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EDUCATION

University of Maine	Orono, ME, USA
Ph.D. , Forest Resources/Bioproducts Engineering, GPA: 3.9	Dec. 2017
Advisor: Douglas J. Gardner	
Dissertation: Cellulose Nanofibril-Reinforced Polypropylene for Extrusion-based Additive Manufacturing.	
Nanjing Forestry University	Nanjing, Jiangsu, China
M.S. , Wood Science and Technology, GPA: 3.8	June 2013
Dissertation: Micro and Nano-scale Characterization of Poplar/PF Interphase	
Advisor: Mingjie Guan	
Central South University of Forestry and Technology	Changsha, Hunan, China
B.S. , Wood Science and Engineering, GPA: 3.5	June 2010
Capstone: Research Review on Residential Wood Structures	

RESEARCH INTERESTS

- [1] Wood-based products, bamboo-based products, natural fibers, carbon fiber, fiber modification, nanofiber drying, particle morphology;
- [2] Thermoplastics, biodegradable polymers, engineering polymers, commodity polymers, plastic foams;
- [3] Natural fiber-reinforced-polymer composites, carbon fiber-reinforced-polymer composites, cellulose nanofibril-reinforced-polymer composites;
- [4] packaging innovation, membrane engineering;
- [5] Interface, interphase, surface energy, surface chemistry, adhesion and adhesive;

[6] 3D printing, additive manufacturing, large-scale additive manufacturing, extrusion, injection molding, compression molding, applied rheology;

[7] Numerical modeling, classic laminates plate theory, digital image correlation, electronic speckle pattern interferometry.

PROFESSIONAL MEMBERSHIPS

Member, Society of Plastic Engineers,	2016-2018
Member, Technical Association of Pulp and Paper Industry,	2017-2018

SELECTED GRANTS AND HONORS

Ford Motor Company

Recycling Polyamide 12 Waste from Selective Laser Sintering for Extrusion-based Additive Manufacturing.

Role: Co-PI	2017
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University of Maine, College of Nature Sciences, Forestry and Agriculture

Fred Griffee Memorial Award	2018
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1 out of 400 graduate students in the college wins this award every year

University of Maine, School of Forest Resources

Lee & Sunny Allen International Experience Travel Scholarship	2017
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Blumenstock Family Forest Products Graduate Student of the Year Award	2015
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George L. Houston Scholarship	2014
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Nanjing Forestry University

First Place, Graduate Scholarship	2011-2012
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Central South University of Forestry and Technology

Enterprise Scholarship

China Flooring Holding Company Limited. Hong Kong	2010
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Excellent Volunteer, 50th Anniversary of Central South University of

Forestry and Technology	2008
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Annual Undergraduate Scholarship	2006-2010
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Society of Plastic Engineers

Poster competition award. 10th SPE Polymer Nanocomposites Conference 2016
SPE Automotive Composites Conference & Exhibition (ACCE)

Graduate Scholarship Award 2016-2017

Two of the scholarships are given to full-time graduate students, anywhere in the world, who are pursuing degrees in Polymer Science, Composites, Plastics or a related engineering discipline. The selected projects show most significant impact of using polymer composites in the automotive or other ground-transportation industry.

Poster award, 9th SPE Polymer Nanocomposites Conference 2014

American Society of Agricultural and Biological Engineers

First place, poster competition award, Northeast Agriculture and Biological Engineering Conference (NABEC), 2016

RESEARCH & TEACHING EXPERIENCE

Co-mentor of a capstone project for undergraduate student, University of Maine

Mechanical Properties of Cellulose Nanofibril Filled Polypropylene Composites 2017

Co-mentor of Research Experiences for Undergraduates-NSF, University of Maine

Thermal Properties of Cellulose Nanofibrils Filled Polypropylene for 3D Printing 2017

Mechanical Properties of Cellulose Nanofibrils Reinforced PLA by 3D Printing 2015

Surface Modification of Cellulose Nanofibrils by Silanes during Spray Drying 2014

Graduate Research Assistant, University of Maine 2013 to 2017

Project I: Enhanced Material Property Performance in Three Dimensional (3-D) Printing using Cellulose Nanofibril-filled Polymer Composites. USDA.

Project II: Renewable Nanocomposites Made from Lignocellulosic Fillers and Transparent Polymer Matrices. USDA.

Project III: Pilot Scale Study on Spray Drying Cellulose Nanofibrils. USDA.

Graduate Research Fellow, Nanjing Forestry University 2010-2013

Teaching Assistant, Nanjing Forestry University 2010

Lectured *The Anatomy of Bamboo Culms*

WORKING EXPERIENCE

Postdoctoral Research Associate, University of Maine, January, 2018 to date

[1] Cellulose Nanofibers as oxygen barrier in multi-layer packaging system. National Institute of Food and Agriculture, United States Department of Agriculture.

[2] High-feed rate additive manufacturing of composites tooling using low-cost micro and nano-cellulose-filled thermoplastics. In collaboration with Oak Ridge National Laboratory, Department of Energy.

[3] Electrospinning of Cellulose nanofibrils and PVA for composites making.

Intern at Ford Motor Company, Sustainable Biomaterials & 3D printing 2017

[1] Recycle Nylon12 Waste from Selective Laser Sintering for Carbon Composites.

[2] Utilization of Natural Fibers (wood, bamboo, agave, cellulose etc.) in Plastic Automotive Parts.

PROFESSIONAL CONTRIBUTIONS

Invited reviewer for journals:

Composites Part A: applied science and manufacturing; Cellulose; Holzforschung; Industrial Crops and Products; Macromolecular Materials and Engineering; ACS Omega; Journal of Materials Science; Journal of Applied Polymer Science; Materials; Fibers; Applied Science; Polymers; Journal of Manufacturing and Materials Processing; Recycling; ACS Books; Progress in Additive Manufacturing;

PATENTS

[1] U.S. Provisional Patent Application No.: 62/587,233. Gardner D. J., **Wang L.** and Sanders J.E. Improved Filaments for 3D Printing. Date of application: November 16, 2017.

PUBLICATIONS

Book chapters:

[1] Gardner, D. J., M. Blumentritt, **L. Wang** and N. Yildirim. 2015. Adhesion theories in wood adhesive bonding. In: Progress in Adhesion and Adhesives, K. L. Mittal, Ed. Scrivener Publishing, Beverly, MA, pp 125-168.

Peer-reviewed journal articles:

- [1] Guan MJ, Yong C, **Wang L**. Shear Strain and Microscopic Characterization of Bamboo Bonding Interface with Polyvinyl alcohol Modified Phenol-Formaldehyde Resin. *Journal of Applied Polymer Science*, 2013, 130(2): 1345-1350.
- [2] Guan MJ, **Wang L**, Chang X.M. Fluorescence tracking analysis of poplar and phenol-formaldehyde bonding interface. *Journal of Nanjing Forestry University (Natural Sciences Edition)*, 2013, 37(5):125-128.
- [3] Guan M, Yong C, **Wang L**. Microscopic characterization of modified phenol-formaldehyde resin penetration of bamboo surfaces and its effect on some properties of two-ply bamboo bonding interface. *BioResources*, 2014, 9(2), 1953-1963.
- [4] Guan MJ, **Wang L**, Yong C. Digital Image Correlation Measuring Shear Strain Distribution on Wood/Adhesive Interphase Modified by Sealants. *Bioresources*, 2014, 9(3), 5567-5576.
- [5] Gardner, D. J., M. Blumentritt, **L. Wang** and N. Yildirim. Adhesion theories in wood adhesive bonding: a critical review. *Rev. Adhesion Adhesives*, 2014.2(2):127-172. DOI: 10.7569/RAA.2014.097304
- [6] Gardner D.J., Han Y. and **Wang L**. Wood-plastic composite technology. *Current Forestry Reports*. 2015. DOI 10.1007/s40725-015-0016-6.
- [7] **Wang L.**, Sanders J.E., Gardner D.J. and Han Yousoo. *In-situ* modification of cellulose nanofibrils by organosilanes during spray drying. *Industrial Crops and Products*, 2016, 95:129-135.
- [8] **Wang L.** and Gardner D.J. Effect of Fused Layer Modeling (FLM) Processing Parameters on Impact Strength of Cellular Polypropylene. *Polymer*, 2016. 113: 74-80.
- [9] **Wang L.**, Gramlich W.M. and Gardner, D.J. Improving the Impact Strength of Polylactic acid (PLA) in Fused Layer Modeling (FLM). *Polymer*. 2017, 114: 242-248.
- [10] **Wang L.**, Gardner D.J. and Bousfield D.W. Cellulose Nanofibril-Reinforced Polypropylene Composites for Material Extrusion: Rheological Properties. *Polymer Engineering and Science*. 2017. DOI 10.1002/pen.24615
- [11] **Wang L.** and Gardner D.J. Enhanced Cellulose Nanofibrils/Polypropylene Composites for 3D Printing. *SPE Plastics Research Online*. 2017. DOI 10.2417/spepro.006940
- [12] **Wang L.**, Roach A.W., Gardner D.J. and Han Y. Mechanisms Contributing to Mechanical

Property Changes of Cellulose Nanofibrils Reinforced-Polypropylene Composites. *Cellulose*. 2017. DOI <https://doi.org/10.1007/s10570-017-1556-7>.

[13] **Wang L.**, Gramlich W.M., Gardner D.J. and Han Y. Spray-dried Cellulose Nanofibril-Reinforced Polypropylene Composites for Extrusion-based Additive Manufacturing: nonisothermal crystallization kinetics and thermal expansion. *Journal of Composites Science*. 2018. 2(1), 7. doi:10.3390/jcs2010007

[14] **Wang L.** and Gardner D.J. Contribution of Printing Parameters to Interfacial Strength of Polylactic acid (PLA) in Material Extrusion Additive Manufacturing. *Progress in Additive Manufacturing*. 2018. <https://doi.org/10.1007/s40964-018-0041-7>

[15] **Wang L.**, Sanders J.E., Gardner D.J. and Han Yousoo. Effect of Fused Deposition Modeling Process Parameters on the Mechanical Properties of Filled Polypropylene. *Progress in Additive Manufacturing*. 2018. DOI: 10.1007/s40964-018-0053-3

[16] **Wang L.**, Kiziltas A., Lee E., Mielewski D.F. and Gardner D.J. Closed-Loop Recycling of Polyamide12 Powder from Selective Laser Sintering in Sustainable Composites. *Journal of Cleaner Production*. 2018. 10;195:765-72. <https://doi.org/10.1016/j.jclepro.2018.05.235>

[17] **Wang L.**, Palmer J., Tajvidi M., Gardner D.J. and Han Y. Thermal Properties of Spray-dried Cellulose Nanofibril-Reinforced Polypropylene Composites from Extrusion-based Additive Manufacturing. *Journal of Thermal Analysis and Calorimetry*. 2018. DOI: 10.1007/s10973-018-7759-9.

Conference articles:

[1] **Wang L.**, Guan M.J., Q.S. Zhang. Preliminary Research on Characteristics of Bamboo Briquette Charcoal as Solid Fuel. *Key Engineering Materials*, 2012. 517: 81-86.

[2] **Wang L.**, Guan M.J. Influence of Veneers' Lathe Checks on Strain Distribution at Wood-adhesive Interphase Measured by Electronic Speckle Pattern Interferometry (ESPI). 55th SWST International Convention. Beijing, China, 2012. August 27-31, 2012.

[3] Guan M.J., Yong C., **Wang L.**. Selected Properties of Bamboo Scrimber Flooring Made of *India Melocanna baccifera*. 55th SWST International Convention. Beijing, China, 2012. August 27-31, 2012.

PRESENTATIONS

Oral:

- [1] Gardner D.J., **Wang L.**, Sanders J.E. An approach to enhance material property performance in 3D (FLM) printing using cellulose nanofibril-filled polymer composites. 10th SPE Polymer Nanocomposites Conference, 2016. October 16-18, Bethlehem, PA, USA.
- [2] **Wang L.**, Gramlich W.M., Gardner D.J. and Han Y. Cellulose Nanofibrils Enhanced Polypropylene Composites for Fused Filament Fabrication: nonisothermal crystallization kinetics and thermal expansion. International Conference on Nanotechnology for Renewable Materials, 2017. June 5-8, Montreal, Canada.
- [3] **Wang L.**, Sanders J.E., Gardner D.J. Cellulose Nanofibril-Reinforced Polypropylene Composites for Extrusion-based Additive Manufacturing. SPE ACCE, 2017. September 5-8, Novi, MI, USA.

Poster:

- [1] **Wang L.**, Guan M.J. Influence of Veneers' Lathe Checks on Strain Distribution at Wood-adhesive Interphase Measured by Electronic Speckle Pattern Interferometry (ESPI). 55th SWST International Convention. 2012. August 27-31, Beijing, China.
- [2] **Wang, L.** and Gardner D.J. Cellulose Nanofibrils Reinforced Polymers by Additive Manufacturing, SPE Polymer Nanocomposites Conference, 2014. October 13-15, Lehigh University, Bethlehem, PA, USA.
- [3] Gardner D.J., **Wang L.** and Y. Han. Using inverse gas chromatography to measure processing effects on cellulose nanofibril surface energy. Inverse Gas Chromatography Symposium, 2015. May 4-5, Newark, NJ, USA.
- [4] Sanders J.E., **Wang L.** and Gardner D.J. *In-situ* Modification of Cellulose Nanofibrils during Spray Drying. UMaine Student Research Symposium. 2016. April 27, Bangor, ME, USA.
- [5] **Wang L.** and Gardner D.J. Cellulose Nanofiber Reinforced Polymers by 3D Printing. UMaine Student Research Symposium, 2016. April 27, Bangor, ME, USA.
- [6] **Wang L.** and Gardner D.J. Contribution of Printing Parameters on the Bonding Quality of 3D Printed PLA. International Symposium on Bioplastics, Biocomposites and Biorefining,

2016. May 31- June 3, Guelph, Ontario, Canada.

[7] **Wang L.** and Gardner D.J. Improved Impact Strength of PLA by 3D Printing. Northeast Agriculture and Biological Engineering Conference (NABEC), 2016. July 30-August 3, Orono, ME, USA.

[8] **Wang L.** and Gardner D.J. 3D Printed CaCO₃-filled Polypropylene (PP) with Increased Impact Strength for Crash Protection Application. SPE Automotive Composites Conference and exhibition, 2016. Sept 7-9, Novi, MI, USA.

[9] **Wang L.** and Gardner D.J. Mechanical Properties of Polypropylene from 3D Printing. 10th SPE Polymer Nanocomposites Conference, 2016. October 16-18, Bethlehem, PA, USA.

[10] Sanders J.E., **Wang L.** and Gardner D.J. *In-situ* modification of cellulose nanofibrils by organosilanes during spray drying. 10th SPE Polymer Nanocomposites Conference, 2016. October 16-18, Bethlehem, PA, USA.

[11] **Wang L.**, Gramlich W.M., Gardner D.J. and Han Y. Cellulose Nanofibrils Enhanced Polypropylene Composites for Fused Filament Fabrication: nonisothermal crystallization kinetics and thermal expansion. International Conference on Nanotechnology for Renewable Materials, 2017. June 5-8, Montreal, Canada.

REFERENCES

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