

# Allison Hess-Dunning

## Education

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Case Western Reserve University  
*Ph.D. in Electrical Engineering*  
Dissertation: "Integration of Process-Incompatible Materials for Microfabricated, Polymer-based Neural Interfaces"  
Thesis Advisor: Christian A. Zorman, Ph.D.

Cleveland, Ohio  
May 2011

Case Western Reserve University  
*M.S. in Electrical Engineering*  
M.S. Thesis: "Design and Fabrication of Polynorbornene- and Liquid Crystal Polymer-Based Electrode Arrays for Biomedical Applications"

Cleveland, Ohio  
May 2008

### *Courses taken (toward both graduate degrees):*

- Integrated Circuit Technology
- MOS Integrated Circuit Design
- Fabrication of Silicon Microelectromechanical Systems
- Biomedical Microdevices
- Advanced Neural Microsystems
- Introduction to Neurobiology
- Electronic Analysis and Design
- Advanced Sensors
- Electronics for Biomedical Engineering
- Introduction to Nanotechnology
- Electromagnetic Energy Conversion
- Design and Analysis in Engineering and Science

University of Pittsburgh  
*B.S. in Engineering Physics, minor in Electrical Engineering*  
*Summa cum laude*

Pittsburgh, Pennsylvania  
May 2005

## Experience

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Associate Investigator  
*Louis Stokes Cleveland Department of Veterans Affairs Medical Center*

- Develop novel neural interfaces to both the central and peripheral nervous systems using MEMS-based technologies and novel soft materials

June 2011-present

Research Assistant  
*Case Western Reserve University*

Aug. 2005-May 2011  
Cleveland, Ohio

## Teaching Assistant

*Case Western Reserve University*

*Cleveland, Ohio*

EECS 321: Semiconductor Electronic Devices

Jan. to May 2010

- Responsible for checking problem set solutions for accuracy and grading all problem sets.

EECS 245: Electronic Circuits

Jan. to May 2009

- Checked problem set solutions for accuracy
- Graded problem sets, quizzes and exams
- Held weekly recitation sessions
- Held review sessions before exams
- Ran teaching laboratory sessions

ENGR 210: Introduction to Circuits and Instrumentation

Aug. to Dec. 2006

- Ran teaching laboratory sessions
- Checked problem sets solutions for accuracy.
- Graded problems sets, quizzes, and exams.

## Electrical Engineering Intern

April-Aug. 2003, May-Aug. 2004

*ZIN Technologies*

*Brook Park, Ohio*

- Utilized Monte Carlo simulation software to simulate radiation exposure of electronic equipment to the harsh environment of space.
- Determined the I-V characteristics and measured and modeled filter characteristics of Space Acceleration Measurement System (SAMS).
- Translated raw data from a fiber optic gyroscope aboard the failed STS-107 space shuttle flight to determine the rotation of the shuttle over time.

## Honors and Awards

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2013	Career Development Award – Level 1 – Rehabilitation R&D, Department of Veterans Affairs
2012	Postdoctoral Diversity Travel Award – Neural Interface Conference 2012
2010	Materials Research Society Fall 2010 Meeting – Best Poster Award
2008	AVS 55 <sup>th</sup> International Symposium & Exhibition, BioMEMS Topical Conference - Young Investigator Award (1 of 2 awards given, only graduate student recipient)
2007	IEEE Conference on Neural Engineering Travel Award
2005	Case Prime Fellowship
2002	Fessenden-Trott Scholarship Recipient, University of Pittsburgh
2001	University Scholarship Recipient, University of Pittsburgh

Memberships: MRS, IEEE, AVS, AAAS, Tau Beta Pi, Sigma Pi Sigma

## Grant Support

7/2013-6/2015: CDA-1 “Nanobiosensing Neural Probes for Traumatic Brain Injury Applications”

FY2012: RIP “Mechanically-Flexible Micro-Optrode Platform for Optical Neural Stimulation Applications”

## Peer-reviewed Journal Publications

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- [6] **A.E. Hess**, K. Potter, D.J. Tyler, C.A. Zorman, J.R. Capadona, "Environmentally-controlled Microtensile Testing of Mechanically-Adaptive Polymer Nanocomposites for Ex Vivo Characterization," *Journal of Visualized Experiments*, e50078, (2013). [Chosen for a JoVE press release, View Count: 1,284 as of 2/26/2014]
- [5] **A.E. Hess**, D.M. Sabens, H.B. Martin, C.A. Zorman, "Diamond-on-Polymer Microelectrode Arrays Fabricated Using a Chemical Release Transfer Process", *Journal of Microelectromechanical Systems*, vol. 20, pp. 867-875 (2011).
- [4] A. Barnes, **A. Hess**, C. Zorman, M. Diewvilai, "Development of a Packaging System for Clinical Evaluation of a Nanocomposite-Based Neural Electrode Array Fabricated from a Chemoresponsive Polymer Substrate", *Journal of Surface Mount Technology*, vol. 24, pp. 17-25 (2011).
- [3] J.P. Harris, **A.E. Hess\***, S.J. Rowan, C. Weder, C.A. Zorman, D.J. Tyler, J.R. Capadona, "In vivo deployment of mechanically adaptive nanocomposites for intracortical microelectrodes", *Journal of Neural Engineering*, vol. 8, pp. 046010, (2011). [\*co-first author]
- [2] **A.E. Hess**, J.R. Capadona, K. Shanmuganathan, L. Hsu, S.J. Rowan, C. Weder, D.J. Tyler, C.A. Zorman, "Development of a stimuli-responsive polymer nanocomposite toward biologically-optimized, MEMS-based neural probes ", *Journal of Micromechanics and Microengineering*, vol. 21, pp. 054009, (2011).
- [1] **A.E. Hess**, D.M. Sabens, H.B. Martin, C.A. Zorman, "Polycrystalline Diamond-on-Polymer Electrode Arrays Fabricated Using a Polymer-Based Transfer Process", *Electrochemical and Solid-State Letters*, vol. 13, pp. J129-J131, (2010).

## Conference Proceedings Papers

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- [8] **A.E. Hess-Dunning, D.J. Tyler, C.A. Zorman**, "Stretchable Thin-Film Metal Structures on a Stimuli-Responsive Polymer Nanocomposite for Mechanically-Dynamic Microsystems," *Technical Digest of The 17<sup>th</sup> International Conference on Solid State Sensors, Actuators and Microsystems (Transducers 2013)*, Barcelona, Spain, June 16-20, 2013.
- [7] **A.E. Hess**, K. Shanmuganathan, J.R. Capadona, L. Hsu, S. Rowan, C. Weder, D.J. Tyler, C.A. Zorman, "Mechanical Behavior of Microstructures from a Chemo-responsive Polymer Nanocomposite Based on Cotton Cellulose Nanofibers," in *Technical Digest – 24<sup>th</sup> International Conference on Microelectromechanical System (MEMS 2011)*, Cancun, Mexico, January 23-27, 2011, pp. 453-456.
- [6] **A.E. Hess** and C.A. Zorman, "Fabrication and Characterization of MEMS-Based Structures from a Bio-Inspired, Chemo-responsive Polymer Nanocomposite," *Proceedings - Fall 2010 Meeting of the Materials Research Society*, Boston MA, November 29-December 3, 2010, 1299, pp. 1-6. (also cited as Abstract #S4.7 in the technical program) **Best Poster Award**
- [5] **A. Hess**, D. Sabens, H. Martin, C. Zorman, "Polycrystalline Diamond-On-Polymer Microelectrode Arrays For Mechanically-Flexible Neural Interfacing", in *Technical Digest - 2010 Solid State Sensors, Actuators and Microsystems Workshop (Hilton Head 2010)*, Hilton Head SC, June 6-10, 2010, pp. 142-145

- [4] **A. Hess**, J. Dunning, J. Harris, J.R. Capadona, K. Shanmuganathan, S.J. Rowan, C. Weder, D.J. Tyler, and C.A. Zorman, "A Bio-Inspired, Chemo-responsive Polymer Nanocomposite for Mechanically Dynamic Microsystems", in *Technical Digest of The 15<sup>th</sup> International Conference on Solid State Sensors, Actuators and Microsystems (Transducers 2009)*, Denver CO, June 21-25, 2009, pp. 224-227.
- [3] **A. Hess**, J. Dunning, D. Tyler and C.A. Zorman, "A Polynorborene-Based Microelectrode Array For Neural Interfacing" *Technical Digest - 14<sup>th</sup> International Conference on Solid State Sensors, Actuators and Microsystems (Transducers 2007)*, Lyon France, June 9-14, 2007, pp. 1235-1238.
- [2] **A. Hess**, J. Dunning, D. Tyler, and C.A. Zorman, "Development of a Microfabricated Flat Interface Nerve Electrode Based on Liquid Crystal Polymer and Polynorborene Multilayered Structures", *Proceedings - 3<sup>rd</sup> International IEEE EMBS Conference on Neural Engineering*, Kohala Coast, Hawaii, May 2– 5, 2007, pp. 32-35.
- [1] **A. Hess**, J. Du, R. Parro, J. Dunning and C.A. Zorman, "PECVD Silicon Carbide as a Thin Film Packaging Material for Microfabricated Neural Electrodes", *Proceedings - Spring 2007 Meeting of the Materials Research Society*, San Francisco CA, April 9-12, 2006, Also cited as *Material Research Society Symposium Proceedings*, vol. 1009E, paper # 1009-U04-03.

### **Abstracts of Conference Presentations**

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- [13] **A. Hess-Dunning**, C.A.Zorman, D.J. Tyler, "Intracortical Probes for Neural Recording Based on a Stimuli-Responsive Polymer Nanocomposite Substrate with Switchable Stiffness," presented at Neural Interfaces Conference 2012, Salt Lake City, UT, June 18-20, 2012, Abstract #E-27.
- [12] N. Brill, **A. Hess**, L. Miller, C. Ethier, D.J. Tyler, "Selective Activation of Upper Extremitry Muscles Using High Density Nerve Cuff Electrodes in Nonhuman Primates," presented at Neural Interfaces Conference 2012, Salt Lake City, UT, June 18-20, 2012, Abstract #I-1.
- [11] H.B. Martin, D.M. Sabens, **A.E. Hess**, C.A. Zorman, "Diamond-on-polymer Microelectrode Arrays as Flexible Electrochemical Sensors," presented at *Fall 2010 Meeting of the Materials Research Society*, Boston, MA, November 29 - December 3, 2010, Abstract #A8.4.
- [10] **A.E. Hess**, K. Shanmuganathan, J. Harris, J.R. Capadona, L. Hsu, S.J. Rowan, C. Weder, D.J. Tyler, C.A. Zorman, "Fabrication of Mechanically-Dynamic, Chemo-Responsive Polymer Nanocomposite Microdevices for Neural Interfacing," presented at *Biomaterials Day*, November 6, 2010, Cleveland, Ohio.
- [9] D.M. Sabens, **A.E. Hess**, C.A. Zorman, H.B. Martin, "Electrochemistry on a flexible diamond-on-polymer electrode array," presented at *21<sup>st</sup> European Conference on Diamond, Diamond-Like Materials, Carbon Nanotubes, and Nitrides*, Budapest, Hungary,
- [8] H. Martin, J.M. Halpern, D.M. Sabens, **A.E. Hess**, C.A. Zorman and H.J. Chiel, "Mechanically-flexible Diamond Electrodes for Implantable Neural Devices", presented at the *2010 European MRS Spring Meeting*, Strasbourg, FR, June 7-9, 2010. **Invited Talk**
- [7] H.B. Martin, J.M. Halpern, D.M. Sabens, **A.E. Hess**, and C.A. Zorman, "Mechanically-flexible diamond electrodes for implantable sensors" presented at the *2009 Annual Meeting of the American Institute of Chemical Engineering*, Nashville TN, November 8-13, 2009, Abstract # 154b.

- [6] D. Sabens, **A.E. Hess**, C.A. Zorman and H.B. Martin, “Mechanically-flexible Electrode Arrays based on Selectively-grown Diamond Thin Film Patterns and Temperature-Sensitive Polymer Substrates”, presented at the *20<sup>th</sup> European Conference on Diamond*, (Diamond 2009), Athens, Greece, October 6-10, 2009. Abstract # O81.
- [5] D. Sabens, **A. Hess**, C.A. Zorman and H. Martin, “Mechanically flexible Electrode Arrays based on Selectively Grown Diamond Thin Film Patterns and Temperature Sensitive Polymer Substrates” presented at the *New Diamond and NanoCarbons Conference 2009*, Traverse City MI, June 7-11, 2009.
- [4] J.P. Harris, J.R. Capadona, K. Shanmuganathan, **A. Hess**, J. Dunning, S.J. Rowan, C. Zorman, C. Weder, and D.J. Tyler, “Cortical Tissue Response to a Mechanically-Dynamic Polymer Nanocomposite”, presented at the *37<sup>th</sup> Annual Meeting of the Society for Neuroscience*, November 15-19, 2008, Washington, DC.
- [3] J. Capadona, K. Shanmuganathan, J. Harris, **A. Hess**, J. Dunning, C. Zorman, D. Tyler, S. Rowan, and C. Weder, “Bio-inspired Mechanically-dynamic Polymer Nanocomposites for Intercortical Microelectrode Substrates”, presented at the *214<sup>th</sup> Meeting of the Electrochemical Society*, Honolulu HI, October 12-17, 2008.
- [2] **A. Hess**, J. Dunning, D. Tyler and C.A. Zorman, “Development of Microfabricated Peripheral Nerve Electrodes Made from Liquid Crystal Polymer and Polynorbornene”, presented at the *38<sup>th</sup> Annual Neural Interfaces Conference*, Cleveland OH, June 16-18, 2008.
- [1] **A. Hess**, J. Dunning, D. Tyler and C.A. Zorman, “A Polynorbornene-based Microelectrode Array for Neural Interfacing”, presented at *Neural Engineering and Rehabilitation Lectures*, Cleveland, Ohio, June 8, 2007.

### **Invited Talks and Other Presentations**

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- [12] S. Koppaka, **A.E. Hess**, P. Marasco, D.Tyler, “Force Required to Insert Probes into Epineurial and Perineurial Membranes“, Biomedical Engineering Society Conference, Hartford, Connecticut, October 14, 2011, abstract #Fri-2-5-F.
- [11] C. Zorman and **A. Hess**, "Development of New Materials and Processes for Mechanically-flexible, Microfabricated Neural Electrode Arrays for Long-Term Implant Applications", presented at the Department of Chemical Engineering Seminar, University of Louisville, October 15, 2010, **invited**.
- [10] **A. Hess**, D. Sabens, H. Martin, and C.A. Zorman, “Microfabrication of Flexible Diamond Microelectrode Arrays on Polymer Substrates”, presented at Research ShowCase 2010, Case Western Reserve University, April 15, 2010.
- [9] J. Harris, J. Capadona, **A. Hess**, J. Dunning, K. Shanmuganathan, S. Koppaka, S. Rowan, C. Weder, C. Zorman, and D. Tyler, “Tissue response to mechanically dynamic intracortical microelectrodes”, Research Day and 40th Anniversary Celebration, Department of Biomedical Engineering, Case Western Reserve University, Cleveland, Ohio 44106, October 22, 2009.
- [8] J.P Harris, J.R. Capadona, K. Shanmauganathan, **A. Hess**, J. Dunning, S.J. Rowan, C.A. Zorman, C. Weder, and D.J. Tyler, “Pliant polymer microprobes for intracortical electrodes”, Biomedical Engineering Society (BMES) Annual Meeting, Pittsburgh PA, October 7-10, 2009, Poster # PS 10A-162.

- [7] **A. Hess**, J. Dunning, J. Harris, J. Capadona, D. Tyler, and C.A. Zorman, "Fabrication and Evaluation of Mechanically Dynamic Microsystems from a Bio-inspired Polymer Nanocomposite", presented at Research ShowCase 2009, Case Western Reserve University, April 16, 2009.
- [6] **A. Hess**, J. Dunning, J. Harris, J.R. Capadona, K. Shanmuganathan, S. Rowan, C. Weder, D. Tyler and C.A. Zorman, "Microfabrication of MEMS-based Neural Probes from a Bio-inspired, Mechanically Dynamic Polymer Nanocomposite", presented at the AVS 55th International Symposium, Boston MA, October 19-24, 2008.
- [5] J. Harris, J.R. Capadona, K. Shanmuganathan, S.J. Rowan, C. Weder, **A. Hess**, J. Dunning, C.A. Zorman, and D.J. Tyler "Cortical Response to Polyvinyl Acetate- Tunicate Whisker Polymer Nanocomposite (PVAc-TW)", presented at Research ShowCase 2008, Case Western Reserve University, Cleveland OH April 16-17, 2008.
- [4] **A. Hess**, J. Dunning, D.J. Tyler, K. Polasek, N. Brill, C.A. Zorman "Development of Microfabricated, Mechanically Flexible, Peripheral Nerve Electrode Arrays, presented at Research ShowCase 2008, Case Western Reserve University, Cleveland OH April 16-17, 2008.
- [3] **A. Hess**, J. Dunning, D. Tyler and C.A. Zorman, "A Polynorborene-based Microelectrode Array for Neural Interfacing", Neural Engineering and Rehabilitation Lectures, Cleveland, Ohio, June 8, 2007.
- [2] **A. Hess**, J. Dunning, D. Tyler and C.A. Zorman, "Development of FINE Electrode Structures Based on Micromachined Polymer Substrates", Research Showcase 2007, Case Western Reserve University, Cleveland, Ohio, April 11-12, 2007.
- [1] V. Keesara, **A. Hess**, and C.A. Zorman, "Process Development and Evaluation of Polynorborene as a Structural Material in Multilayered Flexible Devices" presented at Research ShowCase 2006, Case Western Reserve University, Cleveland, Ohio, April 5-6, 2006.