

Curriculum Vitae

Chelsea Simone Davis, Ph.D.

701 West Stadium Avenue, West Lafayette, IN | 765.494.9216 | Chelsea@purdue.edu

EDUCATION

University of Massachusetts, Amherst, MA
Ph.D. in Polymer Science and Engineering 2012
Thesis: "Surface Instabilities for Adhesion Control"
Advisor: Alfred J. Crosby

University of Massachusetts, Amherst, MA
M.S. in Polymer Science and Engineering 2007

North Carolina State University, Raleigh, NC
B.S. in Textile Engineering 2005
Area of Concentration: Product and Process Design
Received College of Textiles Academic Honors Award
Graduated Summa Cum Laude

North Carolina State University, Raleigh, NC
B.A. in Spanish Language and Literature 2005
Graduated Summa Cum Laude

APPOINTMENTS AND PROFESSIONAL EXPERIENCE

Purdue University School of Materials Engineering
Assistant Professor 2016 – Present
Research Area: Characterization of polymer interfaces via contact and fracture mechanics coupled with fluorescence microscopy.

École Supérieure de Physique et de Chimie Industrielles, Paris, France
Visiting Professor 2016
Collaborators: Costantino Creton and Anke Lindner
Research Area: Wrinkle geometry-dependent adhesion

National Institute of Standards and Technology, Gaithersburg, MD
Materials Research Engineer 2015 – 2016
Research Area: Characterization of energy absorbing materials via contact and fracture mechanics.

National Institute of Standards and Technology, Gaithersburg, MD
National Research Council Post-Doctoral Research Fellow 2013 – 2015
Advisor: Jeffrey Gilman
Research Area: Characterization of cellulosic nanocomposites utilizing novel fluorescence imaging techniques coupled with mechanical testing.

CHELSEA SIMONE DAVIS

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École Supérieure de Physique et de Chimie Industrielles, Paris, France

Michelin Post-Doctoral Research Fellow

2012 – 2013

Advisors: Costantino Creton and Anke Lindner

Research Area: Contact time dependence of adhesion strength in elastomeric networks.

University of Massachusetts, Amherst, MA

Graduate Research Assistant

2007 – 2012

Advisor: Alfred Crosby

Research Areas: Patterned surface roughness and buckling instabilities for adhesion control.

Milliken and Company, LaGrange, GA

Process Improvement Engineer

2006

Applied statistical process control tools to improve production of silicone-coated automotive fabrics.

Milliken Research Center, Spartanburg, SC

Engineering Intern

2005

Optimized novel automotive fabric patterning equipment and coordinated implementation in production facility.

Milliken and Company, Laurens, SC

Engineering Intern

2004

Improved weft-insertion warp-knitting machines by optimizing system gear ratios.

North Carolina State University, Raleigh, NC

Undergraduate Research Assistant

2003

Advisor: Wendy Krause

Research Area: Effect of additives on the rheological properties of hyaluronic acid and the time dependence of the viscoelastic response.

PUBLICATIONS AND PAPERS

1. **C.S. Davis**, K.E. Hillgartner, S.H. Han, J.E. Seppala, “Mechanical strength of welding zones produced by polymer extrusion additive manufacturing.” Submitted **2017**.
2. J.W. Woodcock, J.W. Gilman, R. Beams, **C.S. Davis**, N. Chen, S. Stranick, D. Shah, F. Volrath, “Observation of interfacial damage in a silk-epoxy composite, using hyperspectral and fluorescence lifetime imaging of a simple mechanoresponsive fluorescent probe.” *Advanced Materials Interfaces*, Accepted **2017**.
3. D.M. Fox, R.S. Rodriguez, M.N. Devilbiss, J.W. Woodcock, **C.S. Davis**, R. Sinko, S. Keten, J.W. Gilman, “Simultaneously tailoring surface energies and thermal stabilities of cellulose nanocrystals using ion exchange: effects on polymer composites properties for transportation, infrastructure, and renewable energy applications.” *ACS Applied Materials & Interfaces*, (40) **2016**, 27270.
4. B. Natarajan, N.D. Orloff, R. Ashkar, S. Doshi, K.A. Twedt, A. Krishnamurthy, **C.S. Davis**, A.M. Forster, E. Thostenson, J. Obrzut, R. Sharma, J.A. Liddle, “Multiscale metrologies for process optimization of carbon nanotube polymer composites.” *Carbon*, (108) **2016**, 381.

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5. M. Zhu, T. Li, **C.S. Davis**, Y. Yao, J. Dai, Y. Wang, F. AlQatari, J.W. Gilman, L. Hu, "Transparent and haze wood composites for highly efficient broadband light management in solar cells." *Nano Energy*, (26) **2016**, 332.
6. **C.S. Davis**, N.D. Orloff, J.W. Woodcock, C.J. Long, K.A. Twedt, B. Natarajan, J.E. Seppala, J.J. McClelland, J. Obrzut, J.A. Liddle, J.W. Gilman, "Domain formation in carbon nanotube composites controlled by mass fraction impacts electrical properties." *Composites Science and Technology*, (133) **2015**, 23.
7. **C.S. Davis**, D.L. Grolman, A. Karim, J.W. Gilman, "Perspective: What do we still need to understand to commercialize nanocellulose?" *Green Materials*, (3) **2015**, 53.
8. **C.S. Davis**, R.J. Moon, S. Ireland, E.J. Foster, L. Johnston, J.A. Shatkin, K. Nelson, A.M. Forster, M.T. Postek, A.E. Vladár, J.W. Gilman, "NIST-TAPPI Workshop on Measurement Needs for Cellulose Nanomaterials Report", Vancouver, Canada, **2015**, DOI: 10.6028/NIST.SP.1192.
9. J.H. Kim, N.A. Heckert, S.P. Mates, J.E. Seppala, W.G. McDonough, **C.S. Davis**, K.D. Rice, G.A. Holmes, "Effect of fiber gripping method on the single fiber tensile test: II. Comparison of fiber gripping materials and loading rates." *Journal of Material Science*, (50) **2015**, 2049.
10. **C.S. Davis**, J.W. Woodcock, J.W. Gilman, "Preparation of nanoscale multi-walled carbon nanotube dispersions in a polyetheramine epoxy for ecotoxicological assessment." *NIST Special Publication Series*, (1200-9) **2015**. DOI: 10.6028/NIST.SP.1200-9.
11. E. Kroner, **C.S. Davis**, "A Study of the Adhesive Foot of the Gecko: Translation of a Publication by Franz Weitlaner." *The Journal of Adhesion*, (91) **2015**, 481.
12. **C.S. Davis**, F. Lemoine, T. Darnige, D. Martina, C. Creton, A. Lindner, "Debonding mechanisms of soft materials at short contact times." *Langmuir*, (35) **2014**, 10626.
13. **C.S. Davis**, D. Martina, C. Creton, A. Lindner, A.J. Crosby, "Enhanced adhesion of elastic materials to small-scale wrinkles." *Langmuir*, (28) **2012**, 14899.
14. **C.S. Davis**, A.J. Crosby, "Wrinkle morphologies with two distinct wavelengths." *Journal of Polymer Science B*, (50) **2012**, 1225. Featured on Journal Cover.
15. **C.S. Davis**, A.J. Crosby, "Mechanics of wrinkled surface adhesion." *Soft Matter*, (7) **2011**, 5373.
16. S. Kundu, **C.S. Davis**, T. Long, R. Sharma, A.J. Crosby, "Adhesion of non-planar wrinkled surfaces." *Journal of Polymer Science B*, (49) **2011**, 179.
17. G. Miquelard-Garnier, A.B. Croll, **C.S. Davis**, A.J. Crosby, "Contact-line mechanics for pattern control." *Soft Matter*, (6) **2010**, 5789.

PRESENTATIONS AND POSTERS

Invited Presentations

1. **C.S. Davis**, "Visualizing polymer interfaces: Unique measurement strategies," *Department of Materials Science and Engineering, Virginia Polytechnic Institute and State University*, Blacksburg, VA, September 2016.
2. **C.S. Davis**, J.W. Woodcock, R.N. Beams, M. Wang, A.F. Forster, S.J. Stranick, J.W. Gilman, "Self-Reporting Damage Sensors," *Nonwovens and Related Technologies Conference*, Raleigh, NC, September 2016.
3. **C.S. Davis**, J.W. Woodcock, R. Beams, S. Stranick, J.W. Gilman, "Visualizing polymer composite interfacial deformation," *ECI Composites at Lake Louise*, Lake Louise, Canada, November 2015.
4. **C.S. Davis**, "Visualizing polymer interfaces: Unique measurement strategies," *Department of Materials Science and Engineering, University of Maryland*, College Park, MD, October 2015.
5. **C.S. Davis**, "Understanding polymer interfaces: Unique measurement strategies," *Department of Mechanical Engineering, Johns Hopkins University*, Baltimore, MD, April 2015.

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6. **C.S. Davis**, “Polymer interfaces: Applying new tools to old questions,” *School of Materials Engineering, Purdue University*, West Lafayette, IN, November 2014.
7. **C.S. Davis**, J.W. Woodcock, M. Zammarano, J.W. Gilman, “Visualizing the interface: Applying optical methods to nanoscopic questions,” *AVS 61st International Symposium & Exhibition*, Baltimore, MD, November 2014.
8. **C.S. Davis**, “Polymer adhesion: Dwell time effects,” *Department of Physics, Georgetown University*, Washington, DC, May 2014.
9. **C.S. Davis**, “Polymer adhesion: Dwell time effects,” *École Supérieure de Physique et de Chimie Industrielles ParisTech*, Paris, France, March 2014.
10. **C.S. Davis**, D. Martina, F. Lemoine, C. Creton, A. Lindner, “Polymer adhesion: Contact time effects,” *Science of Adhesion Gordon Research Seminar*, South Hadley, MA, July 2013.
11. **C.S. Davis**, A. Lindner, C. Creton, A.J. Crosby, “Polymer adhesion: Contact time and roughness effects,” *Macromolecular Materials Gordon Research Seminar*, Ventura, CA, January 2013.
12. **C.S. Davis**, A.J. Crosby, “Contact adhesion of wrinkled surfaces,” *Annual Meeting of the Adhesion Society, Peebles Student Award Session*, Savannah, GA, February 2011.

Contributed Presentations

13. **C.S. Davis**, J.W. Woodcock, R.N. Beams, M. Wang, A.F. Forster, S.J. Stranick, J.W. Gilman, “Self-Reporting Damage Sensors,” *American Physical Society March Meeting*, Baltimore, MD, March 2016.
14. **C.S. Davis**, J.W. Woodcock, R.N. Beams, M. Wang, A.F. Forster, S.J. Stranick, J.W. Gilman, “Self-Reporting Damage Sensors,” *Annual Meeting of the Adhesion Society*, San Antonio, TX, February 2016.
15. **C.S. Davis**, D. Grolman, J. Youngblood, J.W. Gilman, A. Karim, “Strengthening block copolymer thin films with cellulose nanocrystals (CNC),” *TAPPI International Conference on Nanotechnology for Renewable Materials*, Atlanta, GA, June 2015.
16. **C.S. Davis**, J.W. Woodcock, R.N. Beams, M. Zammarano, S.J. Stranick, J.W. Gilman, “Visualizing the interface: Applying optical methods to nanoscopic questions,” *Annual Meeting of the Adhesion Society*, Savannah, GA, February 2015.
17. **C.S. Davis**, D. Martina, F. Lemoine, C. Creton, A. Lindner, “Polymer adhesion: Short contact time effects,” *Annual Meeting of the Adhesion Society*, San Diego, CA, March 2014.
18. **C.S. Davis**, F. Lemoine, D. Martina, C. Creton, A. Lindner, “Polymer adhesion: Contact time effects,” *Annual Meeting of the Adhesion Society*, Daytona Beach, FL, March 2013.
19. **C.S. Davis**, D. Martina, A. Lindner, C. Creton, A.J. Crosby, “Mechanics of wrinkle adhesion in elastic and viscoelastic films,” *Annual Meeting of the Adhesion Society*, New Orleans, LA, February 2012.
20. **C.S. Davis**, A.J. Crosby, “Mechanics of wrinkled surface adhesion,” *American Physical Society March Meeting*, Dallas, TX, March 2011.
21. **C.S. Davis**, A.J. Crosby, “Adhesion of aligned wrinkles,” *Annual Meeting of the Adhesion Society*, Daytona Beach, FL, February 2010.

Poster Presentations

22. **C.S. Davis**, J.W. Woodcock, R.N. Beams, S.J. Stranick, J.W. Gilman, “Visualizing strain at the interface of silk/epoxy composites,” *3rd International Workshop on Multiscale Dynamics of Polymeric Materials*, Paris, France, November 2016.
23. **C.S. Davis**, J.W. Woodcock, R.N. Beams, S.J. Stranick, J.W. Gilman, “Visualizing strain at the interface of silk/epoxy composites,” *Science of Adhesion Gordon Research Conference*, South Hadley, MA, July 2015.

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24. **C.S. Davis**, N.D. Orloff, J.W. Woodcock, C.J. Long, K.A. Twedt, B. Natarajan, J.J. McClelland, J. Obrzur, J.A. Liddle, J.W. Gilman, “Carbon nanotube-rich domain effects on bulk electrical properties of nanocomposites,” *NIST Sigma Xi Postdoctoral Poster Presentations*, Gaithersburg, MD, February 2015.
25. **C.S. Davis**, J.W. Woodcock, M. Zammarano, S. Stranick, J.W. Gilman, “Imaging cellulosic composite interfaces with FRET,” *TAPPI International Conference on Nanotechnology for Renewable Materials*, Vancouver, BC, Canada, June 2014.
26. **C.S. Davis**, D. Martina, F. Lemoine, C. Creton, A. Lindner, “Adhesion at short dwell times,” *NIST Sigma Xi Postdoctoral Poster Presentations*, Gaithersburg, MD, February 2014.
27. **C.S. Davis**, D. Martina, F. Lemoine, C. Creton, A. Lindner, “Adhesion at short dwell times,” *Science of Adhesion Gordon Research Conference*, South Hadley, MA, July 2013.
28. **C.S. Davis**, D. Martina, A. Lindner, C. Creton, A.J. Crosby, “Wrinkle adhesion of confined elastomers,” *Macromolecular Materials Gordon Research Conference*, Ventura, CA, January 2013.
29. **C.S. Davis**, D. Martina, A. Lindner, C. Creton, A.J. Crosby, “Mechanics of wrinkle adhesion in elastic and viscoelastic films,” *Center for UMass/Industry Research on Polymers Fall Meeting*, Amherst, MA, October 2011.
30. **C.S. Davis**, A.J. Crosby, “Model wrinkle adhesion,” *Center for UMass/Industry Research on Polymers Fall Meeting*, Amherst, MA, October 2010.
31. **C.S. Davis**, A.J. Crosby, “Model wrinkle adhesion,” *NEW.Mech Poster Event*, Cambridge, MA, September 2010.
32. **C.S. Davis**, A.J. Crosby, “Adhesion of aligned wrinkles,” *Gecko Workshop*, Saarbrücken, Germany, July 2010, First Prize Poster Award.
33. **C.S. Davis**, A.J. Crosby, “Adhesion of aligned wrinkles,” *IGERT Project Meeting Poster Session*, Washington, DC, May 2010.
34. **C.S. Davis**, A.J. Crosby, “Crumpled shell and membrane adhesion,” *Science of Adhesion Gordon Research Conference*, New London, NH, July 2009, Excellent Poster Award.
35. **C.S. Davis**, A.J. Crosby, “Crumpled shell adhesion,” *Annual Meeting of the Adhesion Society*, Savannah, GA, February 2009.
36. **C.S. Davis**, A.J. Crosby, “Adhesion of responsive shell surfaces,” *American Physical Society March Meeting*, New Orleans, LA, March 2008.
37. **C.S. Davis**, A.J. Crosby, “Adhesion of surface ribbons,” *Center for UMass/Industry Research on Polymers Fall Meeting*, Amherst, MA, October 2007.

AWARDS AND HONORS

Sigma Xi Scientific Research Society Election to Membership	2016
Visiting Professorship, ESPCI	2016
National Research Council Postdoctoral Research Fellowship	2013 - 2015
Pebbles Award for Graduate Student Research in Adhesion Science	2011
NSF Integrative Graduate Education and Research Traineeship (IGERT)	2008 – 2010
First Prize Poster, INM Gecko Workshop, Saarbrücken, Germany	2010
Excellent Poster Award, Adhesion Gordon Research Conference	2009
Proctor and Gamble Graduate Research Fellowship	2007 – 2008
University of Massachusetts Graduate Student Fellowship	2006 – 2007
College of Textiles Academic Scholarship	2005
Phi Beta Kappa Honor Society	2003 – 2005
Phi Kappa Phi Honor Society	2003 – 2005

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Centennial Scholars Full Undergraduate Scholarship 2001 – 2005

INTERNATIONAL EXPERIENCE

TAPPI International Conference on Nanotechnology
Vancouver, Canada 2014
Presented Poster: Imaging cellulosic composite interfaces with FRET

Université Pierre et Marie Curie - Jussieu
Paris, France 2013
Course: A3 – French language for beginners

Alliance Française
Paris, France 2012
Courses: A1 and A2 – French language for beginners

École Supérieure de Physique et de Chimie Industrielles (ESPCI)
Paris, France 2011
Researched adhesion of wrinkles on soft, viscoelastic films
Completed a peer-reviewed paper highlighting the results of this study

Institute of New Materials Gecko Workshop
Saarbrücken, Germany 2010
Presented poster in student poster competition, won first prize.

Pohang Science and Technology University (POSTECH)
Pohang, South Korea 2008
Researched adhesion of block copolymer films

Korean National Polymer Symposium
Seoul, South Korea 2008

Universidad Internacional
Cuernavaca, Mexico 2002
Studied Spanish language and Mexican culture

PROFESSIONAL AFFILIATIONS

Sigma Xi Scientific Research Society, Member 2016 – Present
American Association for the Advancement of Science, Member 2016 – Present
Adhesion Society, Secretary 2016 – Present
Adhesion Society, Member 2009 – Present
Technical Association of the Pulp and Paper Industry, Member 2014 – Present
American Physical Society, Member 2008 – Present
Polymer Science and Engineering Student Group, Member 2003 – 2005
Textile Engineering Society, Vice-President 2004 – 2005
Engineers Council, Textile Engineering Representative 2003 – 2005

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STUDENT ADVISING

Graduate Students

1. Mitchell Rencheck
2. Hyeyoung Son

MENTORING

- Mentored graduate student in Polymer Engineering at the University of Akron with Alamgir Karim and Jeffrey Gilman, 2014-2016.
- Mentored Summer Undergraduate Research Fellow from Purdue University on nanocellulose film mechanics project at NIST, 2014.
- Supervised several French undergraduate and graduate students in collaborative research experiences while at the ESPCI, 2012-2013.
- Mentored visiting graduate student from Tsinghua University on continuation of wrinkle adhesion research project while at the ESPCI, 2013.
- Supervised high school and undergraduate students in collaborative summer research experience at UMass, 2009.
- Supervised three middle and high school teachers in research experience for teachers at UMass, 2008.
- Co-led PSE first-year graduate student Mentoring Program, 2007 – 2008.
- Supervised first two teams of high school seniors working on research projects in conjunction with the Crosby Research Group (program has since been formalized into an ongoing collaboration based on curriculum established in the first year), 2007 – 2008.

SERVICE AND OUTREACH

- Organized and chaired sessions on characterization and metrology, Adhesion Society Annual Meetings, 2014-2017.
- Organized NIST Impact Mitigating Materials Workshop in conjunction with the Center for Hierarchical Materials Design, 2016.
- Led discussion for “Mechanical Adhesion, Surface Tension, and Friction” Session, Science of Adhesion Gordon Research Seminar, 2015.
- Organized and chaired session on metrology tools for nanocellulose, TAPPI Nanotechnology Conference, 2015.
- Organized NIST Workshop on Measurement Needs for Nanocellulose in conjunction with TAPPI Nanotechnology Conference, 2014.
- Participated in both Outreach and ASPIRE programs to increase diversity in the natural sciences by inspiring K-12 students with extracurricular science activities and hands-on demonstrations, 2006 - 2012.
- Developed and presented Nanotechnology Education Outreach Presentation for high school students, 2008-2010.
- Served as student host for prospective graduate students during UMass PSE departmental recruitment weekends and throughout recruiting season, 2007 – 2011.
- At NC State, worked with Habitat for Humanity, Service Raleigh, Wake County Food Bank, University Open House, New Student Orientation, and served as Student Ambassador for the College of

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Textiles, 2001-2005.

COLLABORATORS

Anke Lindner	École Supérieure de Physique et de Chimie Industrielles (ESPCI)
Costantino Creton	École Supérieure de Physique et de Chimie Industrielles (ESPCI)
Jeffrey Gilman	National Institute of Standards and Technology (NIST)
Jonathan Seppala	National Institute of Standards and Technology (NIST)
Aaron Forster	National Institute of Standards and Technology (NIST)
Fritz Vollrath	University of Oxford
Liangbing Hu	University of Maryland
Douglas Fox	American University
Alamgir Karim	University of Akron
Santanu Kundu	Mississippi State University
Guillaume Miquelard-Garnier	Arts et Métiers, ParisTech, France
Andrew Croll	University of North Dakota
David Martina	Institut Langevin, ParisTech, France
Elmar Kroner	INM Leibniz Institute for New Materials, Saarbrücken, Germany

POSTDOCTORAL RESEARCH ADVISORS

Jeffrey Gilman	National Institute of Standards and Technology (NIST)
Costantino Creton	École Supérieure de Physique et de Chimie Industrielles (ESPCI)
Anke Lindner	École Supérieure de Physique et de Chimie Industrielles (ESPCI)

GRADUATE RESEARCH ADVISOR

Alfred Crosby	University of Massachusetts Amherst
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UNDERGRADUATE RESEARCH ADVISOR

Wendy Krause	North Carolina State University
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