

**Ryszard Wycisk, Ph.D.**

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*“The difficulty lies not so much in developing new ideas as in escaping from old ones.”*

John Maynard Keynes

**Qualifications/Skills/Experience/Expertise****Technical**

- Energy conversion and storage - fuel cells and batteries
- Membranes and separators
- Electrostatic processing – fabrication of porous polymeric and nanoparticle structures
- Physicochemical characterization of materials

**Non-Technical**

- Teamwork and management of small teams
- Writing/co-writing research proposals for funding
- Entrepreneurial experience (former VP of a small business)

**Education**

1989-1993 Ph.D. Chemical Engineering, Wroclaw University of Science and Technology, Wroclaw Poland  
1994-1996 Postdoctoral Scholar, Department of Chemical Engineering, Tulane University, New Orleans, LA

**Appointments**

2011-present Research Associate Professor, Department of Chemical and Biomolecular Engineering, Vanderbilt University, Nashville, TN  
2010-2011 Senior Research Scientist, American Science and Technology Corp., Charleston, WV  
2006-2010 Research Assistant Professor, Department of Chemical Engineering, Case Western Reserve University, Cleveland, OH  
2002-2006 Senior Research Associate, Department of Chemical Engineering, Case Western Reserve University, Cleveland, OH  
2000-2002 Research Assistant Professor, Department of Chemical Engineering, Tulane University, New Orleans, LA  
1996-2000 VP Research and Development, Senco Co., Ltd., Wroclaw, Poland  
1993-1996 Researcher, Institute of Organic and Polymer Technology, Wroclaw University of Technology, Wroclaw, Poland

## **Professional Societies**

The Electrochemical Society

## **Professional Activities**

- Co-Chair, Fuel Cell Membranes, Electrode Binders, and MEA Performance, 221<sup>st</sup> ECS Meeting (2012).
- Fuel Cell Membranes Workshop Instructor, North American Membrane Society Meetings (2003, 2004, 2005), ICOM 2008.
- Co-Chair, Fuel Cell and Membranes Session, North American Membrane Society Meeting (2007), NSF Review Panelist (2006-2008)
- Reviewer for publications of the Royal Society of Chemistry, Journal of Membrane Science, Journal of Chemical Education, plus some ten others
- Editorial Advisory Board Member – The Open Energy and Fuels Journal
- Editorial Board - Materials (MDPI)
- Education Night, ACS Cleveland Section Meeting – invited speaker (April 2008)

## **Awards**

American Institute of Chemists Foundation Award (1995)

Awards of the President of the Wroclaw University of Technology (1992, 1994)

Award of the Polish Ministry of Education (1990)

## **Classes Taught**

ChBE 4870/5870 – Polymer Science and Engineering (2011-present)

## **Other**

Faculty Adviser - Undergraduate Honor Council (2015-present)

## **Recent Publications**

K. Waldrop, R. Wycisk and P.N. Pintauro, Application of electrospinning for the fabrication of proton-exchange membrane fuel cell electrodes, *Current Opinion in Electrochemistry*, 21, 257 (2020).

Md. Masem Hossain, Z. Shang, R. Wycisk, and P.N. Pintauro, Pore-Filled PEMs from Poly(Phenylene Sulfonic Acid)s and Electrospun Poly(Phenylene Sulfone) Fiber Mats, *ECS Trans.* 98, 367 (2020).

R. Wycisk, P.N. Pintauro, Electrospun Proton-conducting Membranes for PEM Fuel Cells, in. “Polymer Applications in Fuel Cells” (V. Mittal, Ed.) pp. 29-56, Central West Editing, March 15, 2019.

D. Powers, R. Wycisk, P.N. Pintauro, Electrospun tri-layer membranes for H<sub>2</sub>/Air fuel cells. *Journal of Membrane Science*, 573, 107 (2019).

Y.C. Li, Z. Yan, Z., J. Hitt, R. Wycisk, P.N. Pintauro, T.E. Mallouk, Bipolar Membranes Inhibit Product Crossover in CO<sub>2</sub> Electrolysis Cells. *Advanced Sustainable Systems*, 2(4), 1700187 (2019).

J. Slack, B. Halevi, G. McCool, J. Li, R. Pavlicek, R. Wycisk, S. Mukerjee, and P. Pintauro, Electrospun Fiber Mat Cathode with Platinum-Group-Metal-Free Catalyst Powder and Nafion/PVDF Binder, *ChemElectroChem*, 5, 1537 (2018).

Z. Yan, L. Zhu, Y.C. Li, R.J. Wycisk, P.N. Pintauro, M.A. Hickner, T.E. Mallouk, The balance of electric field and interfacial catalysis in promoting water dissociation in bipolar membranes, *Energy Environ. Sci.*, Advance Article, <http://dx.doi.org/10.1039/C8EE01192C> (2018).

E.C. Self, M. Naguib, R.E. Ruther, E.C. McRen, R. Wycisk, G. Liu, J. Nanda, and P.N. Pintauro, High Areal Capacity Si/LiCoO<sub>2</sub> Batteries from Electrospun Composite Fiber Mats, *ChemSusChem*, 10(8),1823 (2017).

M.A. Abu-Saied, R. Wycisk, M.M. Abbassy, G.A. El-Naim, F. El-Demerdash, M.E. Youssef, H. Bassuony, P.N. Pintauro, Sulfated chitosan/PVA absorbent membrane for removal of copper and nickel ions from aqueous solutions-Fabrication and sorption studies, *Carbohydr. Polym.* 165, 149 (2017).

R.P. Dowd, A. Verma, Y. Li, D. Powers, R. Wycisk P.N. Pintauro, T.V. Nguyen, A Hydrogen-Vanadium Reversible Fuel Cell Crossover Study. *Journal of The Electrochemical Society*, 164(14), F1608 (2017).

J.J. Slack, R. Wycisk, N. Dale, A. Kumar, P.N. Pintauro, Electrospun Nanofiber Fuel Cell MEA Cathodes with PtCo/C Catalyst, *ECS Transactions*, 80 (8), 829 (2017).

C. Shen, R. Wycisk, and P.N. Pintauro, High performance electrospun bipolar membrane with a 3D junction, *Energy and Environmental Science*, 10, 1435 (2017).

J.W. Park, R. Wycisk, P.N. Pintauro, V. Yarlagadda, T.V. Nguyen, Electrospun Nafion/Polyphenylsulfone Composite Membranes for Regenerative Hydrogen Bromine Fuel Cells, *Materials*, 9(3), 143 (2016).

E.C. Self, E.C. McRen, R. Wycisk, P.N.Pintauro, LiCoO<sub>2</sub>-based fiber cathodes for electrospun full cell Li-ion batteries. *Electrochimica Acta*, 214, 139 (2016).

A.M. Park, R.J. Wycisk, X. Ren, F.E. Turley, P.N. Pintauro, Crosslinked poly(phenylene oxide)-based nanofiber composite membranes for alkaline fuel cells, *J. Mater. Chem. A*, 4, 132 (2016).

M. Brodt, R. Wycisk, N. Dale, P. Pintauro, Power Output and Durability of Electrospun Fuel Cell Fiber Cathodes with PVDF and Nafion/PVDF Binders, *J. Electrochem. Soc.* 163(5), F401 (2016).

J.W. Park, R. Wycisk, P.N. Pintauro, Nafion/PVDF nanofiber composite membranes for regenerative hydrogen/bromine fuel cells, *J. Membrane Sci*, 490, 103 (2015).

E.C. Self, R. Wycisk, P.N. Pintauro, Electrospun Titania-Based Fibers for High Areal Capacity Li-ion Battery Anodes, *J. Power Sources*, 282, 187 (2015).

M.A. Abu-Saied, M.E. Youssef, M.E. El-Naggar, R. Wycisk, H. Bassuony, Efficient Adsorption of Copper and Nickel Ions from Aqueous Solution Using Sulfonated Poly (vinyl alcohol)/Chitosan/Arabic Gum as Adsorbent Membrane, *Australian Journal of Basic and Applied Sciences*, 9(35), 310 (2015).

M. Brodt, T. Han, N. Dale, E. Niangar, R. Wycisk and P. Pintauro, Fabrication, In-Situ Performance, and Durability of Nanofiber Fuel Cell Electrodes, *J. Electrochem. Soc.* 162(1) F84 (2015).

A. Park, F. Turley, R. Wycisk, P. Pintauro, Diol-Crosslinked Electrospun Composite Anion Exchange Membranes, *Journal of The Electrochemical Society* 162(6) F560 (2015).

M. Litt and R. Wycisk, Poly(arylenesulfonic acids) with Frozen-In Free Volume as Hydrogen Fuel Cell Membrane Materials, *Polymer Reviews* 55(2) 307 (2015).

R. Wycisk, P.N. Pintauro, and J.W. Park, New developments in proton conducting membranes for fuel cells, *Current Opinion in Chemical Engineering* 4, 71 (2014).

W. Zhang, R. Wycisk, D.L. Kish, and P.N. Pintauro, Pre-Stretched Low Equivalent Weight PFSA Membranes with Improved Fuel Cell Performance, *J. Electrochem. Soc.* 161(6), F770 (2014).

R. Wycisk, D. Barpaga, S. Pintauro, M.D. LeVan, and P.N. Pintauro, Electrospun zirconium hydroxide nanoparticle fabrics as sorptive/reactive media, *Adsorption* 20(2-3) 261 (2014).

A.M. Park, F.E. Turley, R.J. Wycisk, and P.N. Pintauro, Electrospun and Cross-Linked Nanofiber Composite Anion Exchange Membranes, *Macromolecules* 47(1) 227 (2014).

M. Brodt, R. Wycisk, and P.N. Pintauro, "Nanofiber Electrodes for High Power PEM Fuel Cells," *ECS Transactions* 50(2) 1301 (2013).

J. W. Park, R. Wycisk, and P. N. Pintauro, "Membranes for a Regenerative H<sub>2</sub>/Br<sub>2</sub> Fuel Cell," *ECS Transactions* 50(2) 1217 (2013).

### **Selected Conference Presentations**

R. Wycisk, M. Hossain, Z. Shang and P.N. Pintauro, "Proton Exchange Membranes for Low Relative Humidity Fuel Cell Operation Based on Poly(Phenylene Sulfonic Acid)" hosted on the iPosterSessions platform at the 2020 Virtual AIChE Annual Meeting, November 16-20, 2020 (virtual conference presentation).

R. Wycisk, M. Hossain, Z. Shang, and P. N. Pintauro , Pore-Filled PEMs from Poly(Phenylene Sulfonic Acid)s and Electrospun Poly(Phenylene Sulfone) Fiber Mats, PRiME 2020, October 4-9, 2020 (virtual conference presentation).

A. Mondal, R. Wycisk, P. Pintauro, E. Self, J. Nanda, Si Anodes for Li-Ion Batteries from Electrospray/Spin Particle-Polymer Nanofibers, MRS Fall Meeting and Exhibit, December 1-6, Boston, MA, 2019.

R. Wycisk, P.N. Pintauro, M. Litt, Composite PEMs from Electrospun Crosslinkable Poly(Phenylene Sulfonic Acid)s, DOE Hydrogen and Fuel Cells Program Review, April 29-May 1, Crystal City, VA, 2019

D. Powers, R. Wycisk, P. Pintauro, Electrospun Tri-Layer Proton-Exchange Membranes for H<sub>2</sub>/Air Fuel Cells, NAMS 27th Annual Meeting, June 9-13, Lexington, KY, 2018.

J.J. Slack, R. Wycisk, N. Dale, A. Kumar, P.N. Pintauro, Electrospun Nanofiber Fuel Cell MEA Cathodes with PtCo/C Catalyst, Abstract #1555, 232 ECS Meeting, National Harbor, MD, October 1-5, 2017.

P.N. Pintauro, R. Wycisk, M. Cunningham, C. Shen, Electrospun Nanofiber Composite Bipolar Membranes, Abstract #1765, Pacific Rim Meeting on Electrochemical and Solid-State Science, Honolulu, Hawaii, USA, October 2-7, 2016.

E.C. Self, E C. McRen, R. Wycisk, P. N. Pintauro, High Performance Nanofiber Electrodes for Li-Ion Batteries Using Particle/Polymer Electrospinning, 18<sup>th</sup> International Meeting on Lithium Batteries, Chicago, IL, June 19-24, 2016.

P.N. Pintauro, J. Slack, R. Wycisk, M. Brodt, Particle/Polymer Nanofiber Mat Electrodes for Hydrogen/Air Fuel Cells, TechConnect, Washington DC, May 22-26, 2016.

R. Wycisk, J.W. Park and P.N. Pintauro, Electrospun PFSA/PVDF Membranes for H<sub>2</sub>/Br<sub>2</sub> Flow Battery, ARPA-E Bi-Annual Grid Storage Meeting, Chicago, May 28-19, 2015.

G. Lin, T. Nguyen, P. Pintauro, R. Wycisk, A. Weber, Hydrogen-Bromine Electrical Energy Storage System, ARPA-E Summit, February 9-11, 2015.

R. Wycisk, D. Barpaga, M. D. LeVan, and P.N. Pintauro, Electrospun Nanoparticle Fabrics as Sorptive/Reactive Media. FOA 11, 11th International Symposium on the Fundamentals of Adsorption, Baltimore, May 19-24, 2013.

R. Wycisk, J. Ballengee, J.W. Park, M. Brodt, P.N. Pintauro, Electrospun Nanofiber Membranes and Electrodes for Fuel Cells, Nanotech, Washington DC, May 12-16, 2013.

A.M. Park, F.E. Turley, R. Wycisk, and P.N. Pintauro, Polysulfone-Based Electrospun Anion Exchange Membranes, 224<sup>th</sup> ECS Meeting, San Francisco, Oct 27-Nov 1, 2013.

E.C. Self, R. Wycisk, and P.N. Pintauro, Electrospun Polymer/Particle Composite Nanofiber Anodes for Li-Ion Batteries, 224<sup>th</sup> ECS Meeting, San Francisco, Oct 27-Nov 1, 2013.

R. Wycisk, K.M. Lee, M.H. Litt, and P.N. Pintauro, Ionene membranes for alkaline fuel cells, 22<sup>nd</sup> NAMS Meeting, New Orleans, June 9-13, 2012.

R. Wycisk, A. Manesh, and A. Davari, Direct Carbon Monoxide Fuel Cells, Alternative Energy Symposium 2010, IL, Chicago, October 7, 2010.

J. Lin, R. Wycisk, J. Muldoon, and P.N. Pintauro, Nonfluorinated Polyphosphazene as Electrode Binder in PEM Fuel Cell, 217<sup>th</sup> ECS Meeting, Vancouver, Canada, April 25-30, 2010.

## Patents

P.N. Pintauro, E. Pereira, R. Wycisk, WO2017205458A1, Nanofiber-based bipolar membranes, fabricating methods and applications of same, May 24, 2017.

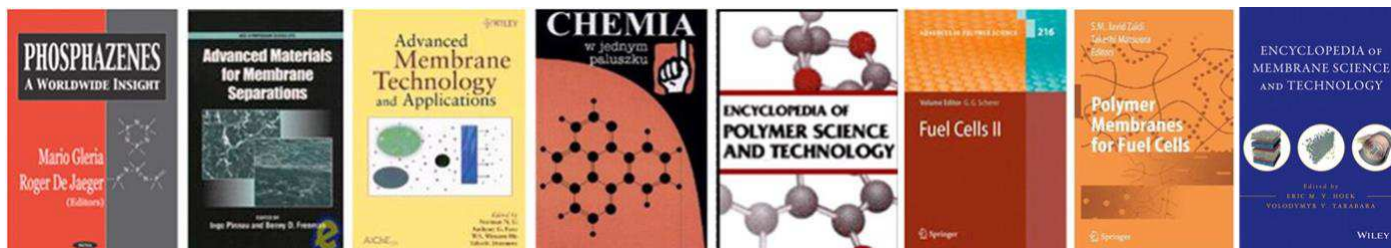
P. Pintauro, P. Mather, **R. Wycisk**; Pat. Appl. 20100227247, Nanocapillary Networks and Methods of Forming Same, Sept. 9, 2010.

J. Muldoon, **R.J. Wycisk**, P.N. Pintauro (Toyota Motor Engineering and Manufacturing North America, Inc., Case Western Reserve University) Pat. Appl. 20090004526, Proton Exchange Membrane for Fuel Cell, Jan. 1, 2009.

J. Muldoon, **R.J. Wycisk**, J. Lin, P.N. Pintauro, K. Hase (Case Western Reserve University, Toyota Motor Engineering and Manufacturing North America, Inc.) Pat. Appl. 20080167392, Novel Electrolytes for Fuel Cell Electrodes, July 10, 2008.

J. Lin, **R. Wycisk**, P.N. Pintauro; Pat. Appl. 20080124606, Stretched Proton Exchange Membrane, May 29, 2008.

W. Li, J. Muldoon, H. Hamaguchi, A. Tsujiko, T. Saito, **R.J. Wycisk**, J. Lin, P.N. Pintauro; Pat. Appl. 20070015040, Novel Electrolytes to Enhance Oxygen Reduction Reaction (ORR) in the Cathode Layer of PEM Fuel Cell, Jan 18, 2007.



Co-authored book chapters