeling and Experiments on the Role of Strand-to-Strand Interface Quality on the Properties of Oriented Strandboard	
2:25 - 2:50	Wood-Adhesive Bonding Failure: Modeling and Simulation	4:10 - 4:35	Discrete Element Modeling (DEM) of the Rotary Drum	

# Conference at a Glance, cont.

## Wednesday, September 30

<b>Session 4A: Bio-Based</b>		9:50 - 10:10	<b>Coffee Break</b>		<b>Polyurethane from Liquefied Kenaf Core for Wood Laminating Adhesive</b>
8:20 - 8:25	<b>Introduction by Session Moderators</b>	10:10 - 10:35	<b>Comparing Soy Protein Isolate and Wheat Gluten as Bio-Based Binders for the Wood Industry</b>	11:50 - 12:00	<b>Questions &amp; Answers</b>
8:25 - 8:50	<b>Optimizing the Reactivity of Soy Proteins in Wood Resins</b>	10:35 - 11:00	<b>Protein Hybrid Adhesives: Chemical Characterization and Reaction Mechanisms</b>	12:00 - 1:30	<b>Luncheon</b>
8:50 - 9:15	<b>Soy Adhesive – Moisture Interactions</b>	11:00 - 11:25	<b>Protein Hybrid Adhesives: Adhesive Performance, Formulation Latitude, and Chemical Structure</b>	<b>Session 5A: Analytical</b>	
9:15 - 9:40	<b>Soy Latex Like Adhesive for Wood Veneer Applications</b>	11:25 - 11:50	<b>Production of</b>	1:30 - 1:35	<b>Introduction by Session Moderators</b>
9:40 - 9:50	<b>Questions &amp; Answers</b>			1:35 - 2:00	<b>Small Specimen Wood-Rheology: A Tool to Understand HMR Coupling Mechanism</b>
<b>Session 4B: Engineered Wood</b>			<b>Woods in the Field of Engineered Wood Products</b>		<b>Structural Application</b>
8:20 - 8:25	<b>Introduction by Session Moderators</b>	9:40 - 9:50	<b>Questions &amp; Answers</b>	11:25 - 11:50	<b>Reinforcement of Laminated Beam Bond Lines with Interposed Metal Resistive Heating Networks</b>
8:25 - 8:50	<b>Block Shear and Flexure Testing to Examine the FRP-Wood Bond Interface</b>	9:50 - 10:10	<b>Coffee Break</b>	11:50 - 12:00	<b>Questions &amp; Answers</b>
8:50 - 9:15	<b>Evaluation of Adhesive Bonds in Glulam Posts with Thermally Modified Spruce</b>	10:10 - 10:35	<b>Ductile Adhesively Bonded Timber Joints</b>	12:00 - 1:30	<b>Luncheon</b>
9:15 - 9:40	<b>Innovative Programs Led in France to Promote the Use of Domestic</b>	10:35 - 11:00	<b>Low Intrusion Techniques for Strengthening of Timber Structures in Reconstruction</b>	<b>Session 5B: Applications II</b>	
		11:00 - 11:25	<b>Flat Wise Green Gluing of Norway Spruce for</b>	1:30 - 1:35	<b>Introduction by Session Moderators</b>
				1:35 - 2:00	<b>Dependence of Strength</b>

## Why should I attend?

This is the 9<sup>th</sup> in a series of conferences dedicated to the exchange of information and ideas about research on wood adhesives, adhesion to wood, and new bonded-wood products. The **2009 International Conference on Wood Adhesives** provides a forum for discussions among researchers, producers, and consumers of wood adhesives and will act as a catalyst for new research on wood adhesives and on new concepts for using adhesives to bond wood to itself and to non-wood materials. The conference is held in conjunction with ASTM D 14 Wood Adhesives Committee on October 1, 2009 and with the Wood-Based Composites Center-NSF I/UCRC Planning Meeting on October 1 and 2.

See registration on page 6 or visit [www.WoodAdhesivesConference.org](http://www.WoodAdhesivesConference.org).

## Who should attend?

This conference will be of direct benefit to researchers and research planners concerned with the development and utilization of wood adhesives. It will also serve as an extremely useful forum for suppliers and users of wood adhesives, suppliers of chemicals to the adhesives industry, and manufacturers of equipment used in the production and analysis of bonded wood products. See registration on page 6 or visit [www.WoodAdhesivesConference.org](http://www.WoodAdhesivesConference.org).

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2:00 - 2:25	<b>Characterizing pMDI Reactions with Wood Cell Walls. Part I: High-Resolution Solution-State NMR Spectroscopy</b>	3:45 - 4:10	<b>Diffusion Processes at Glue Joints of Wood-Based Materials Evaluated by Means of Neutron Imaging</b>
2:25 - 2:50	<b>Investigation of PF Adhesive Penetration in Wood by Micro X-ray Tomography</b>	4:10 - 4:35	<b>Sophisticated Analyses of Low Emission Resins</b>
2:50 - 3:00	<b>Questions &amp; Answers</b>	4:35 - 5:00	<b>Rheological Characterization of Wood Adhesives and Droplet Size Prediction</b>
3:00 - 3:20	<b>Refreshment Break</b>	5:00 - 5:10	<b>Questions &amp; Answers</b>
3:20 - 3:45	<b>3D Characterization of Adhesives Penetration into Wood by Means of Synchrotron Radiation</b>		



	<b>Values of Glued Wood Bonds on Specimen Geometry</b>		<b>Formaldehyde Resin by Co-polymerization Modification</b>	4:35 - 5:00	<b>Development of Floor Tiles from Philippine Bamboos</b>
2:00 - 2:25	<b>Glued Laminated Timber-Shear Test of Glue Lines</b>	3:45 - 4:10	<b>Adhesive Application of Liquefied Green and Mountain-Pine Beetle Infested Lodgepole Pine Barks</b>	5:00 - 5:10	<b>Questions &amp; Answers</b>
2:25 - 2:50	<b>Development of Liquefied Lignin Phenolic Resin for Composite Wood Product Applications</b>				
2:50 - 3:00	<b>Questions &amp; Answers</b>	4:10 - 4:35	<b>Identification and Comparison of the Extractives Chemical Compounds in Natural and Planted Cypress Tree by GC/MS</b>		
3:00 - 3:20	<b>Refreshment Break</b>				
3:20 - 3:45	<b>Study on the Bonding Property of Melamine and Urea-</b>				

Continental Breakfast served at 7:30 am on all three days of the Conference

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# Registration Information

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## Fees

### REGULAR ATTENDEE FEE

The regular attendee fee is **\$595 USD** per person and includes conference materials, all sessions, three continental breakfasts, three luncheons, six coffee/refreshment breaks, and one reception.

### STUDENT FEE (full-time ; ID required)

The student registration fee is **\$195 USD** per person and includes conference materials, all sessions, three continental breakfasts, three luncheons, six coffee/refreshment breaks, and one reception.

### GROUP RATES

To register four or more attendees, group discounts are available. Please contact the Forest Products Society for details at 608-231-1361, ext. 208 or [conferences@forestprod.org](mailto:conferences@forestprod.org).

The onsite registration desk will be located in the Convention Center of Harveys Resort Hotel & Casino. Registration desk hours will be: Sunday, September 27 from 3:00-7:00 pm and Monday, September 28 –Wednesday, September 30 from 7:00 am-5:00 pm.

### CANCELLATIONS

Full refunds for cancellations will be given if requested by mail, e-mail, phone, or fax by September 14, 2009. A charge of 15% of the registration fee will be incurred if the cancellation is made between September 15-21, 2009. NO REFUNDS will be given after September 21, 2009. Attendees may be substituted at any time at no charge.

### MONDAY EVENING RECEPTION

A Monday evening reception on September 28 will feature poster presentations and exhibits by suppliers of materials, equipment, products, and technical services related to the wood adhesives industry.

### SPONSORSHIP OPPORTUNITIES

Sponsorship opportunities are available for special recognition during the conference. Conference literature will include sponsor logos. Various levels of sponsorship are available, starting from \$750. Please visit [www.WoodAdhesivesConference.org](http://www.WoodAdhesivesConference.org) or contact the Forest Products Society for details at 608-231-1361, ext. 208 or [conferences@forestprod.org](mailto:conferences@forestprod.org).

### EXHIBIT SPACE

The cost for each exhibit space (display table) is \$575 USD. A reception with exhibitors will take place on Monday, September 28 at 5:30-8:00 pm. Exhibits will remain on display for the duration of the conference until Wednesday afternoon. Exhibit space includes one 6-foot skirted display table, plus electrical hookup and one complimentary conference registration. If you would like to reserve a display table, please fill out and return the enclosed registration form.

### POSTER PRESENTATIONS

Poster presentation spaces are still available. The poster session will take place on Monday, September 28 from 5:30-8:00 pm, during an informal reception. The posters will remain on display until Wednesday afternoon. The poster session will consist of poster presentations by individuals who are stationed at a booth space similar to a typical exhibit booth. Each space contains a draped table and a 4- by 8-foot posterboard on which an abstract, key points, conclusions, charts, and diagrams are posted. If you believe you have technical materials suitable for a poster presentation (no commercial materials accepted), please contact the Forest Products Society at 608-231-1361, ext. 208 or [conferences@forestprod.org](mailto:conferences@forestprod.org). You may also submit your request for a poster presentation online at [www.WoodAdhesivesConference.org](http://www.WoodAdhesivesConference.org). Poster presentations will be accepted based upon a review of their suitability to the objectives of the conference and on the availability of space.

### PROCEEDINGS OF PRESENTATIONS AT THE CONFERENCE

A complete proceedings of all presentations given will be prepared following the conference. Attendees will be notified when the proceedings are available and can purchase a copy at cost.

# Registration Form

SAVE \$75 on registration. Register by SEPTEMBER 14 at [www.WoodAdhesivesConference.org](http://www.WoodAdhesivesConference.org)

The 2009 International Conference on Wood Adhesives  
Harveys Resort Hotel & Casino  
Lake Tahoe, Nevada, USA  
September 28-30, 2009

Please mail registration to:  
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Madison, WI 53705-2295 USA  
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## REGISTRATION FEES – Register early and save through September 14!

Regular attendee (\$595 USD) \_\_\_\_\_

Student (\$195 USD) (full-time student; ID Required) \_\_\_\_\_

Exhibit space (\$575 USD) \_\_\_\_\_

Late fee (\$75 USD) (after September 14) \_\_\_\_\_

TOTAL \_\_\_\_\_

## I'D LIKE TO BECOME A SPONSOR

Yes, I'd like to become a sponsor.  
Please contact me about sponsorship opportunities.

## IMPORTANT!

Please indicate which concurrent sessions you will be more likely to attend:

Session 1A - Environmental  Session 1B - Applications I

Session 2A - Resin Chemistry I  Session 2B - Composites

Session 3A - Resin Chemistry II  Session 3B - Modeling

Session 4A - Bio-Based  Session 4B - Engineered Wood

Session 5A - Analytical  Session 5B - Applications II

## SPECIAL NEEDS

If you have any special needs, such as a special diet, or needs related to sight, hearing, or physical mobility, please give a brief description of these needs below. Early notification will enable us to more efficiently accommodate your needs. Special Needs:

## MY EMPLOYMENT AREA IS:

Architect  Association  Consulting/Technical  Education/Consulting  Education/Extension  Engineer

Government  Mfr. of Wood-Based Product  Publisher  Research  Retired  Student  Supplier  Other

## METHOD OF PAYMENT

Payment in U.S. funds or purchase order must accompany registration form. Make checks payable to the Forest Products Society. You may order through your Visa, MasterCard, Discover, or American Express by supplying the information requested below.

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# Conference Information

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## CONFERENCE CO-CHAIRS

**Charles R. Frihart**, Head of Wood Adhesives Science & Technology, Performance Enhanced Biopolymers, USDA Forest Products Laboratory, Madison, Wisconsin, USA;

**Christopher G. Hunt**, Research Chemist, Performance Enhanced Biopolymers, USDA Forest Products Laboratory, Madison, Wisconsin, USA;

**Robert J. Moon**, Materials Research Engineer, USDA Forest Products Laboratory, Madison, Wisconsin, USA, and Adjunct Assistant Professor, Birck Nanotechnology Center and School of Materials Engineering, Purdue University, West Lafayette, Indiana, USA

## PLANNING COMMITTEE MEMBERS AND SESSION MODERATORS

**Michael J. Birkeland**, R&D Project Manager, HRT-Ashland, Edgerton, Wisconsin, USA;

**Nicole R. Brown**, Assistant Professor of Wood Chemistry, Penn State University, University Park, Pennsylvania, USA;

**Zhiyong Cai**, Material Research Engineer, USDA Forest Products Laboratory, Madison, Wisconsin, USA;

**Chunping Dai**, Senior Scientist and Group Leader, FPInnovations – Forintek Division, Vancouver, British Columbia, Canada;

**Manfred Dunky**, Manager, Research & Application Technology, Kronospan GmbH, Lampertswalde, Germany and Lecturer, Wood-Based Panels & Adhesives, Inst. of Wood Science & Technology, University of Natural Resources & Applied Life Sciences, Vienna, Austria;

**Charles E. Frazier**, Thomas M. Brooks Professor, Dept. of Wood Science & Forest Products, Virginia Tech, Blacksburg, Virginia, USA;

**Douglas J. Gardner**, Professor, Advanced Engineered Wood Composites Center and School of Forest Resources, University of Maine, Orono, Maine, USA;

**Warren J. Grigsby**, Science Leader, Scion, Rotorua, New Zealand;

**David P. Harper**, Assistant Professor, Forest Products Center, University of Tennessee, Knoxville Tennessee, USA;

**Philip E. Humphrey**, President, Adhesive Evaluation Systems, Inc., Corvallis, Oregon, USA;

**Fred A. Kamke**, JELD-WEN Professor of Wood-Based Composite Science, Dept. of Wood Science & Engineering, Oregon State University, Corvallis, Oregon, USA;

**Winford T. Liles**, R&D Director, Huber Engineered Woods, Commerce, Georgia, USA;

**Joseph J. Marcinko**, Principal Scientist, Advanced Biopolymer Technologies, Mantua, New Jersey, USA;

**Richard M. Rammon**, R&D Program Manager, Georgia-Pacific Chemicals, LLC, Decatur, Georgia, USA;

**Klaus Richter**, Head, Wood Laboratory, EMPA, Swiss Federal Laboratories for Materials Testing & Research, Duebendorf, Switzerland;

**Robert G. Schmidt**, Senior Vice President – Research & Technology, Arclin, Mississauga, Ontario, Canada;

**Kay-Uwe Schober**, Professor in Timber Engineering & Structural Design, Mainz University of Applied Sciences, Mainz, Germany;

**Milan Sernek**, Associate Professor, Dept. of Wood Science & Technology, University of Ljubljana, Ljubljana, Slovenia;

**Magdalena Sterley**, Researcher, SP Technical Research Inst. of Sweden, SP Wood Technology, Stockholm, Sweden;

**Xiuzhi (Susan) Sun**, Professor, Dept. of Grain Science & Industry, Kansas State University, Manhattan, Kansas, USA;

**Ken Van Langenberg**, Team Leader, Wood Adhesives & Composites, CSIRO Materials Science & Engineering, Melbourne, Australia

**DATE AND LOCATION**

September 28-30, 2009

Harveys Resort Hotel & Casino

18 Highway 50

Lake Tahoe, NV 89449 USA

[www.harveystahoe.com](http://www.harveystahoe.com)

Reservations: 800-455-4770 (Group Code: Harveys Lake Tahoe S09FPS)

Online Reservations: <http://www.harrahs.com/CheckGroupAvailability.do?propCode=HLT&groupCode=S09FPS>

**HOTEL ACCOMMODATION**

The host hotel for the convention is Harveys Resort Hotel & Casino. Like a fine wine, some things get better with age. Harveys was the first hotel-casino to be built in South Lake Tahoe, and it's still the best place to stay and play on the Lake. Located near crystal clear waters and majestic mountains, you'll find our wonderful, newly renovated Four-Diamond hotel and casino. Harveys has state-of-the-art guestrooms, spectacular restaurants, live entertainment, luxurious spas and saunas, a fitness center, and a world-class casino. With the best in amenities, gaming, shopping, and entertainment, Harveys Lake Tahoe is your perfect getaway.



A block of rooms has been reserved at Harveys at a special group rate of \$109 + tax (single or double occupancy) for Sunday-Thursday

night (September 28 - October 1); \$189 + tax for Friday and Saturday night (September 26-27). The room block will be held through Sunday, September 6, 2009. After September 6, remaining rooms in the block will be released for sale to the general public, and attendees cannot be guaranteed the group rate or room availability after this date. To assure that your reservation will be accepted, reserve your room well in advance of the conference, and absolutely no later September 6.

To make your reservation, phone 800-455-4770 and mention Group Code: Harveys Lake Tahoe S09FPS to receive the special rate. For online reservations, please visit <http://www.harrahs.com/CheckGroupAvailability.do?propCode=HLT&groupCode=S09FPS>. All reservations must be guaranteed with a major credit card. This deposit is not refundable for any cancellation or early departure within 72 hours from the date of arrival.

**TRANSPORTATION FROM RENO TO LAKE TAHOE**

South Tahoe Express offers shuttle service from the Reno-Tahoe International Airport to Harveys Lake Tahoe. Multiple departures available daily. For information, please visit [www.southtahoexpress.com](http://www.southtahoexpress.com). For additional transportation options or for directions, please visit Harveys at [www.harveystahoe.com/casinos/harveys-lake-tahoe/casino-misc/getting-here-detail.html](http://www.harveystahoe.com/casinos/harveys-lake-tahoe/casino-misc/getting-here-detail.html).

# Conference Schedule Details

## Monday, September 28

### 8:30 - 8:40 **Welcome**

**Charles R. Frihart**, Head of Wood Adhesives Science & Technology, Performance Enhanced Biopolymers, USDA Forest Products Laboratory, Madison, Wisconsin, USA

### 8:40 - 8:45 **Introduction by Session Moderators**

**Robert J. Moon**, Materials Research Engineer, USDA Forest Products Laboratory, Madison, Wisconsin, USA and Adjunct Assistant Professor, Birck Nanotechnology Center and School of Materials Engineering, Purdue University, West Lafayette, Indiana, USA; **Manfred Dunky**, Manager, Research & Application Technology, Kronospan GmbH, Lampertswalde, Germany and Lecturer, Wood-Based Panels & Adhesives, Inst. of Wood Science & Technology, University of Natural Resources & Applied Life Sciences, Vienna, Austria

### 8:45 - 9:25 **Development and Application of Wood Adhesives in China**

**Jiyou Gu**, Professor and Dean, College of Materials Science & Engineering, Northeast Forestry University, Harbin, P.R. China; **Zhiyong Cai**, Material Research Engineer, USDA Forest Products Laboratory, Madison, Wisconsin, USA

### 9:25 - 10:05 **State of the North American Wood Composites and Wood Adhesives Markets**

**Herbert J. Kennedy**, Regional Sales Manager, Wood Adhesives. Georgia-Pacific Chemicals, LLC, Decatur, Georgia, USA

### 10:25 - 11:05 **North American Resin Suppliers' Green Perspectives**

**Tom C. Ruffing**, Graduate Research Assistant, **Paul M. Smith**, Professor of Forest Products Marketing, and **Nicole R. Brown**, Assistant Professor of Wood Chemistry, Penn State University, University Park, Pennsylvania, USA

### 11:05 - 11:45 **The CARB Rule: Driving Technology to Improve Public Health**

**Jeffery R. Williams**, Air Pollution Specialist, Substance Evaluation Section, California Air Resources Board, Sacramento, California, USA

## Session 1A: Environmental

### 1:30 - 1:35 **Introduction by Session Moderators**

**Robert G. Schmidt**, Senior Vice President – Research & Technology, Arclin, Mississauga, Ontario, Canada; **Winford T. Liles**, R&D Director, Huber Engineered Woods, Commerce, Georgia, USA

### 1:35 - 2:00 **Impact of Green Building on Wood Adhesive**

**Ashlee Cribb**, Market Manager, Wood Adhesives, Georgia-Pacific Chemicals, LLC, Atlanta, Georgia, USA

### 2:00 - 2:25 **CARB Formaldehyde Emission Standards: An International Perspective**

**Tom C. Ruffing** and **Wenping Shi**, Graduate Research Assistants, **Nicole R. Brown**, Assistant Professor of Wood Chemistry, and **Paul M. Smith**, Professor of Forest Products Marketing, Penn State University, University Park, Pennsylvania, USA

### 2:25 - 2:50 **Measurement of Significant Native Formaldehyde Generated During Wood Composite Panel Production**

**Michael J. Birkeland**, R&D Project Manager, HRT-Ashland, Edgerton, Wisconsin, USA; **Charles R. Frihart**, Head of Wood Adhesives Science & Technology, Performance Enhanced Biopolymers, USDA Forest Products Laboratory, Madison, Wisconsin, USA; **James M. Wescott**, Technical Director-Wood Adhesive, HRT-Ashland, Waunakee, Wisconsin, USA; **Linda Lorenz**, Chemist, Performance Enhanced Biopolymers, USDA Forest Products Laboratory, Madison, Wisconsin, USA

### 3:20 - 3:45 **Reduction of Formaldehyde Emission from Particleboard Panels: Evidence for a Threshold Effect due to Remaining UF Resin**

**Mark Irlé**, Director of Research, **Christophe Belloncle**, Senior Researcher, and **Baha Guezguez**, Ph.D. Student, Ecole Supérieure du Bois, Nantes, France

### 3:45 - 4:10 **Do Non-Formaldehyde Emitting Products Have to be Produced with Non-Formaldehyde Adhesives?**

**Astrid Pedersen**, Product Development Manager, IWS, Dynea AS, Lillestrøm, Norway

### 4:10 - 4:35 **Production of Low Formaldehyde Emission UF Resins**

**João Ferra**, Ph.D. Student, Laboratory of Process, Environment & Energy Engineering, FEUP-LEPAE, Porto, Portugal; **Jorge Martins**, Professor, Laboratory of Process, Environment & Energy Engineering, FEUP-LEPAE, Porto, Portugal and Dept. of Wood Engineering, Polytechnic Inst. of Viseu, Viseu, Portugal; **Adélio M. Mendes**, Professor, Laboratory of Process, Environment & Energy Engineering, FEUP-LEPAE, Porto, Portugal; **Mário R. Costa**, Professor, Laboratory of Separation & Reaction Engineering, LSRE, Porto, Portugal; **Luisa H. Carvalho**, Professor, Laboratory of Process, Environment & Energy Engineering, FEUP-LEPAE, Porto, Portugal and Dept. of Wood Engineering, Polytechnic Inst. of Viseu, Viseu, Portugal; **Fernão D. Magalhães**, Professor, Laboratory of Process, Environment & Energy Engineering, FEUP-LEPAE, Porto, Portugal

### 4:35 - 5:00 **AsWood™ – Technologies for Composite Boards with Formaldehyde Emissions as Defined by Nature**

**Kristina Đurkić**, Research Manager, and **José Gomez-Bueso**, Chief Scientist, Dynea AS, Lillestrøm, Norway; **Elke Fliedner**, Senior Chemist, Dynea Erkner GmbH, Erkner, Germany

## Session 1B: Applications I

### 3:15 - 3:20 **Introduction by Session Moderators**

**Philip E. Humphrey**, President, Adhesive Evaluation Systems, Inc., Corvallis, Oregon, USA; **Milan Sernek**, Associate Professor, Dept. of Wood Science & Technology, University of Ljubljana, Ljubljana, Slovenia

### 3:20 - 3:45 **Ultra Fast Structural 2K Adhesives: Continuous Manufacturing and Economical Production with Lot Size One**

**Willi Schwotzer**, CTO, **Hans Peter Luthiger**, Project Leader, **Patrick Steiner**, Technology Manager, and **Sebastian Meyer**, Application Engi-

neer, Nolax AG, Sempach Station, Switzerland

**3:45 - 4:10 Ultrasonic Atomization of Resins for Bio-Based Composites Industry: Opportunities, Challenges & Limitations**

**Lech Muszynski**, Assistant Professor, Dept. of Wood Science & Engineering, Oregon State University, Corvallis, Oregon, USA; **Douglas J. Gardner**, Professor, Advanced Engineered Wood Composites Center and School of Forest Resources, University of Maine, Orono, Maine, USA; **Xuelian Zhang**, Post-Doctoral Research Associate, School of Forest Resources, Penn State University, University Park, Pennsylvania, USA

**4:10 - 4:35 Thermal Behavior of Polyurethane Adhesives Bonded to Wood**

**Klaus Richter**, Head, and **Francisco Lopéz-Suevos**, Research Scientist, Wood Laboratory, EMPA, Swiss Federal Laboratories for Materials Testing & Research, Duebendorf, Switzerland

**4:35 - 5:00 Temperature Dependent Strength of Adhesively Bonded Timber Joints**

**Thomas Tannert**, Scientific Collaborator, R&D, **Till Vallée**, Professor, Civil Engineering, and **Simon Hehl**, Student, Timber Engineering, Bern University of Applied Sciences, Biel, Switzerland

**Tuesday, September 29**

**Session 2A: Resin Chemistry I**

**8:20 - 8:25 Introduction by Session Moderators**

**Douglas J. Gardner**, Professor, Advanced Engineered Wood Composites Center and School of Forest Resources, University of Maine, Orono, Maine, USA; **Richard M. Rammon**, R&D Program Manager, Georgia-Pacific Chemicals, LLC, Decatur, Georgia, USA

**8:25 - 8:50 An Overview on Flame-Retardant Structural Wood Adhesives**

**Jinlan Ju**, Research Scientist, and **Xiang-Ming Wang**, Senior Research Scientist and Group Leader, FPInnovations – Forintek Division, Quebec City, Quebec, Canada; **Martin Feng**, Senior Research Scientist and Project Leader, FPInnovations – Forintek Division, Vancouver, British Columbia, Canada

**8:50 - 9:15 Development of Fire-Resistant Polyurethane Structural Wood Adhesives**

**Jinlan Ju**, Research Scientist, and **Xiang-Ming Wang**, Senior Research Scientist and Group Leader, FPInnovations – Forintek Division, Quebec City, Quebec, Canada; **Martin Feng**, Senior Research Scientist and Project Leader, FPInnovations – Forintek Division, Vancouver, British Columbia, Canada; **Zhenhua Gao**, Professor, College of Material & Engineering, Northeast Forestry University, Harbin, P.R. China

**9:15 - 9:40 Effect of Nano-Clay on the Dynamic Mechanical Properties of Resin Film**

**Yucheng Peng**, Graduate Research Assistant, and **Sheldon Q. Shi**, Assistant Professor, Dept. of Forest Products, Mississippi State University, Starkville, Mississippi, USA

**10:10 - 10:35 Optimization of the Glass Transition Temperature and Cure Regime for Structural Timber Adhesives used for On Site Bonding**

**Adlin Sabrina Muhammad Roseley**, Ph.D., Dept. of Mechanical Engineering, and **Martin P. Ansell**, Reader and Head, Sports & Materials Group, Dept of Mechanical Engineering, University of Bath, Bath, United Kingdom; **Dave Smedley**, Technical Director, Rotafix Ltd., Swansea, United Kingdom

**10:35 - 11:00 Effect of Curing Procedure pH and Alkalinity or Acidity of Wood Adhesives**

**Xiang-Ming Wang**, Senior Research Scientist and Group Leader, FPInnovations – Forintek Division, Quebec City, Quebec, Canada; **Romulo Casilla**, Research Consultant, FPInnovations – Forintek Division, Vancouver, British Columbia, Canada; **Yaolin Zhang**, Research Scientist, FPInnovations – Forintek Division, Quebec City, Quebec, Canada

**11:00 - 11:25 Effects of Esters and Resorcinol on Phenolic Resins as Adhesives in MDF Manufacturing**

**Martin Feng**, Senior Scientist and Project Leader, **Guangbo He**, Scientist, and **Axel Andersen**, Senior Technologist, FPInnovations – Forintek Division, Vancouver, British Columbia, Canada

**11:25 - 11:50 Radiation and Dual Radiation-Thermal Cure Adhesives for Wood Composites**

**David P. Harper**, Assistant Professor, Forest Products Center, University of Tennessee, Knoxville Tennessee, USA

**Session 2B: Composites**

**8:20 - 8:25 Introduction by Session Moderators**

**Zhiyong Cai**, Material Research Engineer, USDA Forest Products Laboratory, Madison, Wisconsin, USA; **Warren J. Grigsby**, Science Leader, Scion, Rotorua, New Zealand

**8:25 - 8:50 The Evolution of Composite Panel Resin Technology**

**Bruce Broline**, R&D Manager, and **Tom Holloway**, Technology Manager, Arclin, Springfield, Oregon, USA; **Robert G. Schmidt**, Senior Vice President – Research & Technology, Arclin, Mississauga, Ontario, Canada

**8:50 - 9:15 Soy Containing High Quality CARB II Compliant PB and MDF**

**James A. Yavorsky**, Senior Research Scientist, Ashland, Wilmington,

# Conference Schedule Details

Tuesday, September 29

Delaware, USA; **Michael J. Birkeland**, R&D Project Manager, HRT-Ashland, Edgerton, Wisconsin, USA; **Richard L. Brady**, Research Scientist, Ashland, Wilmington, Delaware, USA; **James M. Wescott**, Technical Director-Wood Adhesive, HRT-Ashland, Waunakee, Wisconsin, USA

## 9:15 - 9:40 **Producing Panels with Formaldehyde Emission at Wood Levels**

**Eleftheria Athanassiadou**, Head, R&D Support Dept., **Sophia Tsiantzi**, R&D Manager, and **Charles Markessinis**, Research Engineer, Chimar Hellas S.A., Kalamaria-Thessaloniki, Greece

## 10:10 - 10:35 **Resins from Soybean Oil-Based Additives for Natural Fiber Sheet Molding Compound (SMC) Composites: Synthesis and Characterization**

**Sangyeob Lee** and **Kaiwen Liang**, Post-Doctoral Research Associates, and **Sheldon Q. Shi**, Assistant Professor, Dept. of Forest Products, Mississippi State University, Starkville, Mississippi, USA

## 10:35 - 11:00 **Utilization of Plantation Wood in High Performance Wood-Based Structural Composites**

**Andreja Kutnar**, Researcher, Dept. of Wood Science & Technology, University of Ljubljana, Ljubljana, Slovenia; **Fred A. Kamke**, JELD-WEN Professor of Wood-Based Composite Science, Dept. of Wood Science & Engineering, Oregon State University, Corvallis, Oregon, USA; **Milan Sernek**, Associate Professor, Dept. of Wood Science & Technology, University of Ljubljana, Ljubljana, Slovenia

## 11:00 - 11:25 **Utilization of Chitosan as an Adhesive for Bagasse Particleboard**

**Kenji Umemura**, Assistant Professor, **Keiji Kaiho**, Graduate Student, and **Shuichi Kawai**, Professor, Research Inst. for Sustainable Humanosphere, Kyoto University, Kyoto, Japan

## 11:25 - 11:50 **Application of Fundamental Fire-Adhesive Interactions in the Manufacture of MDF**

**Warren J. Grigsby**, Science Leader, and **Armin Thumm**, Scientist, Bio-

## Session 3A: Resin Chemistry II

### 1:30 - 1:35 **Introduction by Session Moderators**

**Nicole R. Brown**, Assistant Professor of Wood Chemistry, Penn State University, University Park, Pennsylvania, USA; **Joseph J. Marcinko**, Principal Scientist, Advanced Biopolymer Technologies, Mantua, New Jersey, USA

### 1:35 - 2:00 **Development of Liquefied Bark Phenolic Resin for Composite Wood Product Applications**

**Martin Feng**, Senior Research Scientist and Project Leader, FPInnovations – Forintek Division, Vancouver, British Columbia, Canada; **Gilles Brunette**, Manager, and **Xiang-Ming Wang**, Senior Research Scientist and Group Leader, and **Yaolin Zhang**, Research Scientist, FPInnovations – Forintek Division, Quebec City, Quebec, Canada; **Shixue Ren**, Associate Professor, Northeast Forestry University, Harbin, P.R. China; **Hui Wan**, Research Scientist, FPInnovations – Forintek Division, Quebec City, Quebec, Canada

### 2:00 - 2:25 **Improved CARB II Compliant Soy Adhesives for Laminates**

**James M. Wescott**, Technical Director-Wood Adhesive, HRT-Ashland, Waunakee, Wisconsin, USA; **Anthony Allen**, Senior Scientist, and **Bryan Spraul**, Scientist, Ashland, Wilmington, Delaware, USA

### 2:25 - 2:50 **Investigation on the Structure-Property Relationships of One Component Polyurethane Prepolymers and Formulated Adhesives**

**Sebastian Clauss**, Scientific Assistant, ETH Zurich, Inst. for Building Materials, Zurich, Switzerland; **Joseph Gabriel**, Technical Director, Purbond, Sempach Station, Switzerland; **Alexander Karbach**, Head of Solid State & Polymer Analysis, CURRENTA GmbH & Co. OHG, Krefeld, Germany; **Mathias Matner**, Head of R&D Prepolymers, Bayer MaterialScience AG, Leverkusen, Germany; **Peter Niemz**, Head of Wood Physics Group, Inst. for Building Materials, ETH Zurich, Switzerland

### 3:20 - 3:45 **Morphological Properties of Moisture-Cure Polyurethane Wood Adhesives**

**Dakai Ren**, Ph.D. Candidate, Macromolecules & Interfaces Inst., and **Charles E. Frazier**, Thomas M. Brooks Professor, Dept. of Wood Science & Forest Products, Virginia Tech, Blacksburg, Virginia, USA

### 3:45 - 4:10 **Performance of 1K Polyurethane in Comparison to Other Wood Adhesives**

**Ulrich Mueller**, Area Manager, Wood Materials Technology, Wood Kplus – Competence Centre for Wood Composites & Wood Chemistry, Linz, Austria and Dept. of Material Sciences & Process Engineering, BOKU – University of Natural Resources & Applied Life Sciences, Vienna, Austria; **Stefan Veigel**, Ph.D. Student, and **Jürgen Follrich**, Research Fellow, Wood Kplus – Competence Centre for Wood Composites and Wood Chemistry, Linz, Austria; **Joseph Gabriel**, Technical Director, Purbond AG, Sempach Station, Switzerland; **Wolfgang Gindl**, Professor, Dept. of Material Sciences & Process Engineering, BOKU – University of Natural Resources & Applied Life Sciences, Vienna, Austria

### 4:10 - 4:35 **A Standard Protocol for Testing Adhesive Bond Strength Development Dynamics with the ABES Technique**

**Philip E. Humphrey**, President, Adhesive Evaluation Systems, Inc., Corvallis, Oregon, USA

### 4:35 - 5:00 **High Temperature Performance of Structural Soy Adhesives**

**Christopher G. Hunt**, Research Chemist, **Charles R. Frihart**, Head of Wood Adhesives Science & Technology, **Jane O'Dell**, Physical Science Technician, and **Linda Lorenz**, Chemist, Performance Enhanced Biopolymers, USDA Forest Products Laboratory, Madison, Wisconsin, USA

## Session 3B: Modeling

- 1:30 - 1:35 Introduction by Session Moderators**  
**Chunping Dai**, Senior Scientist and Group Leader, FPInnovations – Forintek Division, Vancouver, British Columbia, Canada; **Fred A. Kamke**, JELD-WEN Professor of Wood-Based Composite Science, Dept. of Wood Science & Engineering, Oregon State University, Corvallis, Oregon, USA
- 1:35 - 2:00 Modeling the Bond Strength Development in Particleboard and MDF**  
**Christian Lanvermann**, Research Assistant, and **Heiko Thoemen**, Scientist and Lecturer, Dept. of Wood Science, University of Hamburg, Hamburg, Germany
- 2:00 - 2:25 Mechanistic Modeling of Bonding Characteristics and Properties of Wood Composites**  
**Chunping Dai**, Senior Scientist and Group Leader, **Guangbo He**, Scientist, **Changming Yu**, Visiting Professor, and **Jiankang Chen**, Visiting Professor, FPInnovations – Forintek Division, Vancouver, British Columbia, Canada
- 2:25 - 2:50 Wood-Adhesive Bonding Failure: Modeling and Simulation**  
**Zhiyong Cai**, Material Research Engineer, USDA Forest Products Laboratory, Madison, Wisconsin, USA
- 3:20 - 3:45 Predicting the Strength of Adhesively Bonded Timber Joints Using a Probabilistic Method**  
**Till Vallée**, Professor, Civil Engineering, **Thomas Tannert**, Scientific Collaborator, R&D, and **Martin Lehmann**, Assistant, Materials & Wood Technology, Bern University of Applied Sciences, Biel, Switzerland
- 3:45 - 4:10 Numerical Modeling and Experiments on the Role of Strand-to-Strand Interface Quality on the Properties of Oriented Strandboard**  
**John A. Nairn**, Professor, and **Edward Le**, Ph.D. Student, Dept. of Wood Science & Engineering, Oregon State University, Corvallis, Oregon, USA
- 4:10 - 4:35 Discrete Element Modeling (DEM) of the Rotary Drum Blending Process: Input Parameters and Verification**  
**Greg Smith**, Associate Professor, Dept. of Wood Science, University of British Columbia, Vancouver, British Columbia, Canada; **Graeme Dick**, Technical Coordinator, Weyerhaeuser, Edson Structurwood, Edson, Alberta, Canada
- 4:35 - 5:00 Mechanical and Dielectric Response of Thermosetting Wood Adhesives During Cure**  
**Milan Sernek**, Associate Professor, and **Mirko Kariz**, Graduate Assistant, Dept. of Wood Science & Technology, University of Ljubljana, Ljubljana, Slovenia

## Session 4A: Bio-Based

- 8:20 - 8:25 Introduction by Session Moderators**  
**Michael J. Birkeland**, R&D Project Manager, HRT-Ashland, Edgerton, Wisconsin, USA; **Xiuzhi (Susan) Sun**, Professor, Dept. of Grain Science & Industry, Kansas State University, Manhattan, Kansas, USA
- 8:25 - 8:50 Optimizing the Reactivity Soy Proteins in Wood Resins**  
**Amy Philbrook**, Research Fellow, School of Chemistry, Australian National University, Canberra, Australia; **Scott Earnshaw**, Hexion Specialty Chemicals, Mount Maunganui, New Zealand; **Christopher J. Easton**, School of Chemistry, Australian National University, Canberra, Australia
- 8:50 - 9:15 Soy Adhesive – Moisture Interactions**  
**Christopher G. Hunt**, Research Chemist, and **Charles R. Frihart**, Head of Wood Adhesives Science & Technology, Performance Enhanced Biopolymers, USDA Forest Products Laboratory, Madison, Wisconsin, USA; **James M. Wescott**, Technical Director-Wood Adhesive, HRT-Ashland, Waunakee, Wisconsin, USA; **Linda Lorenz**, Chemist, Performance Enhanced Biopolymers, USDA Forest Products Laboratory, Madison, Wisconsin, USA
- 9:15 - 9:40 Soy Latex Like Adhesive for Wood Veneer Applications**  
**Guangyan Qi**, Graduate Research Assistant, Bio-Material & Technology Laboratory, and **Xiuzhi (Susan) Sun**, Professor, Dept. of Grain Science & Industry, Kansas State University, Manhattan, Kansas, USA
- 10:10 - 10:35 Comparing Soy Protein Isolate and Wheat Gluten as Bio-Based Binders for the Wood Industry**  
**Petra Nordqvist**, Ph.D. Student, and **Eva Malmström**, Professor, Dept. of Fibre & Polymer Technology, Royal Inst. of Technology, Stockholm, Sweden; **Farideh Khabbaz**, Senior Research Chemist, Analyscentrum, Casco Adhesives AB, Stockholm, Sweden
- 10:35 - 11:00 Protein Hybrid Adhesives: Chemical Characterization and Reaction Mechanisms**  
**Anthony A. Parker** and **Joseph J. Marcinko**, Principal Scientists, Advanced Biopolymer Technologies, Mantua, New Jersey, USA
- 11:00 - 11:25 Protein Hybrid Adhesives: Adhesive Performance, Formulation Latitude, and Chemical Structure**  
**Joseph J. Marcinko** and **Anthony A. Parker**, Principal Scientists, Advanced Biopolymer Technologies, Mantua, New Jersey, USA
- 11:25 - 11:50 Production of Polyurethane from Liquefied Kenaf (*Hibiscus cannabinus L.*) Core for Wood Laminating Adhesive**  
**Md. Tahir Paridah**, Associate Professor, and **M.F. Juhaida**, Inst. of Tropical Forestry & Forest Products, Universiti Putra Malaysia, Serdang, Selangor, Malaysia; **M. Mohd. Hilmi**, Malaysian Nuclear Agency, Kajang, Selangor, Malaysia; **Z. Sarani**, Material Science Program, Faculty of Science & Technology, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia; **H. Jalaluddin**, Inst. of Tropical Forestry & Forest Products,

# Conference Schedule Details

Wednesday, September 30

Universiti Putra Malaysia, Serdang, Selangor, Malaysia; **A.R. Mohamad Zaki**, Faculty of Science, Universiti Putra Malaysia, Serdang, Selangor, Malaysia

## Session 4B: Engineered Wood

8:20 - 8:25 **Introduction by Session Moderators**

**Klaus Richter**, Head, Wood Laboratory, EMPA, Swiss Federal Laboratories for Materials Testing & Research, Dübendorf, Switzerland; **Kay-Uwe Schober**, Professor in Timber Engineering & Structural Design, Mainz University of Applied Sciences, Mainz, Germany

8:25 - 8:50 **Block Shear and Flexure Testing to Examine the FRP-Wood Bond Interface**

**Gary Raftery**, University Fellow, and **Annette M. Harte**, Senior Lecturer, Dept. of Civil Engineering, National University of Ireland, Galway, Ireland

8:50 - 9:15 **Evaluation of Adhesive Bonds in Glulam Posts with Thermally Modified Spruce**

**Marielle Henriksson** and **Magdalena Sterley**, Researchers, SP Technical Research Inst. of Sweden, Stockholm, Sweden; **Jonas Danvind**, Researcher, SP Technical Research Inst. of Sweden, Skellefteå, Sweden; **Mats Westin**, Researcher, SP Technical Research Inst. of Sweden, Borås, Sweden

9:15 - 9:40 **Innovative Programs Led in France to Promote the Use of Domestic Woods in the Field of Engineered Wood Products**

**Frédéric Simon**, Innovation Manager, Research & Innovation Direction, Timber Engineering Unit, FCBA Technological Inst., Bordeaux, France; **Ronny Bredeesen**, Research Scientist, Wood & Specialty Adhesives, Dynea AS, Lillestrøm, Norway

10:10 - 10:35 **Ductile Adhesively Bonded Timber Joints**

**Maurice Brunner**, Professor, Structural Analysis, **Till Vallée**, Professor, Civil Engineering, and **Thomas Tannert**, Scientific Collaborator, R&D, Bern University of Applied Sciences, Biel, Switzerland

10:35 - 11:00 **Low Intrusion Techniques for Strengthening of Timber Structures in Reconstruction**

**Kay-Uwe Schober**, Professor in Timber Engineering & Structural Design, Mainz University of Applied Sciences, Mainz, Germany; **Karl Rautenstrauch**, Professor and Head, and **Markus Jahreis**, Research Associate, Dept. of Timber & Masonry Engineering, Bauhaus-University of Weimar, Weimar, Germany

11:00 - 11:25 **Flat Wise Green Gluing of Norway Spruce for Structural Application**

**Magdalena Sterley**, Researcher, SP Technical Research Inst. of Sweden, Stockholm, Sweden and Ph.D. Student, Växjö University, Växjö, Sweden; **Erik Serrano**, Professor, and **Bertill Enqvist**, Research Engineer, Växjö University, Växjö, Sweden

11:25 - 11:50 **Reinforcement of Laminated Beam Bond Lines with Interposed Metal Resistive Heating Networks**

**Philip E. Humphrey**, President, Adhesive Evaluation Systems, Inc., Corvallis, Oregon, USA

## Session 5A: Analytical

1:30 - 1:35 **Introduction by Session Moderators**

**Charles E. Frazier**, Thomas M. Brooks Professor, Dept. of Wood Science & Forest Products, Virginia Tech, Blacksburg, Virginia, USA; **David P. Harper**, Assistant Professor, Forest Products Center, University of Tennessee, Knoxville Tennessee, USA

1:35 - 2:00 **Small Specimen Wood-Rheology: A Tool to Understand HMR Coupling Mechanism**

**Sudip Chowdhury**, Graduate Research Assistant, and **Charles E. Frazier**, Thomas M. Brooks Professor, Dept. of Wood Science & Forest Products, Virginia Tech, Blacksburg, Virginia, USA

2:00 - 2:25 **Characterizing pMDI Reactions with Wood Cell Walls. Part I: High-Resolution Solution-State NMR Spectroscopy**

**Daniel J. Yelle** and **Joseph E. Jakes**, Ph.D. Candidates, Dept. of Materials Science, University of Wisconsin-Madison and USDA Forest Products Laboratory, Madison, Wisconsin, USA; **John Ralph**, Professor, Dept. of Biochemistry, University of Wisconsin-Madison, Madison, Wisconsin, USA; **Charles R. Frihart**, Head of Wood Adhesives Science & Technology, Performance Enhanced Biopolymers, USDA Forest Products Laboratory, Madison, Wisconsin, USA

2:25 - 2:50 **Investigation of PF Adhesive Penetration in Wood by Micro X-ray Tomography**

**Fred A. Kamke**, JELD-WEN Professor of Wood-Based Composite Science, and **Guenter Modzel**, Graduate Research Assistant, Dept. of Wood Science & Engineering, Oregon State University, Corvallis, Oregon, USA

3:20 - 3:45 **3D Characterization of Adhesives Penetration into Wood by Means of Synchrotron Radiation**

**Philipp Hass**, Ph.D. Student, ETH Zurich, Inst. for Building Materials, Zurich, Switzerland; **Marco Stampanoni**, Professor, Inst. for Biomedical Engineering, Paul Scherrer Inst., Villigen, Switzerland and ETH Zurich, Inst. for Building Materials, Zurich, Switzerland; **Anders Kaestner**, Research Assistant, Neutron Imaging & Activation Group, Paul Scherrer Inst., Villigen, Switzerland; **David Mannes**, Ph.D. Student, and **Peter Niemz**, Professor, ETH Zurich, Inst. for Building Materials, Zurich, Switzerland

3:45 - 4:10 **Diffusion Processes at Glue Joints of Wood-Based Materials Evaluated by Means of Neutron Imaging**

**Walter Sonderegger**, Scientific Assistant, and **Peter Niemz**, Professor, ETH Zurich, Inst. for Building Materials, Zurich, Switzerland; **Eberhard Lehmann**, Dr., Paul Scherrer Inst., Villigen, Switzerland; **David Mannes**, and **Stefan Hering**, ETH Zurich, Inst. for Building Materials, Zurich, Switzerland

4:10 - 4:35 **Sophisticated Analyses of Low Emission Resins**

**Wolfgang Kantner**, Laboratory & Product Development Manager, and **Johann Moser** and **Christian Heinemann**, Senior Product Development Chemists, Dynea Austria GmbH, Krems, Austria

#### 4:35 - 5:00 **Rheological Characterization of Wood Adhesives and Drop Size Prediction**

**Xuelian Zhang**, Post-Doctoral Research Associate, School of Forest Resources, Penn State University, University Park, Pennsylvania, USA; **Douglas J. Gardner**, Professor, Advanced Engineered Wood Composites Center and School of Forest Resources, and **Douglas W. Bousfield**, Professor, Dept. of Chemical & Biological Engineering, University of Maine, Orono, Maine, USA

#### 4:10 - 4:35 **Identification and Comparison of the Extractives Chemical Compounds in Natural and Planted Cypress Tree by GC/MS**

**Ramin Vaysi**, Assistant Professor, and **E.D.Taherinia**, M.Sc. Student, Dept. of Wood & Paper Technology, Islamic Azad University of Chalous Branch, Chalous, Iran

#### 4:35 - 5:00 **Development of Floor Tiles from Philippine Bamboos**

**Marina A. Alipon**, Scientist I, **Edna B. Bauza**, Senior Science Research Specialist, and **Gilberto N. Sapin**, Science Research Specialist I, Dept. of Science & Technology (DOST), Forest Products R&D Inst. (FPRDI), College, Laguna, Philippines

### Session 5B: Application II

#### 1:30 - 1:35 **Introduction by Session Moderators**

**Magdalena Sterley**, Researcher, SP Technical Research Inst. of Sweden, Stockholm, Sweden and Ph.D. Student, Växjö University, Växjö, Sweden; **Ken Van Langenberg**, Team Leader, Wood Adhesives & Composites, CSIRO Materials Science & Engineering, Melbourne, Australia

#### 1:35 - 2:00 **Dependence of Strength Values of Glued Wood Bonds on Specimen Geometry**

**Goran Mihulja**, Assistant, **Hrvoje Turkulin**, Professor, and **Andrija Bogner**, Associate Professor, Faculty of Forestry, University of Zagreb, Zagreb, Croatia

#### 2:00 - 2:25 **Glued Laminated Timber – Shear Test of Glue Lines**

**René Steiger**, Group Leader, Timber Engineering, and **Klaus Richter**, Head, Wood Laboratory, EMPA, Swiss Federal Laboratories for Materials Testing & Research, Dübendorf, Switzerland

#### 2:25 - 2:50 **Development of Liquefied Lignin Phenolic Resin for Composite Wood Product Applications**

**Yaolin Zhang**, Research Scientist, and **Xiang-Ming Wang**, Senior Research Scientist and Group Leader, FPInnovations – Forintek Division, Quebec City, Quebec, Canada; **Martin Feng**, Senior Research Scientist and Project Leader, FPInnovations – Forintek Division, Vancouver, British Columbia, Canada; **Shixue Ren**, Associate Professor, Northeast Forestry University, Harbin, P.R. China; **Stephane Nadon**, former Technologist, and **Dian-Qing Yang**, Research Scientist, FPInnovations – Forintek Division, Quebec City, Quebec, Canada

#### 3:20 - 3:45 **Study on the Bonding Property of Melamine and Urea-Formaldehyde Resin by Co-polymerization Modification**

**Libin Zhu**, Associate Professor, and **Jiyou Gu**, Professor and Dean, College of Materials Science & Engineering, Northeast Forestry University, Harbin, P.R. China

#### 3:45 - 4:10 **Adhesive Application of Liquefied Green and Mountain-Pine Beetle Infested Lodgepole Pine Barks**

**Yong Zhao**, Ph.D. Student, and **Ning Yan**, Associate Professor, Faculty of Forestry, University of Toronto, Toronto, Ontario, Canada; **Martin Feng**, Senior Research Scientist and Project Leader, FPInnovations – Forintek Division, Vancouver, British Columbia, Canada

### Poster Presentations

#### **Susceptibility of Thermally Modified Beech (*Fagus sylvatica L.*) and Birch (*Betula pubescens Ehrh.*) to Gluing**

**Piotr Boruszewski**, **Piotr Borysiuk**, **Mariusz Mamiński**, and **Marek Grześkiewicz**, Faculty of Wood Technology, Warsaw University of Life Science-SGGW, Warsaw, Poland

#### **Bonding Quality of PE-Bonded Beech Plywood made from Thermally Modified Veneers**

**Piotr Borysiuk**, **Mariusz Mamiński**, **Piotr Boruszewski**, and **Marek Grześkiewicz**, Faculty of Wood Technology, Warsaw University of Life Science-SGGW, Warsaw, Poland

#### **Hyperbranched Macromolecules as Modifiers of the Urea-Formaldehyde Resins**

**Mariusz Mamiński**, Faculty of Wood Technology, Warsaw University of Life Science-SGGW, Warsaw, Poland; **Pawel Parzuchowski**, Faculty of Chemistry, Warsaw University of Technology, Warsaw, Poland; **Piotr Borysiuk** and **Piotr Boruszewski**, Faculty of Wood Technology, Warsaw University of Life Science-SGGW, Warsaw, Poland

#### **Treatment of Veneer with Low Molecular Weight Phenol Formaldehyde Resin to Enhance Dimensional Stability and Biological Properties of Oil Palm Stem Plywood**

**Loh Yueh Feng**, Research Officer, Fibre & Biocomposite Development Centre, Malaysia Timber Industry Board, Banting, Selangor, Malaysia; **Md. Tahir Paridah**, Associate Professor, Inst. of Tropical Forestry & Forest Products, and **Ashaari Zaidon** and **Bakar Edi Suhaimi**, Associate Professors, Faculty of Forestry, Universiti Putra Malaysia, Serdang, Selangor, Malaysia; **Husain Hamdan**, Research Officer, Forest Research Inst. Malaysia, Kepong, Selangor, Malaysia

#### **Characterization of the Two Different Phases in Urea-Formaldehyde Resins**

**João Ferra**, Ph.D. Student, Laboratory of Process, Environment & Energy Engineering, FEUP-LEPAE, Porto, Portugal; **Jorge Martins**, Professor, Laboratory of Process, Environment & Energy Engineering, FEUP-LEPAE, Porto, Portugal and Dept. of Wood Engineering, Polytechnic Inst. of Viseu, Viseu, Portugal; **Adélio M. Mendes**, Professor, Laboratory of Process, Environment & Energy Engineering, FEUP-LEPAE, Porto, Portugal; **Mário R. Costa**, Professor, Laboratory of Separation & Reaction Engineering, LSRE, Porto, Portugal; **Luisa H. Carvalho**, Professor,

## Poster Presentations

Laboratory of Process, Environment & Energy Engineering, FEUP-LEPAE, Porto, Portugal and Dept. of Wood Engineering, Polytechnic Inst. of Viseu, Viseu, Portugal; **Fernão D. Magalhães**, Professor, Laboratory of Process, Environment & Energy Engineering, FEUP-LEPAE, Porto, Portugal

### Visualization of Wood Fiber-Adhesive Interactions of Adhesive Formulations Containing Bio-Based Components

**Warren J. Grigsby**, Science Leader, and **Armin Thumm**, Scientist, Bioproduct Development, Scion, Rotorua, New Zealand

**Bonding of Plantation Teak Wood with Various Adhesives** **Christian Hansmann**, Key Researcher, Wood Kplus – Competence Centre for Wood Composites & Wood Chemistry, Linz, Austria; **Robert Stingl**, Junior Researcher, Dept. of Material Sciences & Process Engineering, BOKU – University of Natural Resources & Applied Life Sciences, Vienna, Austria; **Hermann Pleschberger**, Junior Researcher, and **Ulrich Mueller**, Area Manager, Wood Materials Technology, Wood Kplus – Competence Centre for Wood Composites & Wood Chemistry, Linz, Austria, and Dept. of Material Sciences & Process Engineering, BOKU – University of Natural Resources & Applied Life Sciences, Vienna, Austria

### Solutions for Future Low Emission Plywood

**Olli Hietamies** and **Harri Lepistö**, Product Development Chemists, Dynea Chemicals Oy, Hamina, Finland

### MALDI-TOF Mass Spectrometry of *Acacia mangium* Polyflavonoid Tannin for Plywood Adhesive

**Yeoh Beng Hoong**, M.Sc. Student, Faculty of Forestry, Universiti Putra Malaysia, Serdang, Selangor, Malaysia; **A. Pizzi**, Professor, ENSTIB-LERMAB, Nancy University, Epinal, France; **Md. Tahir Paridah**, Associate Professor, Inst. of Tropical Forestry & Forest Products, Universiti Putra Malaysia, Serdang, Selangor, Malaysia; **H. Pasch**, Dr., Deutsche Kunststoff Inst., Darmstadt, Germany; **M.P. Koh**, Research Officer, Forest Research Inst. Malaysia, Kepong, Selangor, Malaysia

### Observation of Adhesive Penetration into Wood by Laser Scanning Microscopy

**Naruhito Hori**, Assistant Professor, and **Akio Takemura**, Associate Professor, University of Tokyo, Tokyo, Japan

### Monitoring of Wood-Adhesive Interactions during Cure by ARES G2 Rheometer

**Milan Sernek**, Associate Professor, and **Mirko Kariz**, Graduate Assistant, Dept. of Wood Science & Technology, University of Ljubljana, Ljubljana, Slovenia

### Development of Static and Dynamic Measurements of Organic Acids Emitted from Wood and Adhesives for Wood

**Kensuke Kawarada**, Chief Researcher, and **Keiko Kurita**, Researcher, Tokyo Metropolitan Industrial Technology Research Inst., Tokyo, Japan; **Masaharu Ohmi**, Associate Professor, Tokyo University of Agriculture & Technology, Tokyo, Japan

### Protein-based Binders for Particleboards

**Sara Khosravi**, Ph.D. Student, and **Mats Johansson**, Professor, Dept. of Fibre & Polymer Technology, Royal Institute of Technology, Stockholm, Sweden; **Farideh Khabbaz**, Senior Research Chemist, Casco Adhesives AB, Stockholm, Sweden; **Petra Nordqvist**, Ph.D. Student, Dept. of Fibre & Polymer Technology, Royal Institute of Technology, Stockholm, Sweden

### Environmental Performance on Indoor Air Pollutant of Wood-Based Flooring Bonded with Tannin/PVAc Hybrid Adhesives for Surface Bonding

**Sumin Kim**, Assistant Professor, Dept. of Architecture, Soongsil University, Seoul,

Republic of Korea

### Bio-modified PVA Adhesives with Extended Assembly Time

**Yuan Liu**, Senior Product Development Chemist, **Mark Vrana**, Senior Director of Technology & Quality, **Michelle Tobbe**, Technical Director, Wood Adhesives, **Chuck Shuster**, Senior Research Associate, and **Jeffrey Shumaker**, Senior Technical Specialist, Franklin International, Columbus, Ohio, USA

### Study of Esparto Grass (*Stipa tenacissima*. L) Lignins

**Hamid Nadji**, Post-Doctoral Associate, **Y. Bedard**, Expert Technician, **P.N. Diouf**, Post-Doctoral Associate, and **T. Stevanovic**, Professor, University Laval, Quebec City, Quebec, Canada; **A. Benaboura**, Professor, USTHB, Algiers, Algeria; **B. Riedl**, Professor, University Laval, Quebec City, Quebec, Canada

### Carboxymethylcellulose Acetate Butyrate as a Wood Adhesive

**Jesse L. Paris**, Graduate Research Assistant, and **Charles E. Frazier**, Thomas M. Brooks Professor, Dept. of Wood Science & Forest Products, Virginia Tech, Blacksburg, Virginia, USA

### Dynamic Mechanical Analysis: A Novel Method to Screen Potential Wood Adhesive Coupling Agents

**Josh Hosen**, Graduate Research Assistant, and **Charles E. Frazier**, Thomas M. Brooks Professor, Macromolecules & Interfaces Inst., Dept. of Wood Science & Forest Products, Virginia Tech, Blacksburg, Virginia, USA

### Abating the Formaldehyde Emission of Urea-Melamine-Formaldehyde Resin Bonded Medium Density Fiberboards

**Jong-Young Park**, Senior Research Scientist, and **Sang-Min Lee** and **Sang-Bum Park**, Research Scientists, Korea Forest Research Inst., Seoul, Republic of Korea

### Properties of Molded Top Table Depending on Element Shapes and Conditions of Recycled Wood Wastes

**Jeong-Kwan Roh**, Professor, Jinju National University, Jinju, Gyeongnam, Republic of Korea; **Byung-Dae Park**, Assistant Professor, Kyungpook National University, Daegu, Republic of Korea; **Sang-Bum Park**, Research Scientist, and **Jong-Young Park**, Director, Korea Forestry Research Institute, Seoul, Republic of Korea; **Jung-Lak Doh, Manager**, Dolim Wood Co. Ltd, Yangsan Gyeongnam, Republic of Korea

### The Properties of Various Lignocellulose Flour-Plastic Composites (WPC) with a High Filler Content

**Masahiro Takatani**, Associate Professor, Faculty of Agriculture, Kin-ki Daigaku University, Nara-shi, Nara, Japan; **Kei Sakamoto**, Katsulon Co., Higashi-Osakashi, Osaka, Japan; **Takashi Hashimoto** and **Tadashi Okamoto**, Faculty of Agriculture, Kin-ki Daigaku University, Nara-shi, Nara, Japan

### Manufacturing of Binderless-boards from Kaoliang (*Sorghum narvous*)

**Kinji Taki**, Professor, and **Masaaki Yamada**, Assistant Professor, Faculty of Agriculture, Shizuoka University, Shizuoka, Japan; **Yuta Egusa**, Researcher, and **Mitsukazu Kimura**, Manager, Laboratories, Koyo Sangyo Co.Ltd., Tochigi, Japan

### Improve the Water Resistance of Soy-Based Adhesive by Using Sodium Dodecyl Sulfate and Glutaraldehyde

**Fei Li**, Research Assistant, and **Xiaoping Li** and **Weihong Wang**, Professors, Northeast Forestry University, Harbin, P. R. China

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Forest Products Society

2801 Marshall Court

Madison, WI 53705-2295 USA

Phone: 608-231-1361, ext. 208 Fax: 608-231-2152

[conferences@forestprod.org](mailto:conferences@forestprod.org)



#### USDA FOREST SERVICE, FOREST PRODUCTS LABORATORY

The USDA Forest Service, Forest Products Laboratory (FPL), located in Madison, Wisconsin, was established in 1910 as the centralized wood research laboratory of the U.S. Forest Service. The mission of FPL is to improve the use of wood through science and technology, thereby contributing to the conservation and management of the forest resource. Its staff undertakes research that expands the understanding of all aspects of the conversion and use of wood. FPL's Performance Enhanced Biopolymers Work Unit is actively engaged in research on adhesives and adhesion. Portions of this research deal with understanding durability of wood bonds, determining the interaction of adhesives with wood cellular structure, developing new adhesives, and improving the environmental acceptability of adhesives. Research programs are accomplished through coordinated partnerships involving industry, university, and government cooperators. Research findings are published to meet the needs of a variety of public and private sector users. Suggestions for cooperative research projects in the area of wood adhesives are welcome and should be addressed to Dr. Charles R. Frihart, [cfrihart@fs.fed.us](mailto:cfrihart@fs.fed.us).

**Website** [www.fpl.fs.fed.us](http://www.fpl.fs.fed.us)

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