

Prof. Dr. Matthew Suss

Email: mesuss@technion.ac.il, msuss@alumni.stanford.edu

Websites: <http://suss.net.technion.ac.il/>, http://meeng.technion.ac.il/Matthew_Suss.htm

ACADEMIC DEGREES

PhD: 2013, Department of Mechanical Engineering, Stanford University

M.Sc.: 2009, Department of Mechanical Engineering, Stanford University

B.Eng: 2007, Department of Mechanical Engineering, McGill University

ACADEMIC APPOINTMENTS

Assistant Professor: 2014-present, Faculty of Mechanical Engineering, Technion – Israel Institute of Technology, Haifa, Israel

Postdoctoral Associate: 2013-2014, Department of Chemical Engineering, MIT, Cambridge, Massachusetts

Lawrence Scholar: 2010-2013, Lawrence Livermore National Laboratory, Livermore, California

RESEARCH INTERESTS

Electrochemical Systems, capacitive deionization, shock electrodialysis, desalination batteries, fluidized bed electrodes, redox flow batteries, electroosmotic micropumps, electrochemical impedance spectroscopy, rapid prototyping, 3D printing

TEACHING EXPERIENCE

Thermodynamics 2 (undergraduate level) 2015-present, Heat & Mass Transfer (graduate level) 2016-present, Flow electrochemical systems (graduate level) 2016-present, Advanced thermodynamics (graduate level), expected 2017,

PUBLIC PROFESSIONAL ACTIVITIES

Reviewer for scientific journals: 2010-present, Journals: Nature Communications, Energy & Environmental Science, Physical Review Letters, Physics of Fluids, Environmental Science & Technology, Sensors and Actuators A, ACS Applied Materials and Interfaces, Ionics, Water Research, Desalination.

Guest Editor: 2015-2016, Journal of Physics: Condensed Matter, special issue entitled: [“Physics of Emerging Desalination Techniques”](#)

Guest Editor: 2016, Electrochimica Acta, special issue entitled: “International Society of Electrochemistry (ISE) Focus Issue”

Member (2014-present) & Chair (2015-present): [the International Working Group for Capacitive Deionization and Electrosorption](#)

Team leader: 2014-present, [the Israel National Research Center for Electrochemical Propulsion \(INREP\)](#)

Leader in Energy Science: 2014-present, the [Grand Technion Energy Program](#)

Co-chair: 2015, the [2nd International Conference on Capacitive Deionization and Electrosorption](#)

Co-chair: 2016, International Society of Electrochemistry (ISE) 2016, symposia #9, [“Capacitive Electrodes for Environmental Technologies”](#)

Delegate member: 2015-present, representing Israel in the European Federation of Chemical Engineering (EFCE), Working Group of Electrochemical Engineering

FELLOWSHIPS, AWARDS AND HONORS

Year	Organization	Honor/Award
2017	Federal German Ministry for Education and Research (BMBF) Administered by Minerva	ARCHES award (Award for Research Cooperation and High Excellence in Science)
2016	Technion – Israel Institute of Technology	Uzi & Michal Halevy Award for Innovative Applied Engineering
2015	Calcalist daily newspaper	<u>One of the top 6 young researchers to watch in Israel</u>
2015	Israel's Council for Higher Education	Alon Fellowship (most prestigious fellowship for new faculty in Israel)
2014	Technion – Israel Institute of Technology	<u>Named "Leader in Energy Science" for the Grand Technion Energy Program</u>
2014	Israel Science Foundation	<u>Accepted as a member of the Israel National Research Center for Electrochemical Propulsion (INREP)</u>
2014	Technion - Israel Institute of Technology	Horev Fellowship, Leaders in Science & Technology (LIST) Program
2013	Lawrence Livermore National Laboratory	Physical & Life Sciences Directorate Excellence in Publication award
2012	Lawrence Livermore National Laboratory	Physical & Life Sciences Directorate Excellence in Publication award
2010	Lawrence Livermore National Laboratory	Lawrence Scholar fellowship (\$200,000 USD value)
2009	Canadian government	NSERC PGS-D Doctoral scholarship (\$63,000 CAD value)
2009	Quebec government	FQRNT Doctoral scholarship (declined) (\$60,000 CAD value)
2007	Quebec government	FQRNT Master's scholarship (\$30,000 CAD value)
2007	McGill University	Graduated with Distinction and on the Dean's Honour list
2005	University of Sydney	Clean Air Society of Australia and New Zealand Prize in Air Pollution
2004	McGill University	Mr. and Mrs. T.R. McLagan Memorial Scholarship (\$2000 value)

GRADUATE STUDENTS

Theses in Progress

Amit Shocron, M.Sc. 2014-2016 (expected)
 Eric Guyes, M.Sc. 2014-2016 (expected)
 Ilya Loiferman, M.Sc. 2015-2017 (expected)
 Elad Halfon, M.Sc. 2016-2018 (expected)

RESEARCH GRANTS (From Oct 2014 to present)

2014-2019: ISF I-CORE (Israel National Research Center for Electrochemical Propulsion, INREP),
 2,000,000 ILS
 2015-2018: Alon Fellowship, Israel Council for Higher Education, ~180,000 ILS
 2016-2018: Ministry of Energy and Water Resources, co-PI Dr. Roy Bernstein (Ben Gurion),
 ~144,000 ILS (Suss lab)
 2017-2019: ARCHES award, Federal German Ministry for Education and Research (BMBF), co-
 PI Volker Presser, ~425,000 ILS (Suss lab)
 2017-2020: Industrial funding for flow battery development, ~2,000,000 ILS

PUBLICATIONS (Group members in bold, H-index: 11, total citations – google scholar: 836)

Refereed papers in professional journals

25. **EN Guyes, A Schocron, A Simanovski**, PM Biesheuvel, **ME Suss**, “A one-dimensional model for flow-through electrode capacitive deionization”, submitted to *Desalination*, 2016
24. P Srimuk, M Zeiger, N Jäckel, A Tolosa, B Krüner, S Fleischmann, I Grobelsek, M Aslan, **B Shvartsev, ME Suss**,* V Presser,* “Enhanced performance stability of carbon/titania hybrid electrodes during capacitive deionization of oxygen saturated saline water”, submitted to *Electrochimica Acta*, 2016
 *Co-corresponding authors
23. **EN Guyes, A Simanovski, ME Suss**, “Several orders of magnitude increase in hydraulic permeability of flow-through desalination electrodes via laser perforations”, submitted to *Desalination*, 2016
22. HK Mutha, Y Lu, IY Stein, HJ Cho, **ME Suss**, T Laoui, CV Thompson, BL Wardle, EN Wang “Porosimetry and packing morphology of vertically-aligned carbon nanotube arrays via impedance spectroscopy”. Submitted to *Applied Physics Letters*, 2016
21. S. Pattarachai, F. Kaasik, B. Krüner, A. Tolosa, S. Fleischmann, N. Jäckel, M. Aslan, **ME Suss**, and V. Presser, “MXene as a novel intercalation-type pseudocapacitive electrode for capacitive deionization”, Accepted & in press, *Journal of Materials Chemistry A*, 2016

20. **A Shocron, ME Suss**, "The effect of surface transport on water desalination by porous electrodes undergoing capacitive charging". Accepted & in press, *Journal of Physics: Condensed Matter*, 2017
19. S Rubin, **ME Suss**, PM Biesheuvel, M Bercovici, "Induced Charge Capacitive Deionization". Accepted & in press, *Physics Review Letters*, 2017.
18. **H Cohen, S Ein Eli, M Jogi, ME Suss**, "A novel class of suspension electrodes combining slurries and upflow fluidized beds". *ChemSusChem* 9 (21), 3045-3048, 2016.
17. **ME Suss**, K Conforti, L Gilson, CR Buie, MZ Bazant, "Membraneless flow battery leveraging flow-through heterogeneous porous media for improved power density and reduced crossover". *RSC Advances*, 6 (102), 100209-100213, 2016
16. **G.J. Doornbusch**, J Dykstra, PM Biesheuvel, **ME Suss**. "Capacitive deionization with fluidized bed electrodes" *Journal of Materials Chemistry A*, 4, 3642-3647, 2016
15. S Porada, G Feng, **ME Suss**, V Presser, "Organic Capacitive Deionization", *RSC Advances*, 6 (7), 5865-5870, 2016.
14. PM Biesheuvel, HVM Hamelers, **ME Suss**. "Theory of water desalination by porous electrodes with immobile chemical charge." *Colloid and Interface Science Communications*, 9, 1-5, 2015.
13. S Schlumpberger, NB Lu, **ME Suss**, MZ Bazant. "Scalable and Continuous Water Deionization by Shock Electrodialysis." *Environmental Science & Technology Letters*, 2 (12), 367-372, 2015.
 *[Featured in phys.org](#)
 *[Featured on MIT news](#)
 *[Featured by BostInno](#) & [Boston.com](#)
 *[Featured by IEEE Spectrum](#)
12. **ME Suss***, S Porada, M Biesheuvel, J Yoon, V Presser*, "Water desalination via capacitive deionization: What is it and what can we expect from it?" *Energy & Environmental Science*, 2015, 8, 2296-2319
 *Co-corresponding authors
 ***Invited perspective review**
 ***Featured on back cover of Energy and Environmental Science, 2015**
 *[Featured in phys.org](#)
 * [Part of the 2015 most accessed articles themed collection](#)
11. D Deng, W Aouad, WA Braff, S Schlumpberger, **ME Suss**, MZ Bazant, "Water Purification by shock electrodialysis: desalination, filtration, disinfection, and separations". *Desalination*, 357 (2015): 77-83.
 *[Featured in MIT Technology Review](#):
 *[Featured by the American Institute of Physics \(AIP\), as a "News Pick"](#):

***Featured in Water/Waste processing magazine:**

10. **ME Suss**, PM Biesheuvel, TF Baumann, M Stadermann, JG Santiago. "Spatially and temporally resolved measurements of salt concentration between charging porous electrodes for desalination by capacitive deionization". *Environmental Science & Technology*, 2014, 48, 2008-2015.
 9. **ME Suss**, TF Baumann, MA Worsley, KA Rose, T Jaramillo, M Stadermann, JG Santiago. "Impedance-based study of capacitive porous carbon electrodes with hierarchical and bimodal porosity". *Journal of Power Sources*, 2013, 241, 266-273.
 8. R.K. Kalluri, M.M. Biener, **M.E. Suss**, M.D. Merrill, M. Stadermann, J.G. Santiago, T.F. Baumann, J. Biener, A. Striolo, "Unraveling the potential and pore-size dependent capacitance of slit-shaped graphitic carbon pores in aqueous electrolytes". *Physical Chemistry Chemical Physics*, 2013, 15, 2309-2320
 7. MA Worsley, SO Kucheyev, HE Mason, MD Merrill, BP Mayer, J Lewicki, CA Valdez, **ME Suss**, M Stadermann, PJ Pauzauskie, JH Satcher, TF Baumann. "Mechanically Robust 3D Graphene Macroassembly with High Surface Area", *Chemical Communications*, 2012, 48, 8428-8430
 6. **ME Suss**, TF Baumann, WL Bourcier, CM Spadaccini, KA Rose, JG Santiago, M Stadermann. "Capacitive desalination with flow-through electrodes". *Energy and Environmental Science*, 2012, 5, 9511-9519
- * **Featured on back cover of *Energy and Environmental Science*, Issue 11, 2012**
- * **Winner of Physical & Life Science Directorate's 2012 "Excellence in Publication" award**
- * **Featured on CBS News San Francisco:**
- * **Featured as "spotlight news" at phys.org:**
- * **Featured in as "hot news" in RSC Energy & Environmental Science Journal blog:**
- * **Featured as "editor's pick" in R&D Mag:**
- * **Featured as "Research Highlight" in the LLNL Science & Technology Review magazine:**
5. J Biener, M Stadermann, **M Suss**, MA Worsley, MM Biener, KA Rose and TF Baumann. "Advanced carbon aerogels for energy applications". *Energy and Environmental Science*, 2011, 4, 656-667
- * **Winner of Physical & Life Science Directorate's 2011 "Excellence in Publication" award**
- * **Featured on the back cover of *Energy and Environmental Science* Issue 3, 2011**
4. **ME Suss**, A Mani, TA Zangle, JG Santiago. "Electroosmotic pump performance is affected by concentration polarizations of both electrodes and pump". *Sensors and Actuators A*, 2010, 165, 310-315.
 3. S Litster, **ME Suss**, JG Santiago. "A two-liquid electroosmotic pump requiring low applied voltage and power". *Sensors and Actuators A*, 163,1, 2010
 2. DG Strickland, **ME Suss**, TA Zangle, JG Santiago. "Evidence shows concentration polarization and its propagation can be key factors

determining electroosmotic pump performance". *Sensors and Actuators B.* 143, 2, 2009

1. A. Persat*, **ME Suss***, JG Santiago. "Basic principles of electrolyte chemistry for microfluidic electrokinetics. Part II: Coupling between ion mobility, electrolysis, and acid–base equilibria". *Lab Chip*, 2009, 9, 2454 – 2469

**Authors contributed equally to this work*

**Work featured as part of a front cover collage in Lab on a Chip*

Book Chapters

Advanced Carbon Aerogels for Energy Applications, J. Biener, M. Stadermann, **M. Suss**, M. A. Worsley , M. M. Biener, T. F. Baumann, chapter in Carbon-based Nanomaterials and Hybrids: Synthesis, Properties, and Commercial Applications, H.-J. Fecht, K. Bruehne, P. Gluche, CRC Press, 2014

Patents and Patent Applications

M.Z. Bazant, S Schlumberger, **M.E. Suss**, "Method and apparatus of scalable and continuous water desalination, purification, disinfection and separations by shock electro dialysis" US Prov. App. No. 62/347,237, Filed: 8 June 2016

W Braff, CR Buie, MZ Bazant, **M.E. Suss** "Battery with heterogenous flow-through porous media", U.S. Patent Application No: 14/504,539, Filed: 10/02/2014

ME Suss et al. "Segmented electrodes for water desalination", U.S. Patent Application No: 14/223,192, Filed: 03/24/2014

M.E. Suss et al. "Energy harvesting with flow-through porous electrodes". U.S. Patent Application No: 14/024,540, Filed 9/11/2013

M.E. Suss et al., "Flow-through electrode Capacitive Desalination", U. S. Patent application # 13/405088, Filed 2/24/2012

M.E. Suss et al., "Flow-through electrode Capacitive Desalination", WIPO Patent application # WO/2012/148709, Filed 13/04/2012.

CONFERENCES

Plenary, keynote or invited talks

ME Suss. "Upflow fluidized bed electrodes for water desalination and energy storage applications". *Invited Lecture*, to be delivered at the 2016 MRS Fall Meeting & Exhibit, Boston, USA, Nov 27-Dec 2, 2016.

ME Suss. “Water desalination by capacitive deionization: new trends and directions”. *Invited Lecture*, 252nd American Chemical Society National Meeting & Exposition (ACS), Philadelphia, USA, Aug 21-25, 2016.

ME Suss. “Perspectives on water desalination via capacitive deionization”. *Keynote Lecture*, Capacitive Deionization & Electrosorption (CDI&E) 2015, Saarbrücken, Germany, Oct 26-29, 2015

ME Suss. “Basics of capacitive deionization I”. *Invited tutorial lecture*, Capacitive Deionization & Electrosorption (CDI&E) 2015, Saarbrücken, Germany, Oct 26th, 2015

ME Suss. “Introduction to electrochemical devices for energy storage and water desalination: fundamentals and applications”. *Invited Lecture*, 11th 7th European Summer School on Electrochemical Engineering, Leeuwarden, Netherlands, to be delivered June 21-25th, 2015

ME Suss. “Perspective on Flow Batteries”. *Invited Lecture*, The 11th Conference on Advanced Power Sources, Tel-Aviv, Israel, Feb 5th, 2015

ME Suss. “A cyclable membraneless flow battery”. *Invited Lecture*, Israel Electrochemistry 2014, Haifa, Israel, September 16th, 2014

ME Suss. “Flow-through electrode capacitive desalination and experimental characterizations of desalination electrodes”. *Keynote Lecture*, Interfaces Against Pollution (IAP), Leeuwarden, Netherlands, May 23-25th, 2014

ME Suss. “Novel electrochemical systems for energy storage and water desalination leveraging flow-through porous media”. *Keynote Lecture*, 11th International Symposium on Electrokinetic Phenomena (ELKIN), Ghent, Belgium, May 20-23rd, 2014

ME Suss. “Principles of electro-microfluidics”. *Invited Tutorial Lecture*, 11th International Symposium on Electrokinetic Phenomena (ELKIN), Ghent, Belgium, May 20-23rd, 2014

Conference and seminar talks

ME Suss, P.M. Biesheuvel. “Water desalination by capacitive deionization: new trends and directions”. 67th Annual Meeting of the International Society of Electrochemistry (ISE), The Hague, Netherlands, August 21-25, 2016

ME Suss. “Water desalination by capacitive deionization: new trends and directions”. *Seminar Lecture*, McGill University, Department of Chemical Engineering, Montreal, Canada, August 9, 2016

G.J Doornbusch, J Dykstra, PM Biesheuvel, ME Suss. “Fluidized bed capacitive deionization” Capacitive Deionization & Electrosorption (CDI&E) 2015, Saarbrücken, Germany, Oct 26-29, 2015

A Shocron, ME Suss. “The effect of surface transport on water desalination by capacitive deionization” Capacitive Deionization & Electrosorption (CDI&E) 2015, Saarbrucken, Germany, Oct 26-29, 2015

E Guyes, A Shocron, PM Biesheuvel, ME Suss. “Theory and Experiments of flow-through electrode capacitive deionization” Capacitive Deionization & Electrosorption (CDI&E) 2015, Saarbrucken, Germany, Oct 26-29, 2015

M.E. Suss, S Porada, PM Biesheuvel, V Presser. “A perspective on recent developments in capacitive deionization”. 6th International Conference on Carbon for Energy Storage/Conversion and Environment Protection, Poland, Oct 18-22nd 2015

A Shocron, ME Suss. “The effect of surface transport on water desalination by capacitive deionization” Israelelectrochemistry 2015, Bersheva, Israel, Oct 15, 2015

E Guyes, A Shocron, PM Biesheuvel, ME Suss. “Theory and Experiments of flow-through electrode capacitive deionization” Israelelectrochemistry 2015, Bersheva, Israel, Oct 15, 2015.

M.E. Suss, S Porada, PM Biesheuvel, V Presser. “A perspective on recent developments in capacitive deionization”. 10th European Congress of Chemical Engineering, France, Sept 27-Oct 1st 2015

S. Schlumberger, N. B. Lu, **M. E. Suss**, and M. Z. Bazant . “Water Purification in Porous Media Via Shock Electrodialysis”. 228th Meeting of the Electrochemical Society, Oct 2015.

H. K. Mutha, H. J. Cho, N. Lachman, **M. E. Suss**, C. V. Thompson, B. L. Wardle, and E. N. Wang. “In Situ Electrochemical Porosimetry of Vertically-Aligned Carbon Nanotube Carpets through Impedance Spectroscopy”. 227th Meeting of the Electrochemical Society, Chicago, Illinois, May 24-28th, 2015.

ME Suss, K Conforti, L Gilson, MZ Bazant, CR Buie. “A cyclable, membraneless flow battery”. ASME 2014 12th Fuel Cell Science, Engineering and Technology Conference, Boston, Massachusetts, June 30-July 2nd, 2014

ME Suss, K Conforti, L Gilson, CR Buie, MZ Bazant. “A cyclable, membraneless flow battery”. 225th Electrochemical Society Meeting, Orlando, Florida, May 11-15th, 2014

ME Suss. “Flow-through electrochemical systems for energy storage and water desalination”. Seminar at the Mechanical Engineering Faculty seminar, Technion-Israel Institute of Technology, Haifa, Israel, October 7th, 2013

S Schlumberger, **ME Suss**, D Deng, E McVay, A Mani, MZ Bazant. “Water Purification and Brine Concentration by Shock Electrodialysis”. International Symposium on Electrokinetic Remediation (EREM), Boston, Massachusetts, June 23-26, 2013

ME Suss, TF Baumann, JG Santiago, M Stadermann. “Hierarchical porous electrodes for energy storage and desalination”. Seminar at the Mechanical

Engineering Faculty seminar, Technion-Israel Institute of Technology, Haifa, Israel, February 20, 2013

ME Suss, TF Baumann, WL Bourcier, CM Spadaccini, KA Rose, JG Santiago, M Stadermann. "Capacitive desalination with flow-through electrodes". Seminar at the Condensed Matter and Materials Division (CMMD) seminar, Lawrence Livermore National Laboratory, Livermore, CA, USA, August 1, 2012

MA Worsley, M Merrill, **ME Suss**, J. Lee, S. Kucheyev, C Valdez, ... & T Baumann. "Hierarchical Graphene Macroassemblies". Presented at the Electrochemical Society Pacific Rim Meeting (PRiME), Honolulu, Hawaii, USA, October, 2012.

ME Suss, TF Baumann, WL Bourcier, CM Spadaccini, KA Rose, JG Santiago, M Stadermann. "Capacitive desalination with flow-through electrodes". Presented at the ICREA Symposium for Nanofluidics, Colloids and Membranes, Barcelona, Spain, July 16-18, 2012

ME Suss, JG Santiago, T Jaramillo, T Baumann, M Stadermann, KA Rose. "Charging Performance of Carbon Aerogel Electrodes with Hierarchical Porosity for Water Desalination and Energy Storage Applications", Presented at the 219th meeting of the Electrochemical Society, Montreal, Canada, May 3, 2011

MA Worsley, M Stadermann, MM Biener, **ME Suss**, KA Rose, TY Olson, PJ Pauzauskie, J Biener, JH Satcher and TF Baumann. "Graphene Aerogels for Energy Storage", Presented at the spring Material Research Society (MRS) meeting, San Francisco, California, April 26-29, 2011.

ME Suss, A Mani, TA Zangle, JG Santiago. "Towards highly efficient nanoporous electroosmotic pumps: effects of concentration polarization zones sourced from the pump substrate and electrodes", Presented at μ TAS, Groningen, Netherlands, October 4, 2010.

ME Suss, A Mani, TA Zangle, JG Santiago. "Concentration polarization in electroosmotic pumps", Presented at the Gordon Research Conference: Physics and Chemistry of Microfluidics, Lucca, Italy, 2009

ME Suss, J Ramunas, E Junco, JG Santiago. "Optimized electroosmotic pumps for drug delivery applications", Presented at the 215th meeting of the Electrochemical Society, San Francisco, USA, May 1st, 2009