

## LEE W. HOFFMAN

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### EDUCATION

- PhD, Chemistry, December 2010, Flinders University, Adelaide, South Australia  
Thesis title, *Synthesis and characterization of gold nanoparticles in poly(amidoamine) (PAMAM) dendrimers and potential therapeutic applications.*
- MS, Chemistry, March 1996, Michigan State University, East Lansing, MI
- BS, Chemistry, December 1992, University of Wisconsin – La Crosse, La Crosse, WI

### RESEARCH INTERESTS

- Interfacial studies on the self-assembly of natural organic materials, understanding the nature of each component, and development of a mechanism describing this process.
- Dendrimer/metal nanocomposite design and synthesis hosting metal nanoparticles, utilizing the multivalent dendritic polymer architecture for further exploitation with other molecules such as antibodies and other targeting species.
- Surface and interfacial science applications to develop a better understanding of the structure/property relationships of a variety of materials dendritic matter, with particular investigations directed towards developing better control over material/material interaction and formation along with clarifying the mechanism for nanocomposite formation.

### RESEARCH EXPERIENCE

2011-2013, Postdoctoral Research Associate with Prof. James Rice, South Dakota State University, Brookings, South Dakota

- Offered support for a ‘soft materials’ approach for an ongoing, in-depth study of the self-assembly process involved in the formation of natural organic materials.
- Investigated molecule-molecule, molecule-aggregate, and aggregate-aggregate interactions using Langmuir Blodgett surface pressure isotherms.
- Identified local surface charge variances and incorporated this knowledge with isotherm data to provide insight into individual molecular components contributing to self-assembly process.
- Studied size and shape of individual components extracted from Humic Acid using scanning electron microscopy.
- Explored self-assembly of individual components of Humic Acid using small angle scattering.
- Developing reflectometry studies (neutron and x-ray) to describe the molecular ordering

of natural organic matter components before disassembly and after reassembly.

2010, Postdoctoral Research Associate with Dr. Stephen Clarke, Flinders University, Adelaide, South Australia

- Provided contract support on project between CSIRO in Australia and US-based Adventus technologies.
- Evaluated current processes used for development of silicone materials to replace intraocular lens fluid.
- Delivered improved methods and fresh ideas for future development of silicone materials that will result in improved curing with final modulus and extractables meeting the specified limits.

2006-2010, PhD, Flinders University, Adelaide, South Australia, with Dr. Stephen Clarke and Prof. Nico Voelcker

- Synthesized gold nanoparticles stabilized by PAMAM dendrimers using a modified Turkevich method.
- Characterized nanoparticle formation and the resulting dendrimer/nanoparticle composites through a variety of spectroscopic and microscopic techniques, including TEM, AFM, SAXS, NCISS, and DLS. First time AFM phase imaging was used to elucidate gold nanoparticle formation and, with supporting NCISS results, dendrimer/gold nanocomposite thin layer formation is described.
- Applied dendrimer/gold nanocomposite towards enhancement of current cancer therapy and, more specifically, leukemia, resulting in confirmation of cell-specific binding.
- Authored four successful funding applications for large equipment use (once each to APS and IPNS in Chicago and two to ANSTO in Lucas Heights, NSW, Australia).

1999-2001, Sr. Research Chemist, Interfacial Science Research Group, Dow Corning Corporation

- Investigated deposition of Silicone Emulsion that assisted management in understanding the mechanism of silicone-in-water emulsion in key applications on surfaces including fabric and hair fibers through adjustment of formulation and development of technological enhancements.
- Collaborated on projects in conjunction with external academic teams as well as internal customers resulting in:
  - Development of, in conjunction with members of Michigan Molecular Institute, Poly (amidoamine-organosilicon) (PAMAMOS) dendrimers, a new class of materials with a wide range of capabilities from metal ion uptake to controlled porosity. Discoveries included:
    - Characterized surface properties of metal-doped PAMAMOS through various spectroscopies, microscopies and identified potential uses in a wide variety of electronic-based applications.
    - Investigated dielectric and morphology of PAMAMOS materials, which lead to the identification of PAMAMOS as a 4<sup>th</sup> generation inter-layer dielectric
  - Studying effects of the aging on silicones used in High Voltage Insulating applications. Investigated effects of varying degradation techniques on hydrophobicity loss/regain of surfaces.
    - Applied microscopic and spectroscopic tools to characterize degraded materials.
    - Compared similar systems with colleagues at major universities, resulting in a fundamental understanding between ‘real’ versus ‘ideal’ results

which, in turn, proved at least one of the three proposed mechanisms does play a role in insulator degradation

## TEACHING EXPERIENCE

- Drexel University
  - 2014-15 (fall)
    - CHEM 101 – General Chemistry – lecture (honors), lab (honors and non-honors), and recitation (honors) components
  - (winter)
    - CHEM 102 – General Chemistry – lecture (non-honors) and lab (honors)
    - CHEM 101 – General Chemistry – lecture
  - (spring)
    - CHEM 102 – General Chemistry – lecture and course coordinator
    - CHEM 151 – General Chemistry – lab
- South Dakota State University
  - 2014 (summer)
    - CHEM 106 – Inorganic Chemistry lecture (SDSU University Center)
    - CHEM 106L – Inorganic Chemistry lab (SDSU University Center)
    - CHEM 106 – Inorganic Chemistry lecture (Southeast Technical Institute)
  - 2013-14 (fall)
    - CHEM 106 – Inorganic Chemistry lecture
    - CHEM 106L – Inorganic Chemistry laboratory
  - (spring)
    - CHEM 108 – Organic & Biochemistry lecture
    - CHEM 108L – Organic & Biochemistry lab
  - 2013 (summer)
    - CHEM 112 – General Chemistry lecture (co-taught)
    - CHEM 112L – General Chemistry lab
    - CHEM 108L - Organic & Biochemistry laboratory (online)
- Flinders University, Adelaide, South Australia
  - 2009
    - Co-supervised Nanotechnology Honours student
  - 2006-2009
    - Demonstrator/Tutor for introductory undergraduate labs and tutorials
- Kenosha Unified School District No. 1, Kenosha, WI
  - 2002-2003
    - Reuther Central High School, Accelerated Independent Study, instructor of core subjects through computer-generated, self-paced instruction
  - Spring 2002
    - Indian Trails Academy, Science Instructor of chemistry to sophomore students and earth science to senior students

- Dow Corning Corporation, Midland, MI
  - 1997-2001  
Instructor, Silicone Chemistry Section in Pre-Deployment Training for Plant Operators
  - 1997-1999  
Facilitator, Chemistry for the Non-Chemist for Central Test Lab Operators
  - 1997-1999  
Facilitator, Manufacturing and Engineering Silicone Manufacturing Processes for Midland plant employees
- Michigan State University, East Lansing, MI
  - 1993-1996  
Teaching Assistant, introductory lectures and laboratory sections

#### CERTIFICATES, AWARDS AND AFFILIATIONS

- American Crystallographic Association, Inc. Travel Grant, 2013
- Endeavour International Research Scholarship (EIPRS), 2006
- The American Chemical Society, Member 1999 - present
  - Committee on Chemists With Disabilities, 2003-2004, 2011-present
  - Committee on ProjectSEED, 2014-
- Member of the Royal Society of Chemistry, 2012-present

## PATENTS AND FUNDED PROPOSALS

- APS General User Proposal GUP-28654, " Influence of water on the self-assembly of NOM using USAXS"
- APS General User Proposal GUP-32048, "Investigations of NOM self-assembly using X-ray liquid surface reflectometry"
- LANL LC-2012-4408-A, "NOM self-assembly using SANS via labeled components"
- ORNL IPTS 5178, "SANS study of the pore structure of humin"
- APS General User Proposal GUP-48590, "Investigation of the nucleation and growth of gold nanoparticles in the presence of selected dendrimers"
- AINSE ID 4067, 'Elucidation of nanoparticles & quantum dots encapsulated within poly(amidoamine) (organosilicon) matrices by SANS & SAXS'
- AINGRA06268, "SANS analysis of gold in PAMAM dendrimers"
- Australian Provisional Patent 2010900785 entitled "Dendrimer Nanoparticles and Uses Thereof", Applicant name: Flinders Partners Pty Ltd, Filing date: 24 February 2010.

## PEER-REVIEWED PUBLICATIONS

1. Mary-Louise Rogers, Kevin S. Smith, Dusan Matusica , Matthew Fenech, Lee Hoffman, Robert A. Rush and Nicolas H. Voelcker "Non-viral gene therapy that targets motor neurons *in vivo*", *Frontiers in Mol. Neurosci.*, (2014) , *accepted*.
2. Lee W. Hoffman, Gabriela Chilom, Swaminathan Venkatesan, and James A. Rice "Electron and Force Microscopy Characterization of Particle Size Effects and Surface Phenomena Associated with Individual Natural Organic Matter Fractions", *Microsc. Microanal.*, (2014) , 20 (02), 521-530.
3. Lee W. Hoffman, H. Gunther Andersson, Anirudh Sharma, Stephen R. Clarke, and Nicolas H. Voelcker "New insights into PAMAM dendrimer/gold nanoparticle nanocomposite structure," *Langmuir*, (2011), 27 (11), 6759–6767.
4. Carlo Congiusta, Justin Y Granleese, Daniel Graiver, Lee Hoffman, Simon Mathew, Dave Clarke, Martin Johnston, and Stephen R. Clarke, "Novel Grafting onto Silica via Aldehyde Functionality," *Silicon* (2009) 1(1), 29-36.
5. Lee W. Hoffman, Nicolas H. Voelcker, Robert B. Knott, and Stephen R. Clarke, "Poly(amidoamine) (PAMAM) dendrimers and gold nanoparticles – a fresh look", AINSE/ANBUG, Neutron Scattering Symposium, Lucas Heights, Australia, December 4-6, 2007.
6. Petar R. Dvornic, Robert A. Bubeck, Scott D. Reeves, Jeming Li, and Lee W. Hoffman, "Nano-scale templating using honeycomb-like poly(amidoamine-organosilicon) (PAMAMOS) dendrimer networks," *Silicon Chemistry* (2005), 2(5/6), 207-216.
7. Dvornic, Petar R.; Owen, Michael J.; Keinath, Steven E.; Hu, Jin; Hoffman, Lee W.; Parham, Paul L., Poly(amidoamine-organosilicon) (PAMAMOS) dendrimers and their derivatives of

higher degree of structural complexity. Abstracts of Papers, 221st ACS National Meeting, San Diego, CA, United States, April 1-5, 2001.

8. Bubeck, Robert A.; Bauer, Barry J.; Dvornic, Petar R.; Owen, Michael J.; Reeves, Scott D.; Parham, Paul L.; Hoffman, Lee W.. Small-angle neutron scattering from metal ion-containing PAMAMOS dendrimer networks. Abstracts of Papers, 221st ACS National Meeting, San Diego, CA, United States, April 1-5, 2001.
9. R.A. Bubeck, B.J. Bauer, P.R. Dvornic, M.J. Owen, S.D. Reeves, P.L. Parham and L.W. Hoffman, "Small-Angle Neutron Scattering From Metal Ion-Containing PAMAMOS Dendrimer Networks", *Polymeric Materials Science and Engineering*, (2001) 84, 866.
10. P.R. Dvornic, M.J. Owen, S.E. Keinath, J. Hu, L.W. Hoffman and P.L. Parham, "Poly(amidoamine-organosilicon) (PAMAMOS) Dendrimers and Their Derivatives of Higher Degree of Structural Complexity," *Polymer Preprints*, (2001) 42(1), 126.
11. Tatyana P. Collins, Lee W. Hoffman, and James L. Goudie, "Development and Evaluation of a New Product line of Silicone Elastomers for High Voltage Applications, Part 2", Annual Report – Conference on Electrical Insulation and Dielectric Phenomena (2000), (Vol. 1) 255-259.

## TECHNICAL REPORTS AND ABSTRACTS

1. Hoffman, Lee W.; McMillan, Christopher S.; Owen, Michael J.; Dvornic, P. R.; Reeves, Scott D. Doping level effects on morphology and surface properties of metals in radially-layered copoly(amidoamine-organosilicon) (PAMAMOS) dendrimers. Abstracts of Papers, 220th ACS National Meeting, Washington, DC, United States, August 20-24, 2000.
2. Lee W. Hoffman, Tatyana P. Collins, James L. Goudie, Christopher S. McMillan, Debbie K. Milbrandt and Chi-Tang Li, "Development and Evaluation of a New Product Line of Silicone Elastomers for High Voltage Applications", Dow Corning Corporation Report #2000-1000-49227.
3. L. W. Hoffman, S. D. Reeves, M. J. Owen, P. R. Dvornic, C. S. McMillan and J. E. Allen, "Effects of Copper Doping on the Properties of Poly(amidoamine-organosilicon) (PAMAMOS) Dendrimers", Dow Corning Corporation Report #2000-10000-48635.
4. Lee W. Hoffman, Tatyana P. Collins, James L. Goudie, Christopher S. McMillan, Debbie K. Milbrandt and Chi-Tang Li, "Development and Evaluation of a New Product Line of Silicone Elastomers for High Voltage Applications", Conference Record of IEEE International Symposium on Electrical Insulation (2000), 336-340.
5. Lee W. Hoffman, "Wheeler Study of the Amine Content Testing on 929 Emulsion", Dow Corning Corporation, Report #1998-10000-45101.
6. Lee W. Hoffman, "Design and Characterization of Mixed Transition Metal Oxide Thin Film Gas Sensors Derived Through Sol-Gel Chemistry", Thesis, Michigan State University, 1996.
7. Lee W. Hoffman, "Acid No. Test for Dow Corning Medical Antifoam A Compound", Dow Corning Corporation Report #1993-10000-38321.
8. Lee W. Hoffman, "Particle Size Study in the Production of Dow Corning Medical Antifoam AF Emulsion", Dow Corning Corporation Report #1993-10000-38448.

## INVITED LECTURES

1. Lee W. Hoffman, *Postdoctoral Experience*, Preparing For Life After Graduate School, South Dakota EPSCoR-sponsored ACS workshop, invited lecture, 1 June 2011
2. Lee W. Hoffman, *Experiences Shared for Scientists of All Ages*, Commonwealth Scientific and Industrial Research Organisation CREST Celebration, invited lecture, 18 November, 2010.
3. Lee W. Hoffman, *Synthesis and characterization of gold nanoparticles in poly(amidoamine) (PAMAM) dendrimers and potential therapeutic applications*, Michigan Molecular Institute invited lecture, 19 August 2010.
4. Lee W. Hoffman *Nanoparticles in Poly(amidoamine) Dendrimers*, Michigan State University invited lecture, October 2007.

## PRESENTATIONS

1. Lee W. Hoffman, Gabriela Chilom, James A Rice *Using microscopy to probe interfacial properties governing self-assembly of natural organic materials*, 243<sup>rd</sup> American Chemical Society National Meeting, 25-29 March 2012, San Diego, USA.
2. Lee W. Hoffman, Gabriela Chilom, Nathan L Netzer, Chaoyang Jiang, James A Rice, *Mechanistic studies on self-assembly of natural organic material*, 242<sup>nd</sup> American Chemical Society National Meeting, 28August– 1September 2011, Denver, USA.
3. Lee W. Hoffman, Eli Moore, Peter J. Macardle, Stephen R. Clarke, Nicolas H. Voelcker, *Exploring the mechanism of formation of PAMAM – gold nanoparticle complexes*, 240<sup>th</sup> American Chemical Society National Meeting, 22-26 August 2010, Boston, USA.
4. Lee W. Hoffman, *Synthesis and characterization of gold nanoparticles in poly(amidoamine) (PAMAM) dendrimers and potential therapeutic applications*, Flinders University Chemical and Physical Sciences PhD student presentation, 2010.
5. Lee W. Hoffman, Eli Moore, Peter J. Macardle, Stephen R. Clarke, Nicolas H. Voelcker, *Applications of gold/poly(amidoamine dendrimer nanocomposites to cancer therapy*, 2<sup>nd</sup> International Symposium on Biological Applications of Dendrimers, 23-26 July 2010.
6. Lee W. Hoffman, Nicolas H. Voelcker, Peter J. Macardle, Stephen R. Clarke, Emily Anglin, Frances Harding, Eli Moore, *Therapeutic Applications of Gold Nanoparticle Poly(amidoamine) (PAMAM) Dendrimer Composites*, ICONN 2010, 22-26 February 2010, Sydney, Australia.
7. Rogers M.-L.<sup>1</sup>, Matusica D.<sup>1</sup>, Hoffman L.<sup>2</sup>, Voelcker N.H.<sup>2</sup> and Rush R.A., *Specific, Non-viral Gene Delivery Targeting Motor Neurons In-vitro and In-vivo*, ANS/AuPS 2010, January 31-February 2, 2010, Sydney, Australia
8. Lee Hoffman, Nicolas Voelcker, Simon Mathew, Robert Knott, Stephen Clarke, Martin Johnston, *Insight Towards Influence of Poly(amidoamine) (PAMAM) Dendrimers On Gold Nanoparticle Formation*, ICONN 2008, 25-29 February 2008, Melbourne, Australia.
9. Lee W. Hoffman, Nicolas H. Voelcker, Robert B. Knott, and Stephen R. Clarke, *Poly(amidoamine) (PAMAM) dendrimers and gold nanoparticles – a fresh look*, AINSE/ANBUG, Neutron Scattering Symposium, Lucas Heights, Australia, December 4-6, 2007.
10. Lee W. Hoffman, Nicolas H. Voelcker, Robert B. Knott, and Stephen R. Clarke, *Poly(amidoamine) (PAMAM) Dendrimers and Gold Nanoparticles*, ANSTO-AINSE Neutron School on Diffraction, in collaboration with IAEA, 29 November - 3 December 2007 at Lucas Heights Sydney, Australia.

11. Petar R. Dvornic, Agnes M. de-Leuze-Jallouli, Scott D. Reeves, Jin Ju. Lee W. Hoffman and Michael J. Owen, *Poly(amidoamine-organosilicon) (PAMAMOS) Dendrimers and Multi-arm Star Polymers*, 33<sup>rd</sup> American Chemical Society Great Lakes/Central regional meeting, 2001.
12. L. W. Hoffman, C. S. McMillan, M. J. Owen, P. R. Dvornic and S. D. Reeves, *Doping Level Effects on Morphology and Surface Properties of Copper in Radially-Layered Copoly (amidoamine-organosilicon) (PAMAMOS) Dendrimers*, 33<sup>rd</sup> American Chemical Society Great Lakes/Central regional meeting, 2001.
13. Lee W. Hoffman, Peter C. Qian, Michael J. Owen, Petar R. Dvornic, *Molecular Modeling Study on Metal Ions Complexation with PAMAM and PAMAMOS Dendrimers*, Dow Corning 23<sup>rd</sup> Annual Technical Conference, 2001.
14. T. P. Collins, L. W. Hoffman and J. L. Goudie, *Development and Evaluation of a New Product Line of Silicone Elastomers for High Voltage Applications*, Dow Corning 23<sup>rd</sup> Annual Technical Conference, 2001.
15. Lee W. Hoffman, Peter C. Qian, Bhukan Parbhoo, *Molecular Modeling on Diffusions and Surface Interactions in Siloxane Network*, 56<sup>th</sup> Midland Section American Chemical Society Fall Scientific Meeting, Midland, MI, 2000.
16. L. W. Hoffman, C. S. McMillan, U. C. Pernisz, M. J. Owen, S. D. Reeves, R. A. Bubeck, P. L. Parham and P. R. Dvornic, *Poly (amidoamine-organosilicon) Dendrimer-Based Nano-Structured Networks, Their Metal Composites and Thermal Properties*, 56<sup>th</sup> Midland Section American Chemical Society Fall Scientific Meeting, Midland, MI, 2000.
17. T. P. Collins, L. W. Hoffman and J. L. Goudie, *Development and Evaluation of a New Product Line of Silicone Elastomers for High Voltage Applications Part 2*, 2000 IEEE Conference on Electrical Insulation and Dielectric Phenomena.
18. L. W. Hoffman, C. S. McMillan, M. J. Owen, P. R. Dvornic and S. D. Reeves, *Doping Level Effects on Morphology and Surface Properties of Copper in Radially-Layered Copoly (amidoamine-organosilicon) (PAMAMOS) Dendrimers*, 220<sup>th</sup> American Chemical Society National Meeting, 2000.
19. L. W. Hoffman, C. S. McMillan, M. J. Owen, S. D. Reeves and P. R. Dvornic, *Doping Level Effects on Morphology and Surface Properties of Copper in Radially-layered Copoly (amidoamine-organosilicon) (PAMAMOS) Dendrimers*, Dow Corning 22<sup>nd</sup> Annual Technical Conference, 2000.
20. S. D. Reeves, P. R. Dvornic, L. W. Hoffman and M. J. Owen, *The Preparation and Characterization of Metal Nanocomposites in Radially-Layered Copoly (amidoamine-organosilicon) (PAMAMOS) Dendrimer Networks*, 33<sup>rd</sup> Organosilicon Symposium, 2000.
21. L. W. Hoffman, C. S. McMillan, M. J. Owen, S. D. Reeves and P. R. Dvornic, *Doping Level Effects on Morphology and Surface Properties of Copper in Radially-layered Copoly (amidoamine-organosilicon) (PAMAMOS) Dendrimers*, 33<sup>rd</sup> Organosilicon Symposium, 2000.
22. J. L. Goudie, T. P. Collins and L. W. Hoffman, *Development and Evaluation of a New Product Line of Silicone Elastomers for High Voltage Applications*, IEEE International Symposium on Electrical Insulation, Anaheim, CA, April 2-5, 2000.
23. Lee W. Hoffman, *Design and Characterization of Mixed Transition Metal Oxide Thin Film Gas Sensors Derived Through Sol-Gel Chemistry*, master's thesis defense, Michigan State University, 1996.



24. Lee Hoffman, *The Role of Defects in the Chemisorption of Small Molecules on the Surface of Single-Crystal Titanium Oxide*, physical chemistry literature seminar, graduate chemistry department, Michigan State University, 1995.
25. Toeduck Yang, Pedro Did-Aguero, Una Marvet, Lee W. Hoffman, and Marcos Dantus, *Femtosecond Teal-Time Studies of Chemical Reactions and Transition-State Spectroscopy*, Michigan State University Department of Chemistry and Center of Fundamental Materials Research, 1994.
26. Randall Sweet and Lee Hoffman, *Influence of Formulation and Process Parameters on final Product in the Production of Dow Corning Antifoam A Compound*, completion of contract, Dow Corning Corporation, 1993.