Troy R. Hendricks

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Objective To obtain a position in industrial research and development that uses my technical training, analytical abilities and problem solving skills.

Education

2002- Present **Doctorate of Philosophy in Chemical Engineering**
Michigan State University, East Lansing, Michigan
Expected graduation: May 2008, GPA 3.67/4.0
Research Interests: Structure and Patterning of Thin Polymer Films

1998-2002 **Bachelor of Science in Chemical Engineering**
Michigan State University, East Lansing, Michigan
Graduated: May 2002, GPA 3.68/4.0

Research Experience

2002- Present **Graduate Research Assistant** Advisor Dr. Ilsoon Lee
Department of Chemical Engineering and Materials Science, Michigan State University
- Fabrication of conductive patterns on top of self-assembled polyelectrolyte multilayer (PEM) film platforms using copper, nickel, palladium, dendrimers, or exfoliated graphite nanoplatelets
- Mechanical film buckling; investigations of the causes, how to control and prevent it
- Incorporation of functional nanomaterials into PEM nanocomposite films to form multi-functional films
- Design and characterization of multi-functional, nanostructured polymer films

Summer 2002 **Summer Research Internship** Advisor Dr. Christina Chan
Department of Chemical Engineering and Materials Science, Michigan State University
- Practiced basic cell protocols and investigated possible characterization techniques

Summer 2001 **NSF Research Experience for Undergraduates** Advisor Dr. Charles Petty
Department of Chemical Engineering and Materials Science, Michigan State University
- Simulated mixing in a slurry bubble using computational fluid dynamics (Fluent 4.0)

Summer 2000 **NSF Research Experience for Undergraduates** Advisor Dr. Lloyd Ketchum, Jr.
Department Civil Engineering and Geological Sciences, University of Notre Dame
- Studied denitrification of wastewater using bypass on a plug-flow reactor

Teaching Experience

2007- 2008 **Graduate Teaching Assistant**
College of Engineering, Michigan State University
- EGR 100: Introduction to Engineering Design, *two semesters*
- Responsibilities included leading a laboratory section and the grading of reports and exams

2002- 2005 **Graduate Teaching Assistant**
Department of Computer Science and Engineering, Michigan State University
- CSE 101: Computing Concepts and Competencies, *four semesters*
- Responsibilities included teaching class daily and the grading and administration of exams

1999- 2002 **Teaching Assistant**
Lyman Briggs School of Science, Michigan State University
- LBS 118: Calculus I, *six semesters*
- Responsibilities included planning and teaching a weekly review, writing and administering quizzes and the grading of quizzes and exams

Research Highlights

- Creating conductive metal patterns on flexible substrates. We start by depositing PEM films onto a variety of substrates including glass and flexible plastics. Microcontact printing followed by electroless deposition is then used to create metal patterns of copper, nickel, and gold.

- Conductive graphite patterning on flexible substrates. Again we start with PEM film platforms. However instead of using metals which are rigid we use polymer coated graphite nanoplatelets. These nanoplatelets are graphene sheets which have many of the same physical properties as carbon nanotubes but at a fraction of the cost (only $4/pound).
- Using PEM films on rubber substrates we have discovered a method to prevent wrinkles or buckles from forming in polymer films. This is done by incorporating nanoparticles into the PEM films during the layer-by-layer assembly process. The nanoparticles redirect the stress in the film to prevent the film from buckling. Since human skin is similar to our polymer/rubber system this may lead to the reduction of wrinkles in human skin.
- Over 50 articles featuring my work have been posted on the internet including articles from; *MRS Bulletin, Discovery News, The Timesonline and Chemistry world* go to http://www.egr.msu.edu/~leeil/ to see them.

Publications

- "Intact Pattern Transfer of Conductive Exfoliated Graphite Nanoplatelet Nanocomposite Films to Polyelectrolyte Multilayer Platforms" **T.R. Hendricks**, J. Lu, L.T. Drzal, I. Lee. Submitted to *Advanced Materials*, 2007. (Impact Factor = 7.9)
- "A New Approach to a Diffuse Reflector; Electroless Plating of a Self-Assembled Particle Monolayer" J.S. Ahn, **T.R. Hendricks**, I. Lee, *Advanced Functional Materials*, DOI 10.1002/adfm.200700251. (Impact Factor = 6.8)
- "Effects of Catalyst Introduction on Selective Nickel Deposition" **T.R. Hendricks**, E.E. Dams, S.T. Wensing I. Lee. *Langmuir*, **23**, 7404, 2007. (Impact Factor = 3.9)
- "Step-edge Like Template Fabrication of Polyelectrolyte Multilayer Supported Nickel Nanowires" D. Srivastava, **T.R. Hendricks**, I. Lee, *Nanotechnology*, **18**, 245305, 2007. (Impact Factor = 3.0)
- "Wrinkle-Free Nanomechanical Film: Control and Prevention of Polymer Film Buckling" **T.R. Hendricks** and I. Lee. *Nano Letters* **7** (2), 372, 2007. (Impact Factor = 10.0)
- "A Versatile Approach to Selective and Inexpensive Copper Patterns Using Polyelectrolyte Multilayer Coatings" **T.R. Hendricks** and I. Lee. *Thin Solid Films* **515**, 2347, 2006. (Impact Factor = 1.7)
- "Patterned and Controlled Polyelectrolyte Fractal Growth and Aggregations" I. Lee, J.S. Ahn, **T.R. Hendricks**, M.F. Rubner, P.T. Hammond. *Langmuir* **20**, 2478, 2004. (Impact Factor = 3.9)

Conference Proceedings

- "Versatile Conductive Patterning Using Exfoliated Graphite Nanoplatelets, Copper, and Polyelectrolytes" **T.R. Hendricks**, J. Lu, L.T. Drzal, I. Lee. *Polymeric Materials: Science and Engineering Preprint* **36**, 293 2007.
- "Control and Prevention of Polymer Film Buckling by Incorporating Surface Topographies and Nanoparticles" **T.R. Hendricks**, I. Lee. *Polymer Preprints* **48(1)**, 668, 2007.

Patents

- "Wrinkle-Free Nanomechanical Films" Provisional Patent Filed, 6550-000152PS1 Application as filed 11.15.2006 (MSU 07-071F)
- "Micropatterning of Conductive Graphite Particles Using Microcontacting Printing" Provisional Patent Filed 6550-000153PS1 Application as filed 11.15.2006 (MSU 07-072F)
- "Selective Metal Patterns Using Polyelectrolyte Multilayer Coatings" US Patent Filed, 6550-000138PS1 Application as filed 06.16.2007 (MSU 06-027)

Accomplishments and Organizations

- Awarded the Dissertation Completion Fellowship for Spring 2007
- AIChE member, 2001-current
- ACS member, 2007-current
- Laboratory Safety Officer 2004-current
- Deans list 7 semesters
- Awarded best poster in Group 20: Catalysis and Reaction Engineering, undergraduate poster session, AIChE Annual Meeting, Reno, NV 2001

Conference Presentations

- "Conductive Patterning Utilizing Polyelectrolytes for Plastic Electronics" **T.R. Hendricks**, J. Lu, L.T. Drzal, I. Lee, AIChE Annual Meeting, Salt Lake City, Utah, November 2007. (Oral presentation)
- "Nanomaterial Incorporation to Prevent Polymer Film Buckling" **T.R. Hendricks**, I. Lee, AIChE Annual Meeting, Salt Lake City, Utah, November 2007. (Oral presentation)
- "Nanomechanical and Biofunctional Films as Next Wrinkle Fighter" I. Lee, **T.R. Hendricks**, HBA Global Exposition & Educational Conference, Jacob K. Javits Convention Center, New York City, September 2007. (Invited oral presentation).
- "Versatile Conductive Patterning Using Exfoliated Graphite Nanoplatelets, Copper and Polyelectrolytes" **T.R. Hendricks**, J. Lu, L.T. Drzal, I. Lee, 233rd ACS National Meeting, Chicago, Illinois, March, 2007. (Oral presentation)
- "Control and Prevention of Polymer Film Buckling by Incorporating Surface Topographies and Nanoparticles" **T.R. Hendricks**, I. Lee, 233rd ACS National Meeting, Chicago, Illinois, March, 2007. (Oral presentation)
- "Versatile Conductive Patterning" **T.R. Hendricks**, Lee, I. AIChE Annual Meeting, San Francisco, California, November, 2006. (Oral Presentation)
- "Nanoscopic Wrinkled Morphology of Polyelectrolyte Multilayer Films on Poly(dimethylsiloxane) Substrates Induced by Thermal Crosslinking" **T.R. Hendricks**, I. Lee AIChE Annual Meeting, San Francisco, California, November, 2006. (Oral Presentation)
- "Effects of Catalyst Introduction Methods on Metal Pattern Structure and Selectivity Using Dendrimer/Polyelectrolyte Multilayer Coated Substrates" **T.R. Hendricks**, I. Lee AIChE Annual Meeting, Cincinnati, Ohio, November, 2005. (Oral Presentation)
- "Particle Self-Assembly Based Optoelectronic Coatings" J.S. Ahn, **T.R. Hendricks**, P.T Hammond, M.F Rubner, I. Lee (presenter) AIChE Annual Meeting, San Francisco, California, November, 2003. (Oral Presentation)
- "Numerical Simulation of A Bubble Column", **T.R. Hendricks** (presenter), K.M. Baker, S.M. Vermillion (presenter), H. Li, B.P. Raber, and G. Chase, Annual AIChE Meeting, Reno, NV November, 2001. (Poster presentation)

Research Skills

Characterization Techniques

- Optical Microscopy, Atomic Force Microscopy (AFM), Scanning Electron Microscopy (SEM), Transmitted Electron Microscopy (TEM)
- Energy Dispersive X-ray and Spectroscopy (EDXS), X-ray Photoelectron Spectroscopy (XPS), UV-Vis Spectroscopy
- Ellipsometry, Contact Angle and Quartz Crystal Microbalance (QCM) measurements

Computer Software and Tools

- Microsoft Office (Word, Excel, PowerPoint, Access)
- HTML and Dreamweaver
- ChemDraw, Origin, Polymath, Fluent, Endnote and Photoshop

Additional Presentations

- "Functional Polyelectrolyte Multilayer Coatings" **T.R. Hendricks**, I. Lee, NanoDay, Impressions 5 Museum, Lansing MI, April 2007 (Poster Presentation)
- "Functional Polyelectrolyte Multilayer Coatings" **T.R. Hendricks**, I. Lee, American Vacuum Society – Michigan Chapter, Spring Symposium, April 2007 (Poster Presentation)
- "Wrinkle Prevention in Polymer Films Using Nanoparticles" **T.R. Hendricks**, I. Lee, MSU-CHEMS Annual Research Forum 2007, Lansing, Michigan, March 2007. (Oral presentation)
- "Functional Polyelectrolyte Multilayer Coatings" **T.R. Hendricks**, I. Lee, MSU-UM Blue-Green Seminar 2006, MSU, October, 2006. (Poster presentation)
- "Versatile Polyelectrolyte Multilayer Coatings" **T.R. Hendricks**, I. Lee, MSU-CHEMS Annual Research Forum 2006, Lansing, Michigan, March 2006. (Poster presentation)

- "Highly Selective Copper Patterns on Polyelectrolyte Multilayer Coated Substrates" **T.R. Hendricks**, I. Lee, MSU-CHEMS Annual Research Forum 2005, Lansing, Michigan, April, 2005. (Poster presentation)
- "Electroless Deposition and Microcontact Printing on Polyelectrolyte Multilayers Using PAMAM Dendrimers and Dendrimer Encapsulated Nanoparticles" **T.R. Hendricks**, E. E. Dams, I. Lee MSU-CHEMS Departmental Research Forum 2004, MSU March, 2005. (Poster presentation)
- "Electroless Deposition and Microcontact Printing on Polyelectrolyte Multilayers Using PAMAM Dendrimers and Dendrimer Encapsulated Nanoparticles" **T.R. Hendricks**, E. E. Dams, I. Lee. The CFMR Symposium 2004, February, MSU. (Poster presentation)

References available on request