NAMS 2015 PROGRAM GUIDE

Boston Park Plaza & Towers Hotel
Boston, MA, USA

Hosted By:
Clarkson University
University of Connecticut

Conference Chairs:
Ruth Baltus
Jeff McCutcheon
Welcome to NAMS 2015!

Welcome to the 25th North American Membrane Society (NAMS) annual meeting! This conference continues to be recognized as the premier meeting in membrane science and technology, drawing attendees from industry, academia and government from across the globe. We hope that you will take advantage of this opportunity to network and develop new relationships as well as to share and learn about membrane related advances in this ever expanding field. We are extremely pleased with the quality of the program, resulting from an overwhelming number of submissions for oral presentations. We have also lined up three very distinguished plenary speakers. NAMS 2015 will truly be a spectacular event!

We want to acknowledge and thank all of our sponsors and exhibitors for their support of NAMS 2015. With their assistance, we have been able to provide student registration discounts. We have also prepared a rich program for students, including a workshop on Sunday, Lunch with Legends and a poster competition on Monday, with over 160 presentations. We will also honor three outstanding graduate students and three young professionals for their cutting edge work in membrane science. These individuals will present their work at our special awards session on Wednesday morning.

Boston is known as the “Athens of America” and the quality of the city’s cultural offerings is second to none. The city is rich in history and tradition; chock full of sights to see and things to do. If you need help deciding what to do or how to get there, our meeting staff from Destination Partners can provide ideas and information. They will be at the registration desk throughout the meeting – just look for their red shirts!

Thank you for your support and attendance at NAMS 2015! We hope you find the meeting and Boston enjoyable and productive.

Ruth Baltus
Jeff McCutcheon
NAMS 2015 co-chairs
# Conference Organization

**Conference Chairs**  
Ruth Baltus, baltus@clarkson.edu  
Jeff McCutcheon, jeff@engr.uconn.edu

**Student Program Chairs**  
Mary Laura Lind, mllind@asu.edu  
Ryan Lively, ryan.lively@chbe.gatech.edu

**Fundraising Chair**  
Keith Murphy, murphymk@airproducts.com

**Poster Session Chairs**  
Ayse Asatekin, Ayse.Asatekin@tufts.edu  
Matthew Green, mdgreen8@asu.edu  
Manish Kumar, mkumar.psu@gmail.com

**Lunch with Legends Chair**  
AyseAsatekin, Ayse.Asatekin@tufts.edu

**Workshop Chair**  
Isabel Escobar, isabel.escobar@utoledo.edu

**Communications/Social Media Chair**  
Alexia Finotello, AFinotello@dow.com

**Conference Webpage/Cvent Registration System**  
Peggy Anderson, nams@uark.edu

**Abstract Submission**  
Jeff Wood, jeffw@aiche.org  
Stephanie Orvoine-Couvrette, stepo@aiche.org

**University of Arkansas NAMS office**  
Jamie Hestekin, jhesteki@uark.edu

**Clemson University NAMS Treasurer**  
Scott Husson, shusson@clemson.edu
NAMS 2015 Session Co-Chairs

Awards Session
Uwe Beuscher, W.L. Gore, Elkton, MD
Dibakar Bhattacharyya, University of Kentucky, Lexington, KY

Bioseparations/Membranes for Medical Devices I
Ranil Wickramasinghe, University of Arkansas, Fayetteville, AR
Willem Kools, EMD Millipore Corporation, Billerica, MA

Bioseparations/Membranes for Medical Devices II
David Latulippe, McMaster University, Hamilton, ON
David Bohonak, EMD Millipore, Billerica, MA

Forward Osmosis/Pressure Retarded Osmosis, I
William Phillip, University of Notre Dame, Notre Dame, IN
Tzahi Cath, Colorado School of Mines, Golden CO

Forward Osmosis/Pressure Retarded Osmosis, II
Rob McGinnis, Nagare Membranes, New York, NY
Young-hye Na, IBM Almaden Research Center, San Jose, CA

Gas Separations III: Membranes for Carbon Capture
Nitesh Buwania, Chevron, Richmond, CA
Dhaval Bhandari, ExxonMobil Research & Engineering, Annandale, NJ

Inorganic Membranes
Ben Wilhite, Texas A & M, College Station, TX
Bryan Morreale, National Energy Technology Laboratory, Department of Energy, Pittsburgh, PA

Membrane Formation and Characterization I
Hua Wang, GE Global Research, Niskayuna, NY
Irv Joffee, retired, Bern, NC

Membrane Formation and Characterization II
Andrew Livingston, Imperial College London, London, United Kingdom
Vishnu Marla, W.L. Gore, Elkton, MD

Membrane Reactors/Catalytic Membranes
Dongmei (Katie) Li, University of Wyoming, Laramie, WY
Jay Kniep, MTR, Newark, CA
Microfiltration/Ultrafiltration Membranes and Processes II
Ranil Wickramasinghe, University of Arkansas, Fayetteville, AR
Willem Kools, EMD Millipore Corporation, Billerica, MA

Mixed Matrix Membranes
May-Britt Hagg, Norwegian University of Science and Technology / NTNU, Trondheim, Norway
Kenneth J. Balkus Jr., The University of Texas at Dallas, Richardson, TX

Novel Membranes I: Solvent Purification
Looh Tchuin (Simon) Choong, Gradient, MA
Geoffrey Bothun, University of Rhode Island, Kingston, RI

Novel Membranes II: Water Purification
James McGrath, University of Rochester, Rochester, NY
Frederick Stewart, Idaho National Lab, Idaho Falls, ID

Novel Membranes III: Graphenes, Metals and More
Hassan Ait-Haddou, Pall Corporation
Leland Vane, EPA, Cincinnati, OH

Poster Session
Ayse Asatekin, Tufts University, Medford, MA
Matthew Green, Arizona State University, Tempe, AZ
Manish Kumar, Penn State University, University Park, PA

Session in Memory of James E. McGrath
Benny D. Freeman, The University of Texas at Austin, Austin, TX
Judy Riffle, Virginia Tech, Blacksburg, VA
Keith Murphy, Prism Membranes, Air Products and Chemicals Inc., Saint Louis, MO
Daily Program Summary

**Saturday May 30**

7:30 AM – 7 PM  
Registration  
Mezzanine

8 AM – 5 PM  
Workshop 1: Polymeric and Inorganic Membrane Materials and Membrane Formation  
Arlington

**Sunday May 31**

7:30 AM – 7 PM  
Registration  
Mezzanine

8 AM – 5 PM  
Workshop 2: Membranes for Water Treatment  
Berkeley/Clarendon

2 PM – 5 PM  
Student Workshop  
Statler

3 PM – 6 PM  
Exhibitor Set up  
Mezzanine

6 PM – 8 PM  
Welcome Reception  
Georgian

**Monday June 1**

7:30 AM – 5 PM  
Registration  
Mezzanine

8 AM – 6 PM  
Exhibit  
Mezzanine

**Plenary Lecture:**  
Benny Freeman  
Fundamental Studies of Ion Sorption, Diffusion and Transport in Crosslinked Polyelectrolyte Membranes  
Imperial Ballroom
9 AM – 9:30 AM  

**Coffee Break**

9:30 AM – 12:30 PM  

**Parallel Sessions**

Membranes for Gas Separations I  

Membrane Transport I

Microfiltration/Ultrafiltration Membranes and Processes I

Forward Osmosis/Pressure Retarded Osmosis I

9:30 AM – 12:30 PM  

**Parallel Sessions**

Membranes for Gas Separations I

Membrane Transport I

Microfiltration/Ultrafiltration Membranes and Processes I

Forward Osmosis/Pressure Retarded Osmosis I

12:30 PM – 2 PM  

Lunch with Legends  
Note: this is a ticketed event!

2 PM – 3:30 PM  

**Parallel Sessions**

Novel Membranes I: Solvent Purification

Inorganic Membranes

Bioseparations/Membranes for Medical Devices I

Membrane Formation and Characterization I

3:30 PM – 4 PM  

**Coffee Break**

4 PM – 6 PM  

**Parallel Sessions**

Membranes for Energy Applications: Fuel Cells and Batteries

Inorganic Membranes (con’t)

Microfiltration/Ultrafiltration Membranes and Processes II

Membrane Formation and Characterization I (con’t)

8 PM – 10:30 PM  

**Poster Session**
**Tuesday June 2**

7:30 AM – 5 PM  
Registration  
Mezzanine

8 AM – 5:30 PM  
Exhibit  
Mezzanine

8 AM – 9 AM  
**Plenary Lecture:**  
**Gabriel Tkacik**  
Advances in Membrane Morphology Control for Optimum Performance in Biotechnology Separations  
Imperial Ballroom

9 AM – 9:30 AM  
*Coffee Break*

9:30 AM – 12:30 PM  
**Parallel Sessions**  
Membranes for Gas Separations II  
Georgian

Membrane Transport II  
Arlington

Novel Membranes II: Water Purification  
Berkeley/Clarendon

Membranes for Water Treatment and Desalination I  
Statler

12:30 PM – 2 PM  
Lunch on your own

2 PM – 3:30 PM  
**Parallel Sessions**  
Session in Memory of James E. McGrath  
*Introductory remarks at 1:50 PM*  
Georgian

Membrane Reactors/Catalytic Membranes  
Arlington

Bioseparations/Membranes for Medical Devices II  
Berkeley/Clarendon

Membranes for Water Treatment and Desalination II  
Statler

3:30 PM – 4 PM  
*Coffee Break*
4 PM – 5:30 PM  **Parallel Sessions**
Session in Memory of James E. McGrath
(Introductory remarks at 1:50 PM) (con’t – no coffee break)  
Membrane Reactors/Catalytic Membranes (con’t)  
Bioseparations/Membranes for Medical Devices II (con’t)  
Membranes for Water Treatment and Desalination II (con’t)  

5:30 PM – 6:30 PM  NAMS Business meeting

6:30 PM – 7:30 PM  Reception

7:30 PM – 9:30 PM  Banquet

**Wednesday June 3**

7:30 AM – 5 PM  Registration

8 AM – 5:30 PM  Exhibit

**Plenary Lecture:**
**Dr. George Whiteside**
Simplicity as a Strategy in Research

9 AM – 9:30 AM  Coffee Break

9:30 AM – 12:30 PM  **Parallel Sessions**
Awards Session
Gas Separations III: Membranes for Carbon Capture
Forward Osmosis/Pressure Retarded Osmosis II
Membranes for Water Treatment and Desalination III

12:30 PM – 2 PM Lunch on your own

2 PM – 3:30 PM **Parallel Sessions**

- Mixed Matrix Membranes
- Novel Membranes III: Graphenes, Metals and More
- Membrane Formation and Characterization II
- Membranes for Water Treatment and Desalination IV

2 PM – 3:30 PM **Parallel Sessions**

- Mixed Matrix Membranes (con’t)
- Novel Membranes III: Graphenes, Metals and More (con’t)
- Membrane Formation and Characterization II (con’t)
- Membranes for Water Treatment and Desalination IV (con’t)
Workshops

Saturday, May 30

Workshop 1: Polymeric and Inorganic Membrane Materials and Membrane Formation
Arlington, 8AM – 5PM

Lecturers
Henk Verweij, Ohio State University
Maria Coleman, University of Toledo

This workshop includes synthesis and properties of polymeric and inorganic membranes. The morning session will cover the most important inorganic membrane types with an emphasis on transport properties of single- and multi-layer structures. After taking the workshop, participants will be able to quickly evaluate the design and viability of supported membrane concepts. The workshop is of interest for researchers, students, teachers, and project managers. It will be slow-paced with much participant interaction. The polymer membrane portion in the afternoon will provide an overview on material selection and fabrication techniques for production of polymeric membranes. The structures and separation properties of a variety of membranes for microfiltration, ultrafiltration, nanofiltration, reverse osmosis, gas separation will be presented.

Workshop 2: Membranes for Water Treatment
Berkeley/Clarendon, 8AM – 5PM

Lecturers
Isabel Escobar, University of Toledo
Dibakar Bhattacharyya, University of Kentucky

Membrane processes are finding wide applications ranging from water treatment to reactors to advanced bio-separations. Membranes are particularly useful for material recovery and for permeate reuse (such as, water recycle). The workshop is configured as a one day program of about 6 hours of lectures. Both desalination and toxic pollutant removal/destruction techniques will be discussed. The workshop topics include membrane selection criteria, practical information regarding configuration, performance and operating conditions of membrane technology applied to desalination of brackish and seawater, and wastewater reclamation systems, mixed-matrix membranes, and advanced functionalized/responsive membranes from toxic metal capture to water detoxification. Membrane surface and pore
functionalization approaches, reactive nanostructured for water detoxification will be part of the advanced membrane topics. The effects of feed water quality, pretreatment options, operating parameters and performance of membrane units and hybrid options will also be discussed. The workshop material will also include information on economics of membrane systems.

**Sunday, May 31**

**Workshop 3: Emerging Membrane Materials and Manufacturing Methods**  
**Arlington, 8 AM – 5PM**

*Lecturers*  
Bruce Hinds, University of Kentucky  
Suzana Nunes, KAUST

This workshop will focus on emerging new membrane materials (polymeric and inorganic/organic hybrids). The workshop will not present state-of-the-art techniques for membrane fabrication. Recent developments will be presented and their potential for future industrial applications will be discussed. Topics include: membrane manufacturing by molecular self-assembly of block copolymers and other components, preparation of isoporous membranes, carbon nanotubes as selective membrane channels, nanostructured mixed matrix membranes for gas and liquid separation, recent developments in the field of reverse and forward osmosis membranes, stimuli responsive membrane materials, membranes for controlled drug release, tailoring and properties of multicomponent membranes, The most important recent patents in these fields will be reviewed.

**Workshop 4: Membranes for Gas Separations**  
**Berkeley/Clarendon, 8 AM - 5 PM**

*Lecturers*  
Benny Freeman, University of Texas at Austin  
Glenn Lipscomb, The University of Toledo  
Tim Merkel, MTR Inc.

This workshop will cover the entire spectrum of membrane-based gas and vapor separations: from the materials science of gas separation membranes and the fundamentals of membrane transport to the
design and economics of industrial gas separation applications. This workshop should be of interest to membrane researchers as well as membrane practitioners.

**Student Workshop**  
Statler, 2PM – 5PM

**Speakers**  
Dr. Heather Chenette, Assistant Professor, Rose-Hulman University  
Dr. Jeffrey Drese, Senior Engineer, Phillips 66  
Dr. Joshua McNally, Staff Member, Idaho National Laboratory

Come to this FREE workshop for all students to learn about the exciting career opportunities in membrane science and technology. Each of our speakers has gone down a different career path (academic, industry, national laboratory). Come learn the different aspects of each career path and how to prepare for each from these young membrane scientists.

Like previous years, we are soliciting questions from attendees ahead of the meeting so that we can pass them off to our speakers to answer either during their talks or during an open panel discussion. If you have questions for one of our panelists or just in general, email Dr. Mary Laura Lind (mllind@asu.edu) and we will answer them during the workshop.

Also, please bring your resume/CV as our speakers will be able to provide critiques during a breakout session. Both graduate students and undergraduate students are welcome to attend.
Plenary Speakers NAMS 2015

Monday June 1: Imperial Ballroom

Benny Freeman
University of Texas at Austin

Fundamental Studies of Ion Sorption, Diffusion and Transport in Crosslinked Polyelectrolyte Membranes

Charged polymer membranes are widely used for water purification applications involving control of water and ion transport, such as reverse osmosis and electrodialysis. Efforts are also underway worldwide to harness separation properties of such materials for energy generation in related applications such as reverse electrodialysis and pressure retarded osmosis. Improving membranes for such processes would benefit from more complete fundamental understanding of the relation between membrane structure and ion sorption, diffusion and transport properties in both cation and anion exchange membrane materials. Ion-exchange membranes often contain strongly acidic or basic functional groups that render the materials hydrophilic, but the presence of such charged groups has a substantial impact on ion (and water) transport properties. This presentation will discuss aspects of chemistry, thermodynamics, and transport that are or may be at play in such membrane processes. Our long-term goal is to develop and validate a common framework to interpret data from both electrically driven and concentration gradient driven mass transport in such polymers and to use it to establish structure/property relations leading to rational design of membranes with improved performance. Questions of interest include how to properly formulate sorption and transport relationships, how to decouple effects of fixed charge density and water content on sorption and transport properties, how fixed charges affect mobility of counterions and coions, etc. Ion sorption and permeability data were used to extract information about salt diffusion coefficients in charged membranes. Techniques have been developed to determine concentrations of both counter-ions and co-ions in polymers. Salt permeability, sorption and ionic conductivity data have been combined to determine individual ion diffusion coefficients in neutral, cation exchange and anion exchange polymers. The use of models to correlate and, in many cases, predict the experimental data is discussed.
Tuesday June 2: Imperial Ballroom

Gabriel Tkacik
EMD Millipore

Advances in Membrane Morphology Control for Optimum Performance in Biotechnology Separations

Membrane separations are critical in biotechnology drug production. Membranes enable drug safety by removal of bacteria and viruses and provide a convenient tool for achieving the final drug formulation. Over the few decades of biotechnology drug manufacturing, the membrane industry developed many significant improvements that help drug manufacturers to improve drug safety and purity while controlling the manufacturing costs of membrane based unit operations. Many of these improvements are based on optimizing and controlling membrane morphology. Trends in membrane morphology evolution driven by biotechnology manufacturing needs will be described and insights into morphology-derived performance improvements will be illustrated.

Wednesday June 3: Imperial Ballroom

George Whitesides
Harvard University

Simplicity as a Strategy in Research

“Simplicity” as a Component of Invention”. "Complexity" is relatively simple to think about (at least for academics); "simplicity" is more complex. This seminar will consider "simplicity" (together with an idea we call "stackability") as a parameter to guide strategy in research, using two examples--one from ongoing large-scale technology, and one from our own research.
Oral Sessions: Monday June 1 morning

Plenary Session I, Imperial Ballroom
8AM – 9AM

Co-chairs: Ruth Baltus, Clarkson University and Jeff McCutcheon, University of Connecticut

Fundamental Studies of Ion Sorption, Diffusion and Transport in Crosslinked Polyelectrolyte Membranes
Benny Freeman
University of Texas at Austin

Coffee Break 9AM – 9:30AM

Membranes for Gas Separations I
9:30 AM – 12:30PM
Georgian

Co-Chairs: David Hopkinson, U.S. Department of Energy, National Energy Technology Laboratory, Morgantown, WV and JR Johnson, SABIC, Thuwal, Saudi Arabia

9:30AM Pure-and Mixed-Gas Propylene/Propane Permeation Properties of Spiro- and Triptycene-Based Microporous Polyimides
Ramy Swaidan, Bader Ghanem, Raja Swaidan, Eric Litwiller and Ingo Pinnau
KAUST, Thuwal, Saudi Arabia

10 AM Defect-Free PIM-1/Ultem Polyetherimide Dual-Layer Hollow Fibers Membranes for Gas Separation
Lin Hao and Tai-Shung Chung
National University of Singapore, Singapore, Singapore

10:30AM High-Performance ZIF-8 Membranes Fabricated By Interfacial Microfluidic Processing in Polymeric Hollow Fibers
Kiwon Eum¹, Ali A. Rownaghi², William J. Koros¹, Christopher W. Jones¹ and Sankar Nair¹
¹Georgia Institute of Technology, Atlanta, GA, ²Missouri University of Science and Technology, Rolla, MO
11 AM  High Temperature and High Pressure $\text{H}_2/\text{CO}_2$ Separations with NH$_2$-MIL-53/Vtec™ Mixed-Matrix Membranes  
Edson Vladimir Perez Jimenez, Grace D. Kalaw, Kenneth J. Balkus Jr., John P. Ferraris and Inga H. Musselman  
The University of Texas at Dallas, Richardson, TX

11:30AM  Long-Term Testing and Recovery of Pd/Au Membranes  
Ivan Mardilovich, Bernardo Castro Dominguez, Nikolaos Kazantzis, and Yi Hua Ma  
Worcester Polytechnic Institute, Worcester, MA

12 PM  High Performance Polybenzimidazole Membranes for Elevated Temperature $\text{H}_2/\text{CO}_2$ Separations  
Rajinder P. Singh, Kevin W. Dudeck, Ganpat J. Dahe and Kathryn A. Berchtold  
Los Alamos National Laboratory, Los Alamos, NM

**Membrane Transport I**

9:30 AM – 12:30PM

**Arlington**

Co-Chairs: Guy Z. Ramon, Technion – Israel Institute of Technology, Haifa, Israel and Jed W. Pitera, Science & Technology, IBM Almaden Research Center, San Jose, CA

9:30AM  Electrostatic and Electrokinetic Effects in Hindered Transport  
William Deen  
MIT, Cambridge, MA

10 AM  Neutron Radiography As a Measurement Tool for Studying Water and Solute Transport through Desalination Membranes  
Devin L. Shaffer$^1$, Edwin P. Chan$^2$, Daniel S. Hussey$^2$ and Menachem Elimelech$^1$  
$^1$Yale University, New Haven, CT, $^2$National Institute of Standards and Technology, Gaithersburg, MD

10:30AM  Molecular Dynamics Simulations of Water and Contaminant Transport in RO Membranes: Size and Structural Effects  
Meng Shen, Sinan Keten and Richard M. Lueptow  
Northwestern University, Evanston, IL
11 AM  Characterization of the Partitioning of Alkali Metal Salts and Boric Acid from Aqueous Solution into the Active Layers of RO/NF Membranes  
Jingbo Wang and Orlando Coronell  
*University of North Carolina Chapel Hill, Chapel Hill, NC*

11:30AM  Diffusiophoresis Is a Significant Fouling Mechanism in Low Salinity Reverse Osmosis  
Rajarshi Guha  
*Pennsylvania State University, University Park, PA*

12 PM  Real-Time Observation of Mass Transfer Limitations during Hemofiltration Using Confocal Microscopy  
Benjamin J. Feinberg¹, Jeff C. Hsiao¹, Aishwarya Jayagopala¹, Zohora Iqbal¹, Andrew L. Zydney², William H. Fissell³ and Shuvo Roy¹  
¹University of California, San Francisco (UCSF), San Francisco, CA, ²The Pennsylvania State University, University Park, PA, ³Vanderbilt University, Nashville, TN

**Microfiltration/Ultrafiltration Membranes and Processes I**  
9:30 AM – 12:30PM  
**Berkeley/Clarendon**

Co-Chairs: Stephen Ritchie, University of Alabama, Tuscaloosa, AL and Thomas Hamlin, 3M Purification Inc., Meridan, CT

9:30AM  New Hydrophilic Copolymers Based on Polyethersulfone for UF/MF-Membranes  
Martin Weber, Oliver Gronwald and Thomas Weiss  
*BASF SE, Ludwigshafen, Germany*

10 AM  Exploring the Relationship Between Successful Surface Patterning and Membrane Mechanical Behavior  
Yifu Ding, Sajjad Maruf, and Alan R. Greenberg  
*University of Colorado Boulder, Boulder, CO*

10:30AM  Responsive N-Isopropylacrylamide (NIPAAm) Ultrafiltration Membranes  
Sneha Chede¹, Isabel Escobar¹ and Geoff Bothun²  
¹The University of Toledo, Toledo, OH; ²University of Rhode Island, Kingston, RI
11 AM  Highly Porous Superhydrophilic Ultra-Filtration Membrane Based on Electrospun Nylon 6/SiO$_2$ Composite

Md. Shahidul Islam and Md Saifur Rahaman
Concordia University, Montreal, QC, Canada

11:30AM  Synthesis of Ultra-Filtration Nano Composite Membrane for Mitigating Organic Fouling during Water Treatment

Efosa F Iginigun
Howard University, Washington, DC

12 PM  Novel Triangle-Shape Tri-Bore Ultrafiltration Hollow Fiber Membranes Prepared By Sulfonated Polyphenylenesulfone (PPSU) for Oily Wastewater Treatment

Lin Luo$^1$, Gang Han$^1$, Tai-Shung Chung$^1$, Martin Weber$^2$, Claudia Staudt$^2$, and Christian Maletzko$^2$

$^1$National University of Singapore, Singapore, Singapore; $^2$BASF SE, Ludwigshafen, Germany

Forward Osmosis/Pressure Retarded Osmosis I
9:30 AM – 12:30PM
Statler

Co-Chairs: William Phillips, University of Notre Dame, Notre Dame, IN and Tzahi Cath, Colorado School of Mines, Golden CO

9:30AM  Assessing the Feasibility of Using Low Temperature Heat to Meet Water Treatment Demand: A Consideration of Policy, Process, and Economic Constraints

Meagan Mauter
Carnegie Mellon University, Pittsburgh, PA

10 AM  Performance Limitations of Pressure-Retarded Osmosis Power Generation: Experimental Characterization and Module-Scale Analysis

Anthony Straub$^3$, Shihong Lin$^2$, and Menachem Elimelech$^1$

$^1$Yale University, New Haven, CT; $^2$Vanderbilt University, Nashville, TN; $^3$Yale University, New Haven, CT; $^4$Basel University, Switzerland
Oral sessions Monday June 1 morning

10:30AM  Impacts of Produced Water on the Transport and Physiochemical Properties of Forward Osmosis Membranes
Bryan D. Coday and Tzahi Y. Cath
Colorado School of Mines, Golden, CO

11 AM  Synthesis and Application of Ethylenediamine Tetrapropionic Salt As a Novel Draw Solute for Forward Osmosis Application
Qingwu Long and Yan Wang
Huazhong University of Science & Technology, Wuhan, China

11:30AM  Computational Modeling Approach for Optimizing Peak Power Production from Pressure Retarded Osmosis
Yoram Cohen¹, Abraham Sagiv², Panagiotis D. Christofides¹ and Rafi Semiat²
¹University of California, Los Angeles, Los Angeles, CA;
²Technion - Israel Institute of Technology, Haifa, Israel

12 PM  Osmotic Power Generation By Pressure Retarded Osmosis Using Seawater Brine As the Draw Solution and Wastewater Retentate As the Feed
Chun Feng Wan and Tai-Shung Chung
National University of Singapore, Singapore, Singapore
Oral Sessions: Monday June 1 afternoon

**Novel Membranes I: Solvent Purification**

2 PM – 3:30 PM

**Georgian**

Co-Chairs: **Looh Tchuin (Simon) Choong**, Gradient, MA and **Geoffrey Bothun**, University of Rhode Island, Kingston, RI

2PM  **A New Class of Synthetic Membranes: Organophilic Pervaporation Brushes for Organics Recovery**

**Georges Belfort**, James (Chip) Kilduff, Joseph Grimaldi and Joseph Imbrogno

*Rensselaer Polytechnic Institute, Troy, NY*

2:30PM  **Functionalization of Non-Selective Polybutadiene Polymer to Create Hydrophilic Membrane for Dehydration of Alcohols By Pervaporation and Vapor Permeation**

**Leland M. Vane**¹, Vasudevan Namboodiri¹, Gui Lin² and Michael Abar¹

¹ U.S. Environmental Protection Agency, Cincinnati, OH; ²Emerson Climate Technologies, Sidney, OH

3PM  **One Tough Membrane - Poly(ether-ether-ketone) for Organic Solvent Nanofiltration in Extreme Conditions**

**Andrew G. Livingston**, Ludmila Peeva, Joao da Silva Burgal and Santosh Kumbarkar

*Imperial College London, London, United Kingdom*

---

**Inorganic Membranes**

2 PM – 3:30 PM

**Arlington**

Co-Chairs: **Ben Wilhite**, Texas A & M, College Station, TX and **Bryan Morreale**, National Energy Technology Laboratory, Department of Energy, Pittsburgh, PA

2PM  **Ethylene/Ethane Separation with Thermally-Rearranged Polybenzoxazole and Carbon Membranes Derived from an Intrinsically Microporous Hydroxyl-Functionalized Polyimide Precursor**

**Octavio Salinas**, Xiaohua Ma, Eric Litwiller and Ingo Pinnau

*KAUST, Thuwal, Saudi Arabia*
Oral sessions Monday June 1 afternoon

2:30PM  
**Separation of Organic Liquids By MOF-5 Membranes**  
*Amr Ibrahim* and *Jerry Lin*  
*Arizona State University, Tempe, AZ*

3PM  
**Fabrication of Silicon Carbide Sintered Supports and Silicon Carbide Membranes**  
*Sasan Dabir*, Wangxue Deng, Philip Kwong, Malancha Gupta, Muhammad Sahimi and Theodore T. Tsotsis  
*University of Southern California, Los Angeles, CA*

**Bioseparations/Membranes for Medical Devices I**  
*2 PM – 3:30 PM*  
**Berkeley/Clarendon**

Co-Chairs: *Ranil Wickramasinghe*, University of Arkansas, Fayetteville, AR and *Willem Kools*, EMD Millipore Corporation, Billerica, MA

2PM  
**New Membrane Concepts for Improved Blood Purification**  
*Dimitrios Stamatialis*  
*University of Twente - MIRA Institute, Enschede, Netherlands*

2:30PM  
**Silicon Nanomembranes for Discrete Wearable Hemodialysis**  
*James McGrath* and Dean Johnson  
*University of Rochester, Rochester, NY*

3PM  
**Carbon Nanotube Membranes As the Active Element in Remotely Programmable Transdermal Addiction Treatment Device**  
*Bruce J. Hinds*  
*University of Washington, Seattle, WA*

**Membrane Formation and Characterization I**  
*2 PM – 3:30 PM*  
**Statler**

Co-Chairs: *Hua Wang*, GE Global Research, Niskayuna, NY and *Irv Joffee*, retired, Bern, NC

2PM  
**Robust RO/NF Organosilica Membranes for Expanding Liquid-Phase Separation**  
*Toshinori Tsuru*, Suhaina Ibrahim, Hiroki Nagasawa and Masakoto Kanezashi  
*Hiroshima University, Higashi-Hiroshima, Japan*
Oral sessions Monday June 1 afternoon

2:30PM  Control of Surface Morphology of RO Membranes and Improvement of Permeability Via Incorporation of N,N'-Dimethyl Formamide (DMF) in Aqueous Phase
Yiqun Liu, Jian Xu and Hao Yan
SINOPEC Beijing Research Institute of Chemical Industry, Beijing, China

3PM  Reactive Phase Inversion Fabrication of Hydrophilic Membrane Based on Poly (ether imide sulfone) for Ultrafiltration Application
Taghreed Jalal and Suzana Nunes
King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia

Coffee Break 3:30PM – 4PM

Membranes for Energy Applications: Fuel Cells and Batteries
4PM - 6 PM
Georgian

Co-Chairs: Wei Liu, Pacific Northwest National Laboratory, Richland, WA and Michael D. Guiver, Tianjin University, Tianjin China

4 PM  Power Generation By an Industrial-Scale Reverse Electrodialysis (RED) Unit: Experimental Investigation and Performance Evaluation
Ramato Ashu Tufa1,2, Efrem Curcio2,3, Roman Kodým1, Michal Němeček1 and Karel Bouzek1,
1 University of Chemistry and Technology Prague, Prague, Czech Republic; 2University of Calabria, Rende, Italy; 3 Institute on Membrane Technology of the National Research Council (ITM-CNR), c/o University of Calabria, Rende, Italy

4:30PM  Reverse Electrodialysis-Alkaline Polymer Electrolyte Membrane (RED-APEM) Electrolysis System for Perpetual and Sustainable Hydrogen Production
Ramato Ashu Tufa1,2, Debabrata Chanda2, Jaromír Hnat2, Efrem Curcio1,3, Willem van Baak4, Enrico Drioli1,3 and Karel Bouzek2
1 University of Calabria, Rende, Italy; 2 University of Chemistry and Technology Prague, Prague, Czech Republic; 3 Institute on Membrane Technology of the National Research Council (ITM-CNR), c/o University of Calabria, Rende, Italy, 4FUJIFILM Manufacturing Europe B.V., Tilburg, Netherlands
Oral sessions Monday June 1 afternoon

5 PM  Advances in Water Vapor Transport Membranes for Air to Air Devices  
       **Ryan Huizing**¹, Frankie Wong¹, Hao Chen¹, Walter Merida²  
       and Frank Ko²  
       ¹Dpoint Technologies, Vancouver, BC, Canada, ²University of British Columbia

5:30PM  Designing Membranes for Efficient Ion-Conduction  
       **Michael D. Guiver**¹,², Young Moo Lee¹, Nanwen Li³, Donwon Shin¹,⁴ and So Young Lee¹,⁵  
       ¹Hanyang University, Seoul, South Korea, ²Tianjin University, Tianjin, China, ³Chinese Academy of Sciences, Taiyuan, China, ⁴Rensselaer Polytechnic Institute, Troy, NY, ⁵Korea Institute of Science and Technology, Seoul, South Korea

Inorganic Membranes, con’t  
4 PM – 6 PM  
Arlington

Co-Chairs:  **Ben Wilhite**, Texas A & M, College Station, TX and  **Bryan Morreale**, National Energy Technology Laboratory, Department of Energy, Pittsburgh, PA

4 PM  Recent Development of Thin-Sheet Naa Zeolite Membrane Module for Air Dehumidification and Conditioning  
       **Wei Liu**  
       *Pacific Northwest National Laboratory, Richland, WA*

4:30PM  Intensify Lignin Depolymerization Processes By Ceramic Membranes  
       **Serafin Stiefel**, Daniel Menne and Matthias Wessling  
       *AVT.CV, RWTH Aachen University, Aachen, Germany*

5PM  Formation of Ultra-Selective CMS Hollow Fiber Membranes for Advanced Gas Separations  
       **Chen Zhang** and William J. Koros  
       *Georgia Institute of Technology, Atlanta, GA*

5:30PM  The Hydrogen Permeability of Amorphous Ninb-M (M=Sn,Ti and Zr) Metallic Membrane  
       **Tianmiao Lai**, Sudhanshu S. Singh, Arun Sundar S. Singaravelu, Nikhilesh Chawla and Mary Laura Lind  
       *Arizona State University, Tempe, AZ*
Microfiltration/Ultrafiltration Membranes and Processes II
4 PM – 6 PM
Berkeley/Clarendon

Co-Chairs: Ranil Wickramasinghe, University of Arkansas, Fayetteville, AR and Willem Kools, EMD Millipore Corporation, Billerica, MA

4 PM  Triple Bore Hollow Fiber Membrane for Liquid Desiccant Based Dehumidification
NM Srivatsa Bettahalli, Ryan Lefers, Torove Leiknes and Suzana Nunes
King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia

4:30PM  Virus Behavior during Microfiltration of Pre-Coagulated Water
Shankar Chellam and Pasan Bandara
University of Houston, Houston, TX

5PM  Novel Design and Operational Control of Integrated Ultrafiltration – Reverse Osmosis System with RO Concentrate Backwash
Larry Gao, Anditya Rahardianto, Han Gu, Yoram Cohen and Panagiotis D. Christofides
University of California, Los Angeles, Los Angeles, CA

5:30PM  Development of a Membrane-Based Separation Process for the Continuous Enzymatic Saccharification of Lignocellulosic Biomass
Birendra Adhikari1, John Pellegrino1, David A. Sievers2 and Jonathan Stickel2
1University of Colorado, Boulder, CO; 2National Renewable Energy Laboratory, Golden, CO
Oral sessions Monday June 1 afternoon

**Membrane Formation and Characterization I, con’t**
4 PM – 6 PM
Statler

Co-Chairs: **Hua Wang**, GE Global Research, Niskayuna, NY and **Irv Joffee**, retired, Bern, NC

4 PM  **Carbon Molecular Sieve Membrane Structure-Property Relationships for Four Novel 6FDA Based Polyimide Precursors**
Shilu Fu¹, Edgar S. Sanders², Sudhir Kulkarni², William J. Koros¹
¹Georgia Institute of Technology, Atlanta, GA, ²MEDAL - Air Liquide, Newport, DE

4:30PM  **Highly Selective Separation of Cations in Electrodialysis through Nafion Membranes Coated with Polyelectrolyte Multilayer Films**
Nicholas White¹, Maria Misovich¹, Elena Alemayehu¹, Andriy Yaroshchuk² and Merlin Bruening¹
¹Michigan State University, East Lansing, MI, ²Polytechnic University of Catalonia, Barcelona, Spain

5PM  **Developing New Multilayer Polyelectrolyte Charge Mosaic Membranes**
Ghazaleh Vaseghi and Glenn Lipscomb
University of Toledo, Toledo, OH

5:30PM  **Nanostructured Membranes from Triblock Polymer Precursors As High Capacity Adsorbents**
Jacob Weidman¹, William Phillip¹, Ryan Mulvenna² and Bryan W. Boudouris²
¹University of Notre Dame, Notre Dame, IN; ²Purdue University, West Lafayette, IN

**Evening Session**
8PM – 10:30PM
**Poster session**
**Imperial Ballroom**

Co-Chairs: **Ayse Asatekin**, Tufts University, Medford, MA, **Matthew Green**, Arizona State University, Tempe, AZ and **Manish Kumar**, Penn State University, University Park, PA
Oral Sessions: Tuesday June 2 morning

Plenary Session II, Imperial Ballroom
8AM – 9AM

Co-chairs: Ruth Baltus, Clarkson University and Jeff McCutcheon, University of Connecticut
Introduced by Uwe Beuscher, W.L. Gore & Associates, NAMS President

Advances in Membrane Morphology Control for Optimum Performance in Biotechnology Separations
Gabriel Tkacik
EMD Millipore

Coffee Break 9AM – 9:30AM

Membranes for Gas Separations II
9:30 AM – 12:30PM
Georgian

Co-Chairs: Rajinder P. Singh, Los Alamos National Laboratory, Los Alamos, NM and Joseph Mayne, Shell International Exploration and Production (US) Inc, Houston, TX

9:30AM Binary and Ternary Gas Mixture Permeation through Nafion and Its Metal-Substituted Derivatives for Natural Gas Purification
Mohsin Mukaddam, Eric Litwiller and Ingo Pinnau
KAUST, Thuwal, Saudi Arabia

10 AM Rubbery Organic Frameworks-Rofs-Tuning the Gaz-Diffusion through Dynameric Membranes
Mihai Barboiu
Institut Européen des Membranes, Montpellier, France

10:30AM Thermal Stability of ZIF-8 Membranes for Gas Separation
Joshua James and Jerry Lin
Arizona State University, Tempe, AZ
Oral sessions Tuesday June 2 morning

11 AM  Approaches to Suppressing Physical Aging in Carbon Molecular Sieve Membranes for Natural Gas Separations
Graham Wenz, Nitesh Bhuwania and William J. Koros
Georgia Institute of Technology, Atlanta, GA

11:30 AM  New Dimensions in Designing Polymeric Gas Separation Membranes: Building Iptycene Units into Aromatic Polyimides
Shuangjiang Luo¹, Jennifer Wiegand¹, Qiang Liu², Benny D. Freeman² and Ruilan Guo¹
¹ University of Notre Dame, Notre Dame, IN; ²University of Texas at Austin, Austin, TX

12 PM  Upper Bounds for Mixed-Gas Separations Using Polymeric Membranes
Haiqing Lin and Milad Yavari
The State University of New York, Buffalo, NY

Membrane Transport II
9:30 AM – 12:30PM
Arlington

Co-Chairs: Richard Lueptow, Northwestern University, Evanston, IL and Ryan Lively, Georgia Institute of Technology, Atlanta, GA

9:30AM  Particle Deformability Affects the Transport of Soft Colloids through Microfilters
Eduard Benet¹, Aly Badran¹, Xiaoyun Lu¹, Louis Foucard², Franck Vernerey¹ and John Pellegrino¹
¹University of Colorado, Boulder, CO; ²UCLA, Los Angeles, CA

10 AM  Deconvolution of Transport Resistance in Gas Permeation Processes
Sebastian Koester, Michael Alders and Matthias Wessling
AVT.CVT, RWTH Aachen University, Aachen, Germany

10:30AM  Modeling Permeation through Mesoporous Membranes Using Dynamic Mean Field Theory
Ashutosh Rathi, John R. Edison, David Ford and Peter A. Monson
University of Massachusetts Amherst, Amherst, MA

11 AM  Gas Permeability and Selectivity in Glassy Polymers
Matteo Minelli and Giulio Sarti
Università di Bologna, Bologna, Italy
Oral sessions Tuesday June 2 morning

11:30AM  Influence of the Porous Support on the Diffusion PATH in Composite Membranes
          Pingjiao Hao and J. G. Wijmans
          Membrane Technology and Research, Inc, Newark, CA

12 PM   Transport through the Pores in Membrane Distillation: Re-Thinking the Combination of Knudsen Diffusion and Molecular Diffusion
          Jun Jie Wu¹ and Robert W. Field²
          ¹Durham University, Durham, United Kingdom, ²University of Oxford, Oxford, United Kingdom

Novel Membranes II: Water Purification
9:30 AM – 12:30PM
Berkeley/Clarendon

Co-Chairs: James McGrath, University of Rochester, Rochester, NY and Frederick Stewart, Idaho National Lab, Idaho Falls, ID

9:30AM  Artificial Water Channels – Can They Reach Biological Channel-like Performance?
          Manish Kumar¹, JunLi Hou², and Mustafa Erbakan¹
          ¹Pennsylvania State University, University Park, PA; ²Fudan University, Shanghai, China

10 AM   Liquid Flow Across Graphene Membranes
          Jakob Buchheim, Roman M Wyss and Hyung Gyu Park
          Department of Mechanical and Process Engineering ETH, Zürich, Switzerland

10:30AM  Water and Salt Transport Properties of Graphene Oxide Membranes
          Young Hoon Cho, Jae Eun Shin, Seung Jin Jang, Byung Min Yoo and Ho-Bum Park
          Hanyang University, Seoul, South Korea

11 AM   Industrial Fabrication Process for Novel Nanofiltration Membranes Designed for Chinese Municipal Wastewater Market
          Jianzhong Xia
          Beijing OriginWater Technology, Beijing, China

11:30AM  Development of Anti-Fouling Membranes By Chemical Patterning
          Steven Weinman, Na Li and Scott M. Husson
          Clemson University, Clemson, SC
Oral sessions Tuesday June 2 morning

12 PM  Activated Carbon Nanofiber Adsorbent Membranes: Applications in Treatment of Oily Wastewater  
**Basma I. Waisi**\(^{1,2,3}\), Seetha S Manickam\(^1\), Nieck E. Benes\(^2\), Arian Nijmijer\(^2\) and Jeffrey R. McCutcheon\(^1\)  
\(^1\)University of Connecticut, Storrs, CT; \(^2\)University of Twente, Enschede, Netherlands; \(^3\)University of Baghdad, Baghdad, Iraq

Membranes for Water Treatment and Desalination I
9:30 AM – 12:30PM
Statler

Co-Chairs: **Orlando Coronell**, University of North Carolina at Chapel Hill, Chapel Hill, NC and **Ramesh Bhave**, Oak Ridge National Laboratory, Oak Ridge, TN

9:30AM  Block Copolymer Functionalized Thin-Film Composite Membranes for Anti-Fouling and Anti-Microbial Properties Using Atom Transfer Radical Polymerization  
**Jongho Lee**\(^1\), Gang Ye\(^2\), Francois Perreault\(^1\) and Menachem Elimelech\(^1\)  
\(^1\) Yale University, New Haven, CT; \(^2\) Tsinghua University, Beijing, China

10 AM  Integrated NF and Functionalized Membranes for Industrial Water Reuse: Role of Gypsum Precipitation and High Hardness  
**Andrew Colburn**, Minghui Gui, David A. Whitehead and Dibakar Bhattacharyya  
University of Kentucky, Lexington, KY

10:30AM  Inland Brackish Surface Water Desalination By Nanofiltration: Fouling Mechanisms and Pretreatment  
**Mutiara Ayu Sari** and Shankar Chellam  
University of Houston, Houston, TX

11 AM  Polysulfone Membranes Modified with Bioinspired Polydopamine and Silver Nanoparticles Formed \textit{in Situ} to Mitigate Biofouling  
**Kai Loon Chen**, Li Tang and Kenneth Livi  
Johns Hopkins University, Baltimore, MD

11:30AM  Alginate Fouling Reduction with CNT Modified Thin-Film Nanocomposite (TFN) Membrane for Desalination  
**Moon Son**, Hyeongyu Choi, Lei Liu and Heechul Choi  
Gwangju Institute of Science and Technology (GIST), Gwangju, South Korea
12 PM  **Impact of Hydrophilic Polymer Brush Layers on Biofouling Resistance of Polyamide Reverse Osmosis Membranes**  
*Kari J. Moses* and Yoram Cohen  
*University of California, Los Angeles, Los Angeles, CA*

Notes:__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________
Oral sessions Tuesday June 2 afternoon

Oral Sessions: Tuesday June 2 afternoon

Session in Memory of James E. McGrath
2 PM – 5:30 PM
Georgian

Co-Chairs: Benny D. Freeman, The University of Texas at Austin, Austin, TX, Judy Riffle, Virginia Tech, Blacksburg, VA and Keith Murphy, Prism Membranes, Air Products and Chemicals Inc., Saint Louis, MO

1:50PM Introductory Remarks
Judy Riffle, Virginia Tech

2 PM Wholly Aromatic Polymer Electrolytes in Fuel Cell Applications
Bryan S. Pivovar
National Renewable Energy Laboratory, Golden, CO

2:30 PM Aromatic Block Copolymers for High Pressure Electrolysis
Cortney Mittelsteadt\(^1\), Judy Riffle\(^2\), Jason Willey\(^1\), Jarrett Rowlett\(^2\), James E. McGrath\(^2\) and Amin Daryaei\(^3\)
\(^1\)Giner, Inc., Newton, MA, \(^2\)Virginia Tech, Blacksburg, VA, \(^3\)Virginia

3 PM Material Properties of Chlorine Tolerant Sulfonated Polysulfone for Water Purification Applications
Geoffrey M. Geise
University of Virginia, Charlottesville, VA

3:30 PM Continuous Liquid Interface Production (CLIP) of Precise Membrane Structures
Sue Mecham\(^1\), Ali Nebipasagil\(^1\), Rima Januszewicz\(^1\), Benny D. Freeman\(^2\) and Joseph M. DeSimone\(^1\)
\(^1\)University of North Carolina, Chapel Hill, NC, \(^2\)The University of Texas at Austin, Austin, TX

4 PM Advancement in Polyamide Chemistry for Delivering Breakthrough RO Products
Abhishek Roy\(^1\), Steve Rosenberg\(^1\), Robert Cieslinski\(^2\), Ian Tomlinson\(^3\), Katarina Majamaa\(^1\), Steve Jons\(^1\), Mike Korelitz\(^3\), Mou Paul\(^1\), Yasushi Maeda\(^4\), Marty Peery\(^1\) and Jon Johnson\(^1\)
\(^1\)The Dow Chemical Company, Edina, MN, \(^2\)The Dow Chemical Company, Midland, MI, \(^3\)Dow Water & Process Solutions, Edina,
Oral sessions Tuesday June 2 afternoon

4:30 PM  
Research in Membrane Separations: Preparing Students to Tackle Industrial Challenges  
**Benjamin J. Sundell**  
Aramco, Cambridge, MA

5 PM  
Integration of Charged Polymers and Reactive Nanoparticles in Membranes: Synthesis and Applications  
**Dibakar Bhattacharyya**, Minghui Gui, Sebastian Hernandez and Lindell Ormsbee  
*University of Kentucky, Lexington, KY*

**Membrane Reactors/Catalytic Membranes**  
*2 PM – 3:30 PM*  
*Arlington*

Co-Chairs: **Dongmei (Katie) Li**, University of Wyoming, Laramie, WY and **Jay Kniep**, MTR, Newark, CA

2PM  
Natural Gas Steam Reforming for Hydrogen Production Via a Thin Pd/PSS Membrane Reactor at Low Operating Conditions  
**Bryce Anzelmo**, Jennifer Wilcox and Simona Liguori  
*Stanford University, Stanford, CA*

2:30PM  
Membrane Reactor for Scalable Production of Nano-Metal Particles  
**Wei Liu**  
*Pacific Northwest National Laboratory, Richland, WA*

3PM  
Three-Phase Hydrogenation Reactions Using a Ruthenium Coated Polymeric Membrane Reactor  
**John P. Stanford**, Mary E. Rezac and Peter H. Pfommm  
*Kansas State University, Manhattan, KS*
Oral sessions Tuesday June 2 afternoon

Bioseparations/Membranes for Medical Devices II
2 PM – 3:30 PM
Berkeley/Clarendon

Co-Chairs: David Latulippe, McMaster University, Hamilton, ON and David Bohonak, EMD Millipore, Billerica, MA

2PM Appropriately Employing Real-Time and Post-Mortem Techniques
Elmira Kujundzic1, Ajay Lajmi2, Xiaosong Wu 2 and Alan R. Greenberg1
1 University of Colorado at Boulder, Boulder, CO; 2 Pall Corporation, Pensacola, FL

2:30PM Understanding the Role of Nanopatterning in Imparting Anti-Fouling Properties
Meagan Mauter
Carnegie Mellon University, Pittsburgh, PA

3 PM High-Resolution Protein Separation Using a Laterally-Fed Membrane Chromatography Device
Raja Ghosh and Pedram Madadkar
McMaster University, Hamilton, ON, Canada

Membranes for Water Treatment and Desalination, II
2 PM – 3:30 PM
Statler

Co-Chairs: Yuliana Porras Mendoza, Bureau of Reclamation, Denver, CO and Shankar Chellam, University of Houston, Houston, TX

2PM Membrane Fouling Mechanism in a Two-Stage Anaerobic Fluidized-Bed Membrane Bioreactor
Bing Wu, Weikang Lim, Yu Liu and Anthony G. Fane
Nanyang Technological University, Singapore, Singapore

2:30PM PVDF Hollow Fiber Membranes: Process Development and Improved Antifouling Behavior
Walter Kosar1, Roderick Reber III1, Greg O’Brien1, Olivier Lorain2, Sebastien Marcellino2 and Francois Beaume3
1Arkema Inc., King of Prussia, PA, 2Polymem, Toulouse, France, 3Arkema France, Pierre Benite, France
3PM  Evaluation of Silica Fouling in Novel Submerged Membrane Distillation for Produced Water Treatment
Wenwei Zhong
UNSW Australia, Sydney, Australia

Coffee Break 3:30PM – 4PM

Membrane Reactors/Catalytic Membranes, con’t
4 PM – 5:30 PM
Arlington

Co-Chairs: Dongmei (Katie) Li, University of Wyoming, Laramie, WY and Jay Kniep, MTR, Newark, CA

4 PM  From Batch to Continuous – the Osn Route
Ludmila Peeva, Joao da Silva Burgal and Andrew G. Livingston
Imperial College London, London, United Kingdom

4:30 PM  Catalytic Membranes for Production of Biofuels and Chemicals
Xianghong Qian, Anh Vu, and S. Ranil Wickramasinghe
University of Arkansas, Fayetteville, AR

5 PM  A CFD Model of an Integrated Reforming-WGS Membrane Reactor Module
Bernardo Castro Dominguez, Ivan Mardilovich, Anthony G. Dixon, Nikolaos Kazantzis and Yi Hua Ma
Worcester Polytechnic Institute, Worcester, MA

Bioseparations/Membranes for Medical Devices II, con’t
4 PM – 5:30 PM
Berkeley/Clarendon

Co-Chairs: David Latulippe, McMaster University, Hamilton, ON and David Bohonak, EMD Millipore, Billerica, MA

4 PM  Purification of Bacterial Polysaccharide-Based Vaccines Using Ultrafiltration
Andrew L. Zydney¹, Mahsa Hadidi¹ and John. J Buckley²
¹ The Pennsylvania State University, University Park, PA; ² Pfizer Global R&D, Chesterfield, MO
Oral sessions Tuesday June 2 afternoon

4:30PM  Development of Chiral Membranes for Purification of Proteins and Small Molecules  
**Joseph Imbrogno**, Victor Schultz, Robert J. Linhardt and Georges Belfort  
*Rensselaer Polytechnic Institute, Troy, NY*

5 PM  Planar Cell Chromatography  
Girish Kumar, Bo Chen, Carlos Co and **Chia-Chi Ho**  
*University of Cincinnati, Cincinnati, OH*

Membranes for Water Treatment and Desalination, II, con’t  
2 PM – 3:30 PM  
Statler

Co-Chairs: **Yuliana Porras Mendoza**, Bureau of Reclamation, Denver, CO and **Shankar Chellam**, University of Houston, Houston, TX

4 PM  Fouling of Microfiltration and Ultrafiltration Membranes By Flowback and Produced Water from the Marcellus Shale Gas Play  
**Boya Xiong**, Manish Kumar, and Andrew L. Zydney  
*The Pennsylvania State University, University Park, PA*

4:30PM  "Brushing It Off" – Theoretical Design Criteria of Polymer-Brush Coatings for Fouling-Resistant Membranes  
**Guy Z. Ramon**  
*Technion - Israel Institute of Technology, Haifa, Israel*

5 PM  Fouling Mitigation in Reverse Osmosis with Sinusoidal Spacers and Visualization of the Membrane Fouling Process with Multiphysics Modeling  
**Peng Xie**, Lawrence Murdoch and David A. Ladner,  
*Clemson University, Anderson, SC*
Oral Sessions: Wednesday June 3 morning

Plenary Session III, Imperial Ballroom
8AM – 9AM

Co-chairs: Ruth Baltus, Clarkson University and Jeff McCutcheon, University of Connecticut

Simplicity as a Strategy in Research
George Whitesides
Harvard University

Coffee Break 9AM – 9:30AM

Awards Session
9:30 AM – 12:30PM
Georgian

Co-Chairs: Uwe Beuscher, W.L. Gore, Elkton, MD and Dibakar Bhattacharyya, University of Kentucky, Lexington, KY

9:30AM Fabrication of Porous Materials-Based Mixed Matrix Membranes and Porous Matrix Membranes for Controlling Internal Concentration Polarization in Forward Osmosis
Jian-Yuan Lee¹, Fengwei Huo¹, Chuyang Y. Tang², Rong Wang¹ and Anthony G. Fane¹
¹Nanyang Technological University, Singapore, Singapore; ²University of Hong Kong, Hong Kong, Hong Kong

10 AM Development of an Innovative Reverse Osmosis Membrane for Treatment of Urine-Containing Wastewaters
Heather Jamieson, Sofia Herrera and Mary Laura Lind
Arizona State University, Tempe, AZ

10:30AM Functional Reconstitution and Characterization of Bioinspired Artificial Proton Channels
Yuexiao Shen¹, Erol Licsandru², Mihai Barboiu², and Manish Kumar¹,
¹The Pennsylvania State University, University Park, PA, ²Institut Europeen des Membranes, Montpellier, France
Oral sessions Wednesday June 3 morning

11 AM  Anti-Fouling Membrane Development for Osmotic Power Generation
        Xue Li, Tao Cai, and Tai Shung Chung
        National University of Singapore, Singapore, Singapore

11:30AM  Structure/Property Relationships in Polymer Membranes for Water and Energy
        Geoffrey M. Geise
        University of Virginia, Charlottesville, VA

12 PM  Membrane Materials to Meet Desalination Demand in an Energy Constrained World
        Meagan Mauter
        Carnegie Mellon University, Pittsburgh, PA

Gas Separations III: Membranes for Carbon Capture
9:30 AM – 12:30PM
Arlington

Co-Chairs: Nitesh Buwania, Chevron, Richmond, CA and Dhaval Bhandari, ExxonMobil Research & Engineering, Annandale, NJ

9:30AM  Water Vapor and CO₂ Permeation through Amine-Containing Facilitated Transport Membranes and Their Modeling for CO₂ Separation
        Varun Vakharia, Zi Tong and W.S. Winston Ho
        The Ohio State University, Columbus, OH

10 AM  Extended Flue Gas Trials with a Membrane-Based Pilot Plant at a One-Ton-per-Day Carbon Capture Rate
        Lloyd S. White¹, Xiaotong Wei¹, Saurabh Pande¹, Tony Wu² and Timothy C. Merkel¹
        ¹Membrane Technology & Research, Newark, CA, ²Southern Company, Wilsonville, AL

10:30AM  Highly Permeable Thermally Rearranged Polybenzoxazole Hollow Fiber Membranes for CO₂/N₂ Separation
        Jongmyeong Lee, Hye Jin Jo, Kyung Taek Woo, Ju Sung Kim and Young Moo Lee
        Hanyang University, Seoul, South Korea
11 AM  Development of Mixed Matrix Membranes for CO₂ Separation  
**Surendar Reddy Venna**¹, Xu Zhou¹, Anne Marti¹, Alex Spore², Zhicheng Tian³, Nathaniel L. Rosi², Harry Allcock³, Erik Albenze¹, Hunaid Nulwala¹, David Luebke¹ and David Hopkinson⁴  
¹National Energy Technology Laboratory, Pittsburgh, PA; ²University of Pittsburgh, Pittsburgh, PA; ³Pennsylvania State University, University Park, PA; ⁴National Energy Technology Laboratory, Morgantown, WV

11:30 AM  CO₂ Capture By Cold Membrane Operation  
**David Hasse**¹, Sudhir Kulkarni¹, Edgar S. Sanders², Jean Pierre Tranier³, Alex Augustine¹, Jiefu Ma¹, Trapti Chaubey¹ and Jacob Brumback¹  
¹Air Liquide, Newark, DE; ²MEDAL - Air Liquide, Newport, DE; ³Air Liquide, Paris, France

12 PM  Novel Staged Configurations for CO₂ Capture  
**Norfamila Che Mat**¹, Glenn Lipscomb¹ and David Willson²  
¹University of Toledo, Toledo, OH; ²Stanbridge Capital, New York

**Forward Osmosis/Pressure Retarded Osmosis II**  
9:30 AM – 12:30PM  
Berkeley/Clarendon

Co-Chairs:  **Rob McGinnis**, Nagare Membranes, New York, NY and  
**Young-hye Na**, IBM Almaden Research Center, San Jose, CA

9:30AM  Evaluation of the Effect of Osmotic Pressure Difference on the Ethanol Removal from Dilute Solutions Using Forward Osmosis,  
**Alan Ambrosi**¹, Jeffrey R. McCutcheon², Nilo Sérgio M. Cardozo¹ and Isabel Cristina Tessaro¹  
¹Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil; ²University of Connecticut, Storrs, CT

10 AM  Analysis of Forward Osmosis in the Limit of Short and Long Modules  
**Sherwood Benavides** and William A. Phillip,  
University of Notre Dame, Notre Dame, IN

10:30AM  Cation Exchange in Forward Osmosis: Study of pH Effects and Alternative Selective Layers to Mitigate It  
**Jason T. Arena**, Malgorzata Chwatko, Liwei Huang, Holly A. Robillard and Jeffrey R. McCutcheon  
University of Connecticut, Storrs, CT
Oral sessions Wednesday June 3 morning

11 AM  Life-Cycle Assessment of Two Potable Reuse Technologies: State of the Art UF-RO Treatment Vs. Hybrid Osmotic Membrane Bioreactors
Tzahi Y. Cath and Ryan Holloway
Colorado School of Mines, Golden, CO

11:30AM  Ompa – Osmotic Membrane Pressure Actuator – an Intriguing Solution for Enhanced Oil Recovery (EOR),
May-Britt Hägg, Qiang Yu, Maria Teresa Guzman Gutierrez, Marius Sandru and Taek-Joong Kim
1Norwegian University of Science and Technology, Trondheim, Norway; 2SINTEF, Trondheim, Norway

12 PM  Low Temperature Thermal FO Seawater Desalination
Rob McGinnis
Nagare Membranes, New York, NY

Membranes for Water Treatment and Desalination III
9:30 AM – 12:30PM
Statler

Co-Chairs: David A. Ladner, Clemson University, Anderson, SC and Alexia Finotello, The Dow Chemical Company, Freeport, TX

9:30AM  Novel Forward Osmosis Process to Effectively Remove Heavy Metal Ions
Yue Cui and Tai Shung Chung
National University of Singapore, Singapore, Singapore

10 AM  Hybrid Membrane Biosystem for Treatment of Produced Water and Frac Flowback Wastewater
Stephanie M. Riley and Tzahi Y. Cath
Colorado School of Mines, Golden, CO

10:30AM  Viscoelastic Properties of Biofilms: Their Role in Monitoring and Prediction of Reverse Osmosis (RO)
Membranes Biofouling
Diana Ferrando Chavez and Moshe Herzberg, Ben Gurion University of the Negev, Midreshet Ben Gurion, Israel

11 AM  Development of PEI Composite Hollow Fiber Membranes for Removal of Phenol Via Aqueous-Aqueous Membrane Extraction
Chun Heng Loh, Yuan Zhang, Rong Wang, Shuwen Goh and Anthony G. Fane
Nanyang Technological University, Singapore, Singapore
11:30AM  Porous Hydrogel Coatings with Photothermal Carbon Black for Direct Solar Membrane Distillation
Katherine R. Zodrow, Jinjian Wu and Qilin Li,
Rice University, Houston, TX

12 PM  TiO$_2$ Nanofiltration Membranes Prepared By Molecular Layer Deposition
Zhuonan Song, Yi Huang, Mahdi Fathizadeh, Lei Wang, Weiwei Xu and Miao Yu
University of South Carolina, Columbia, SC

Notes:________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
Oral Sessions: Wednesday June 3 afternoon

Mixed Matrix Membranes
2 PM – 3:30 PM
Georgian

Co-Chairs: May-Britt Hagg, Norwegian University of Science and Technology / NTNU, Trondheim, Norway and Kenneth J. Balkus Jr., The University of Texas at Dallas, Richardson, TX

2 PM  Gas Transport in Mixed-Matrix Membranes Containing MOF-74 Nanocrystals Dispersed in Polyimide-Poly(ethylene glycol) Copolymers
Zachary P. Smith, Jonathon E. Bachman and Jeffrey R. Long
University of California, Berkeley, Berkeley, CA

2:30 PM  Functionalized Carbon Nanotube Nanocomposite Membranes for Water Desalination
Wai-Fong Chan
Virginia Polytechnic Institute and State University, Blacksburg, VA

3 PM  Development of a Model Membrane for an Experimental Analysis of Linde Type a Zeolite Water Permeability in Reverse Osmosis
Pinar Cay Durgun, Shawn Fink, Andrew Shabilla, Huidan Yin and Mary Laura Lind
Arizona State University, Tempe, AZ

Novel Membranes III: Graphenes, Metals and More
2 PM – 3:30 PM
Arlington

Co-Chairs: Hassan Ait-Haddou, Pall Corporation and Leland Vane, EPA, Cincinnati, OH

2PM  Development of Defect Tolerant High-Flux Graphene Membranes for Nanofiltration
Doojoon Jang¹, Sean C. O’Hern¹, Piran Kidambi¹, Michael S. H. Boutilier¹, Yi Song¹, Juan-Carlos Idrobo², Jing Kong¹, Tahar Laoui³ and Rohit Karnik¹
¹MIT, Cambridge, MA; ²Oak Ridge National Laboratory, Oak Ridge, TN; ³KFUPM, Dhahran, Saudi Arabia
Oral sessions Wednesday June 3 afternoon

2:30PM  **Chemical Vapor Deposition of Atomically Thin Materials for Membrane and Barrier Applications**  
**Piran Kidambi**¹, Doojoon Jang¹, Michael S. H. Boutilier¹, Luda Wang², Sean C. O’Hern¹ and Rohit Karnik¹  
¹MIT, Cambridge, MA, ²University of Colorado, Boulder, CO  

3PM  **Complexation-Induced Phase Separation: Preparation of Composite Membranes with a Nanometer-Thin Dense Skin Loaded with Metal Ions**  
**Luis Francisco Villalobos** and Viktor Peinemann  
King Abdullah University of Science and Technology, Thuwal, Saudi Arabia

**Membrane Formation and Characterization II**  
2 PM – 3:30 PM  
**Berkeley/Clarendon**

Co-Chairs: **Andrew Livingston**, Imperial College London, London, United Kingdom and **Vishnu Marla**, W.L. Gore, Elkton, MD

2PM  **The Effects of Methanol Conditioning on the Sorption and Diffusion of Organic Vapors into PIM-1**  
**Melinda L. Jue** and Ryan Lively  
Georgia Institute of Technology, Atlanta, GA

2:30PM  **Fundamental Water and Sodium Chloride Transport Properties in a Series of Sulfonated Crosslinked Hydrogel Membranes**  
**Ni Yan**, John Shortreed, Donald R. Paul and Benny D. Freeman  
University of Texas at Austin, Austin, TX

3 PM  **Water-Filled Pores Exist in the Active Layers of Polyamide Thin-Film Composite Membranes**  
**Lin Lin**¹, Rene Lopez¹, Guy Z. Ramon² and **Orlando Coronell**¹  
¹University of North Carolina at Chapel Hill, Chapel Hill, NC, ²Technion – Israel Institute of Technology, Israel
Oral sessions Wednesday June 3 afternoon

Membranes for Water Treatment and Desalination, IV
2 PM – 3:30 PM
Statler

Co-Chairs: Evan Hatakeyama, Chevron, Richmond, CA and Drew Johnson, University of Texas at San Antonio, San Antonio, TX

2PM     Energy-Efficient Reverse Osmosis (EERO) for Seawater Desalination
          Tzyy Haur Chong¹ and William B. Krantz¹,²
          ¹Nanyang Technological University, Singapore, Singapore;
          ²University of Colorado, Boulder, CO

2:30PM   Omniphobic Membrane for Desalination of Highly Saline Wastewaters By Membrane Distillation
          Chanhee Boo, Jongho Lee and Menachem Elimelech
          Yale University, New Haven, CT

3PM      1-Cyclohexylpiperidine-CO₂ Switchable Polarity Solvent (SPS) Draw Solution Performance Results
          Christopher J. Orme, Joshua McNally, Daniel S. Wendt and Aaron D. Wilson
          Idaho National Laboratory, Idaho Falls, ID

          Coffee Break 3:30PM – 4PM

Mixed Matrix Membranes (con’t)
4 PM – 5:30 PM
Georgian

Co-Chairs: May-Britt Hagg, Norwegian University of Science and Technology / NTNU, Trondheim, Norway and Kenneth J. Balkus Jr., The University of Texas at Dallas, Richardson, TX

4 PM     Mixed Matrix Membranes Based on Silica Nanoparticles and Microporous Polymers for Gas Separation
          Xiao Yuan Chen, Denis Rodrigue Sr., and Serge Kaliaguine
          University of Laval, Quebec, QC, Canada
4:30 PM  High Permeability and Selectivity Room Temperature Ionic Liquid-Based Mixed Matrix Membranes for CO$_2$/CH$_4$ Separation
**Zoban Singh**, Richard Noble and Dr. Doug Gin,
*University of Colorado Boulder, Boulder, CO*

5 PM  Vapor-Induced Covalently Interconnecting Polymeric Network: Enhancement of Molecular-Sieving and Mitigation of Non-Selective Interfacial Voids in Mixed Matrix Membranes
**Susilo Japip**, Kuo-Sung Liao, Youchang Xiao and Tai-Shung Chung
*National University of Singapore, Singapore, Singapore*

**Novel Membranes III: Graphenes, Metals and More (con’t)**
4 PM – 5:30 PM
*Arlington*

Co-Chairs: **Hassan Ait-Haddou**, Pall Corporation and **Leland Vane**, EPA, Cincinnati, OH

4 PM  Novel Membrane Material for Hydrogen Separation: Supported Molten Metal Membranes
**Pei Shan Yen**, Yi Hua Ma and Ravindra Datta
*Worcester Polytechnic Institute, Worcester, MA*

4:30 PM  Thermo-Chemical Reactivity and Nitrogen Selectivity of Transition Metal Thin Film Composite (TFC) Membranes
**Charles-François de Lannoy**, Kyoungjin Lee, Simona Liguori, Tom Carver, Jennifer Wilcox
*Stanford University Stanford, CA*

5 PM  Ultra-Thin Nanomembrane Fabrication Via Silicon Substitution
**Gregory Madejski**
*University of Rochester, Rochester, NY*
Membrane Formation and Characterization II (con’t)
4 PM – 5:30 PM
Berkeley/Clarendon

Co-Chairs: Andrew Livingston, Imperial College London, London, United Kingdom and Vishnu Marla, W.L. Gore, Elkton, MD

4 PM  Novel Corrugated PVDF Membranes for Fouling Control in Membrane Distillation
Jehad Kharraz, Muhammad R. Bilad and Hassan A. Arafat
Masdar Institute of Science and Technology, Abu Dhabi, United Arab Emirates

4:30PM  Making Thin Film Composite Hollow Fiber Membranes: Understanding How Support Structure Impacts Transport and Selective Layer Properties
Jian Ren, Jeffrey McCutcheon
University of Connecticut, Storrs, CT

5 PM  Affinity Membrane Adsorbers for Binding Arginine-Rich Proteins
Heather C. S. Chenette¹, Scott M. Husson², and James M. Welsh²
¹Rose-Hulman, Terre Haute, IN; ²Clemson University, Clemson, SC

Membranes for Water Treatment and Desalination, IV, con’t
4 PM – 5:30 PM
Statler

Co-Chairs: Evan Hatakeyama, Chevron, Richmond, CA and Drew Johnson, University of Texas at San Antonio, San Antonio, TX

4 PM  High Performance Thickness-Controlled Graphene Oxide Composite Reverse Osmosis Membrane
Jaewoo Lee¹, Jun Hee Jang¹, Hee-Ro Chae¹, Sang H. Lee¹, Chung-Hak Lee¹, Pyung-Kyu Park², Young-June Won³ and In-Chul Kim⁴,
¹Seoul National University, Seoul, South Korea; ²Yonsei University, Wonju, South Korea; ³Korea Institute of Science and Technology, Seoul, South Korea; ⁴Korea Research Institute of Chemical Technology, Daejeon, South Korea
Oral sessions Wednesday June 3 afternoon

4:30PM  District Heating-Powered Membrane Distillation for Industrial Applications: Wastewater Treatment in Pharmaceutical Industries
Daniel M. Woldemariam and Andrew R. Martin
KTH Royal Institute of Technology, Stockholm, Sweden

5 PM  Development of Water Filters Using Plant Xylem
Krithika Ramchander
MIT, Cambridge, MA

Notes: ________________________________________________________________

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

49
Poster Presentations

Improving Forward Osmosis Performance with the Implementation of MIXED Draw Solutions
Johan Vanneste, Ryan Holloway, R Maltos and Tzahi Cath

Sulfonated Polysulfone Based High Performance Thin Film Composite Membranes for Forward Osmosis
Jian Ren, Brendan O’Grady and Jeffrey McCutcheon

Fabrication of Tunable Nanoporous Membranes with Chemically-Tailored Pore Walls from Triblock Polymer Templates
Jacob Weidman, Ryan Mulvena, Bryan W. Boudouris and William A. Phillip

Helium Ion Microscopy for Membrane Characterization
Indira Sriram, Alexandra Curtin, Jason Holm and Aric Sanders

Acmf Fabrication As an Adsorbent for Emulsified Oil Removal from Brine Waste Water
Basma I. Waisi, Nieck E. Benes, Arian Nijmijer and Jeffrey McCutcheon

The Effect of Antiscalants on Biofouling and Microbial Communities of Reverse Osmosis (RO) Membranes in Seawater Desalination
Amer Sweity

Computational Fluid Dynamics Modeling of Forward Osmosis: Combined Effect of Cross-Flow Velocity and Pore Dimensions on Internal Concentration Polarization
Milad R. Esfahani, Laura H. Arias Chavez and Ehsan Languri

Surface Nanostructuring with Hydrophilic Polymer Brush Layers for Fouling Resistant Ultrafiltration (UF) Membranes
Soomin Kim and Yoram Cohen

Acid Resistance of Zeolite Socony Mobile-5 for Wastewater Recovery Applications
Heather Jamieson, Tianmiao LAI, Pinar Cay Durgun, Adam Huang, Roshini Kalagara, Varun Pattalachinti and Mary Laura Lind

Performance Evaluation of HTI 's Latest High-Flux TFC FO Membrane for Municipal and Industrial Applications
Daniel Wandera

Propylene/Propane Permeation Properties of Spiro- and Triptycene-Based Microporous Polymides
Ramy Swaidan, Bader Ghanem, Raja Swaidan, Eric Litwiller and Ingo Pinnaun
Thin Film Composite Membranes in Closed-Loop Pressure Retarded Osmosis for Power Generation
Lingling Xia, Daniel Anastasio, Jason Arena and Jeffrey R. McCutcheon

High Internal Phase Emulsion Templating As a Potential Method for Producing Ultrafiltration Membranes
Anna Malakian, Ryan Zowada and Reza Foudazi

Rigidity and Microporosity in Pims: Some Caveats
Raja Swaidan, Bader Ghanem, Eric Litwiller and Ingo Pinnau

Electrospun Membranes from Zwitterionic Copolymers
Sefika Ozcan, Papaty Kaner, Peggy Cebe and Ayse Asatekin

Three-Phase Hydrogenation Reactions Using a Catalyst Coated Polymeric Membrane Reactor
John P. Stanford, Peter H. Pfromm and Mary E. Rezac

Novel Photoresponsive Water Filtration Membranes
Papatya Kaner, Xiaoran Hu, Samuel W. Thomas III and Ayse Asatekin

Amphiphilic Random Copolymers with Charged Groups As Membrane Selective Layers
Ilin Sadeghi, and Ayse Asatekin

Norepinephrine Modified PVDF-Psu Supported Thin Film Composite Membranes for Forward Osmosis
Malgorzata Chwatko, Jason T. Arena and Jeffrey R. McCutcheon

Removal of Microcystin-LR By Ultrafiltration and Nanofiltration
Neelam Jagani, Joyner I. Eke and Isabel Escobar

Gas Permeability and Permselectivity Properties of ZIF-11 and ZIF-12 Based Polymer Mixed Matrix Membranes
Mehtap Safak Boroglu, Ahenk Burcu Yumru, Mehtap Ugur and Ismail Boz

Pentiptycene-Based Polyimides with Hierarchically Controlled Molecular Cavity Architecture for Efficient Membrane Gas Separation
Shuangjiang Luo, Qiang Liu, Baohua Zhang, Jennifer Wiegand, Benny D. Freeman and Rui Lan Guo

Linde Type a Zeolite Water Permeability Analysis in a Model Membrane for Brackish Water Desalination
Pinar Cay Durgun, Shawn Fink, Andrew Shabilla, Huidan Yin and Mary Laura Lind
Synthesis of Poly (Vinyl Alcohol)/Cellulose Acetate Ultrafiltration Membranes with Silver for Biofouling Resistance
Audie Thompson, Silver Enyinnia and Felecia Nave

Thermal Energy Assisted Forward Osmosis (TEAFO): Principles, Modeling and Performance
Maqsud Chowdhury and Jeffrey R. McCutcheon

Composite Lignin/Polydimethylsiloxane (PDMS) Membranes for Pervaporation of Ethanol from Dilute Aqueous Solutions
Yifei Xu, and Mary Laura Lind

Sinusoidal Spacers for Membrane Fouling Reduction and Visualization of Membrane Fouling Process
Peng Xie, Lawrence Murdoch and David A. Ladner

Mesophase Templated Porous Polymers As Ultrafiltration Membranes
Sahar Qavi, Chen Kuang and Reza Foudazi

Polymerized Mesophases of Water/Oil/Surfactant Self-Assembly As Potential Membranes for Ultrafiltration
Maryam Omidvarkordshouli, Justin Milavec, Abbas Ghassemi and Reza Foudazi

Fundamental Water and Sodium Chloride Transport Properties in Sulfonated Crosslinked Hydrogel Membranes
Ni Yan, John Shortreed, Donald R. Paul and Benny D. Freeman

Development of Anti-Fouling, Anti-Microbial Membranes for Wastewater Treatment
Steven Weinman, Viatcheslav Freger, Moshe Herzberg and Scott M. Husson

Biophysical Modulation of Lipid Membrane Permeability Using Engineered Nanoparticles
Geoffrey D. Bothun, Matthew Preiss, Christopher L. Kitchens and Ashley E. Hart

Synthesis and Characterization of Sulfonyl-Containing Polybenzimidazoles for Gas Separations
Joshua D. Moon, Hailun Borjigin, Kevin A. Stevens, Ran Liu, Andy Shaver, Benny D. Freeman, J.S. Riffle and James E. McGrath

Chelating Polymer Modified P84 Nanofiltration (NF) Hollow Fiber Membranes for High Efficient Heavy Metal Removal
Jie Gao, Shi Peng Sun, Wen-Ping Zhu and Tai-Shung Chung

Activated Sludge Aeration Waste Heat for Membrane Evaporation of Desalination Brine Concentrate: A Bench Scale Collaborative Study
Drew Johnson, Heather Shipley and Nayana Muppavarapu
Pervaporation and Gas Separation Properties of ZIF-68 Membranes Synthesized Via the Modified Reactive Seeding Method
Alexandra Kasik and Jerry Lin

Microbial Attachment Inhibition through Low Voltage Electrochemical Reactions on Electrically Conducting Membranes
Avner Ronen, Sharon L. Walker and David Jassby

Surfactant Effects on Filtration of Oil/Water Emulsions with Polymer Brush-Modified Membranes
Zhefei Yang

A New Approach for Fabricating a Microporous Ceramic Carbon-Based Membrane
Nouha Tahri and Raja Ben Amar Sr.

Sorption and Diffusion of Organic Vapors into PIM-1 and the Effects of Methanol Conditioning
Melinda L. Jue and Ryan Lively

SAPO-34 Membranes for N2/CH4 Separation: Preparation, Characterization, and Separation Performance
Shiguang Li, Zhaowang Zong, Shaojun James Zhou, Yi Huang, Zhuonan Song, Xuhui Feng, Rongfei Zhou, Howard S. Meyer, Miao Yu and Moises Carreon

Influence of Microporous Membrane Properties on DCMD
Lin Li and Kamalesh K. Sirkar

Bacterial Attachment and Fouling of Nanofiltration Membranes Conditioned with Glycosphingolipids
Christopher J. Arnusch, Robert Haas, Nathaniel C. Wardrip, Jenia Gutman, Kazuyoshi Kawahara, Wolfgang Uhl and Moshe Herzberg

Organic Solvent Reverse Osmosis Using Solvent-Resistant Hollow Fiber Membranes
Dong-Yeun Koh and Ryan P. Lively

Understanding the Effect of Porous Support on the Separation Properties of Thin Film Composite Membranes Using an Integrated Experimental and Simulation Approach
Lingxiang Zhu, Weiguang Jia, Moon Kattula, Koushik Ponnuru, Edward P. Furlani and Haiqing Lin

Through the Modeling Lens: Perspectives on Collaboration Between Process Simulation and Membrane Research
Leaelaf M. Hailemariam, Garth R. Parker Jr., Justyna Warczok, Debra Timmers and Felix Wang
Poster presentations

Analysis of Transient Permeation in Composites with External Mass Transfer Resistance
Jerry H. Meldon and AnhPhong Tran

NOVEL SMALL Cyclic Reverse Osmosis (CRO) Desalination System
Tae Lee

Novel Draw Solution of Hydroacid Complexes in Forward Osmosis Processes
Qingchun Ge and Tai-Shung Chung

Preparation of Chemically-Tailored Copolymer Nanofiltration Membranes
Siyi Qu and William Phillip

Advances in Evapoporometry – Assessment of Anti-Fouling Techniques on Internal Pore Fouling in Membranes
Farhad Zamani, Ebrahim Akhondi, Jia Wei Chew, William B. Krantz and Anthony G. Fane

Effects of a Dual Nanofiller, Nano-TiO2 and MWCNT, for Polysulfone-Based Nanocomposite Membranes for Water Purification
Milad R. Esfahani, Holly Stretz, and Martha J. M. Wells

Oxygen Transfer in Modified Polysulfone Hollow Fiber Membranes for Artificial Lung Applications
Maryam Asgharpour, Neda Mahmoudi, Lauren Reed, Shannon L. Servoss and Jamie A. Hestekin

Kinetics and Mechanisms of Amide Link Scission in the Polyamide Active Layer of Thin-Film Composite Membranes upon Exposure to Free Chlorine
Joshua Powell, Jeanne Luh and Orlando Coronell

A Dedicated Numerical Method for Simulating Fluid Flow and Solute Transport in Membrane Filtration Systems
Claire Strebinger1, Nils Tilton1, Eric Serre2, Denis Martinand3 and Richard M. Lueptow4, (1)Mechanical Engineering, Colorado School of Mines, Golden, CO, (2)CNRS, Marseille, France, (3)University of Aix-Marseille, Marseille, France, (4)Mechanical Engineering, Northwestern University, Evanston, IL

Synthesis and Optimization of Self-Assembled, Post-Functionalized Nanoporous Silica Membranes for Energy Conversion Processes
Sofie Haldrup, Jacopo Catalano, Ilya Zharov and Anders Bentien

Membrane Biofouling Control By Bacterial Quorum Quenching in MBR for Wastewater Treatment
Seonki Lee, Kibaek Lee, Sang H. Lee and Chung-Hak Lee

54
Development of a Thin-Layer Metallic Membrane Supported on Yttria-Stabilized Zirconia for High-Temperature Nitrogen Separation
Kyoungjin Lee, Charles-François de Lannoy, Simona Liguori and Jennifer Wilcox

Measuring Membrane Zeta Potential in High Ionic Strength Environments
Bryan D. Coday, Thomas Luxbacher, Amy Childress, Pei Xu and Tzahi Y. Cath

Polysulfone Modification for Nanofiltration
Blake A. Johnson and Jamie A. Hestekin

Development of Mono and Multilayer Cellulose Acetate Membranes for Controlled Release Applications
Metin Uz and Sacide Alsoy Altinkaya

Effect of Low Temperature Gel Aging on Zeolite LTA Particle Size in Template-Free Hydrogel Process
Afsaneh Khosravi, Julia King, Alexander Maltagliati, Tony Nguyen and Mary Laura Lind

Cellulose/Electrospun PVDF-HFP Membranes for Oil/Water Separation
Raed Hashaikeh and Farah Ahmed

Factors Governing Combined Fouling By Organic and Colloidal Foulants in Cross-Flow Nanofiltration
Oranso T. Mahlangu, Justice M. Thwala, Bhekie B. Mamba, Arnout D'Haese and Arne R. Verliefde

From Natural and Bio-Assisted Toward Biomimetic Artificial Water Channel Systems
Mihai Barboiu

Functionalization of TFC Polyamide Membrane with Copper Nanoparticles Using Spray-and-Spin-Assisted Layer-By-Layer Assembly
Wen Ma, Adel Sorouch, Tran Van Anh Luong, Gregor Brennan and Md Saifur Rahman

Modeling Gas Permeation through Mesoporous Membranes Using Dynamic Mean Field Theory
Ashutosh Rathi, John R. Edison, David Ford and Peter A. Monson

Development of Nanoporous Organic Molecular Materials for Gas Separation Applications
John Yang

Effect of Pore Entrance on the Transport of Spherical Particles in Capillary Pores
Armin Delavari and Ruth E. Baltus
Poster presentations

**Hydrogen Production By Water Splitting Under Visible Light Using N2/Ar Plasma Induced Doped Ordered Nanoporous TiO2 Thin Films**
Syed Islam, Allen Reed, Doo Young Kim and Stephen E. Rankin

**Selection of Improved Working Fluids for the Closed Loop Osmotic Heat Engine**
Kerri Hickenbottom, Johan Vanneste and Tzahi Y. Cath

**Dual Layer Adsorptive Membrane for Protein Separation**
Junfen Sun and Wenjuan Niu

**Non-Dispersive Solvent Extraction of Copper (II) in Hfmc: A CFD Study**
Mohammad Younas and Amir Muhammad

**Fabrication of Micro/Nanoscale Helical Fibers Via Electrospinning and Melt Blowing**
Yongchun Zeng

**Immobilization of Graphene Quantum Dots (GQDs) on the Surface of Metal Oxide Substrates or Polymeric Membranes**
Namal Wanninayake, Andrew Colburn, Minghui Gui, Dibakar Bhattacharyya and Doo Young Kim

**Development of Nanoporous Graphene Membranes for Gas Separation**
Michael S. H. Boutilier, Doojoon Jang, Luda Wang, Sean C. O’Hern, Piran Kidambi, Nicolas G. Hadjiconstantinou and Rohit Karnik

**Modeling and Performance Analysis of Laboratory Forward Osmosis System**
Abraham Sagiv, Yoram Cohen, Panagiotis D. Christofides and Rafi Semiat,

**Gas Permeation and Physical Aging Properties of Iptycene Diamine-Based Microporous Polyimides**
Fahd I Alghunaimi, Bader Ghanem, Nasser Alaslai, Raja Swaidan, Eric Litwiller and Ingo Pinnau

**Synthesis of New Polyazoles for Organic Solvent Resistance Membranes**
Stefan Chisca, Phuoc H.H. Duong, Abdul-Hamid Emwas, Rachid Sougrat and Suzana Nunes

**A Hybrid Hemofiltration-Forward Osmosis Approach for the Implantable Artificial Kidney**
Benjamin J. Feinberg, Andrew B. Wang, Andrew L. Zydney, William H. Fissell and Shuvo Roy

**Molecular Dynamics Simulations of Water and Contaminant Transport in RO Membranes: Chemistry Effects**
Meng Shen, Sinan Keten and Richard M. Lueptow
High Flux Aqueous-Aqueous Extractive Membranes Based on Electrospun Nanofibrous PVDF Scaffolds and PDMS Coating for Removal of Phenol
Meng-Yi Jin, Chun Heng Loh, Yuan Liao, Rong Wang, Shuwen Goh, Jia Ling Bibianna Yeo and Anthony G. Fane

Origin of CO₂ Philicity in Graphene Oxide Membranes
Hee Wook Yoon, Hyo Won Kim, Byung Min Yoo and Ho-Bum Park

Ion Selectivity of Electrodeionization for Hydraulic Fracturing Water Reuse
Brigitte Rodgers

Polybenzimidazole Nanofiltration Membranes with Biomimetic Surfaces
Priyesh Wagh and Isabel Escobar

Forward Osmosis (FO) and Membrane Distillation (MD) for the Reuse of High-Salinity Wastewater (HSW)
Tao He, Baolong Zhao, Zhouwei Wang, Gang Chen, Chunxia Li and Xue-Mei Li

Fabrication of Aquaporin Incorporated Phospholipid Bilayer Membrane with Enhanced Stability
Zhining Wang, Miaoqi Wang and Wande Ding

The Study of Ozonation and Biofiltration for the Effective Removal of Algal Toxins
Joyner I. Eke, Isabel Escobar and Neelam Jagani

Cellulose Composite Membranes with Ionic Liquid As a Green Solvent
Sara Livazovic, Zhenyu Li, Ali Reza Behzad, Klaus-Viktor Peinemann and Suzana Nunes

Polyacrylonitrile Supported Thin Film Composite Hollow Fiber Membranes for Forward Osmosis
Jian Ren and Jeffrey R. McCutcheon

Effect of UV/H₂O₂ Pretreatment on the Natural Organic Matters Fouling on Nanocomposite Ultrafiltration Membranes
Negin Koutahzadeh, Milad Rabbani Esfahani, Holly A. Stretz and Dr. Pedro E. Arce

Monoclonal Antibody Purification from CHO Cell Supernatant Using Overload and Elute Chromatography with Newly Developed Multimodal Membrane Adsorbers
Juan Wang and Scott M. Husson

Cellulose Nanofiber Composite Membranes for Water Purification
Nithinart Chitpong and Scott M. Husson
Poster presentations

**Using Ultrathin Silicon Nanomembranes to Construct a Poisson-Boltzmann Model of Concentration Polarization in Charged Particle Separations**
**Karl Smith**, Josh Winans and James McGrath

**Salt Responsive Ligands for Hydrophobic Interaction Chromatography**
Xianghong Qian, Zizhao Liu and **S. Ranil Wickramasinghe**

**Effect of Synthesis Time, Temperature and Reactant Ratio on ZIF-71 Particle Size for Use in Biofuel Separation**
**Huidan Yin**, Heather Jamieson, Afsaneh Khosravi and Mary Laura Lind

**Improving Forward Osmosis Performance with the Implementation of Mixed Draw Solutions**
**Ryan Holloway** and Tzahi Y. Cath

**Identifying Performance Limiting Parameters in Forward Osmosis Desalination through Module-Scale Modeling**
**Akshay Deshmukh**, Ngai Yin Yip, Shihong Lin and Menachem Elimelech

**Integrated NF and Functionalized Membranes for Industrial Water Reuse: The Role of Gypsum Precipitation and High Hardness**
**Andrew Colburn**, Minghui Gui, David A. Whitehead and Dibakar Bhattacharyya

**Treatment of Hyper-Saline Produced Water By Forward Osmosis**
**Mustafa Al-Furaiji**, Jason T. Arena, Maqsud Chowdhury, Nieck E. Benes and Jeffrey McCutcheon

**The Hydrogen Permeability of Amorphous Ninb-M (M=Sn,Ti and Zr) Metallic Membrane I**
**Tianmiao LAI**, and Mary Laura Lind

**Retardation of Plasticization through Miscible Polymers of Intrinsic Microporosity Blending**
**Wai Fen Yong** and Tai-Shung Chung

**Combined Colloidal and Organic Fouling of FO Membranes at Elevated Ionic Strengths: Fouulant-Fouulant Interactions and Fouling Reversibility**
Machawe M. Motsa, **Bhekie B. Mamba** and Arne R. Verliefde

**Enhanced Fouling By Inorganic and Organic Foulants on Pressure Retarded Osmosis (PRO) Hollow Fiber Membranes Under High Pressures**
**Si Cong Chen**, Chun Feng Wan and Chung Tai-Shung

**On the Transport Properties of Flavorings in Semicrystalline Polymers**
**Björn Heidrich**, Kitty Nijmeijer and Horst-Christian Langowski
Developing Wrinkle Free Thin-Film Composite Membrane on a Compacted Woven Fabric Mesh Support for Pressure Assisted Osmosis

Soleyman Sahebi

Development of Anti-Fouling Thin-Film Composite Forward Osmosis Membranes By Grafting Functionalized Silica Nanoparticles for Wastewater Treatment

Caihong Liu

Micro-Scale Separation of Biomolecules Via Stirred-Well Filtration (SWF) Technique

Amir S. Kazemi and David R. Latulippe

A One Pot Method for Nanocomposite Gas Separation Membrane Formation: Ultem, Teflon AF, and PMP Membranes

Daniel Lee and Nancy K. Lape

High Performance Hollow Fiber Mixed Matrix Membranes

Shan Wickramanayake, Surendar Venna and David Hopkinson

Transferring Membrane Polymer Properties into Gas Separation Process Performance

Markus Priske, Tymen Visser, Ingrid Velthoen, Joerg Balster and Goetz Baumgarten

High Ethene/Ethane Selectivity in 2,2¢-Bipyridine-Based Silver(I) Complexes By Removal of Coordinated Solvent


Structure-Property-Performance Relationships in Hydrophilic-Hydrophobic Proton Exchange Membranes

Ozma Lane, Jarrett Rowlett, Amin Daryaei, Judy S. Riffle and James E. McGrath

A Mechanistic Fouling Attachment Model in Ultrafiltration of Latex Paint Effluents

Amira Abdelrasouil, Huu Doan and Ali Lohi

Niobium, Vanadium, Tantalum: Metallic Membranes for N₂ Separation and Improvement of Post-Combustion Capture

Simona Liguori, Kyoungjin Lee, Bryce Anzelmo, Charles-François de Lannoy and Jennifer Wilcox, Energy Resources Engineering, Stanford University, Stanford, CA

On the Modelling of ‘Delayed' Fouling

Robert W. Field
Good Golly Miss Molly: Fabrication and Thermo-Chemical Testing of Molybdenum Metallic Thin Film Membranes for Nitrogen Separation

Charles-François de Lannoy, Kyoungjin Lee, Simona Liguori and Jennifer Wilcox

Comparative Study of the Effects of Sodium Sulphate and Sodium Acetate on Some Functional Properties of Some Melon Seed Flours: Protein Solubility Profile and Water Absorption Capacity

Joan O. Ogundele

Dynamic Process Simulation and Process Control of Biogas Permeation Processes

Marco Scholz, Michael Alders, Jonas Lölsberg and Matthias Wessling

Fouling Resistant, High Flux Membranes with ~1 Nm Effective Pore Size By Zwitterionic Copolymer Self-Assembly

Prity Bengani and Ayse Asatekin

Hydrogen Separation Using Mixed-Matrix Membranes (MMMs) Derived from Blends of 6FDA-Durene and Polybenzimidazole Compatibilized with Colloidal ZIF-7

Do Nguyen, Nimanka Panatipiya, Bradley Moreno, Yu Huang, Inga H. Musselman, Kenneth J. Balkus Jr. and John P. Ferraris

Responsive N-Isopropylacrylamide (NIPAAm) Membranes

Sneha Chede, Isabel Escobar and Geoff Bothun

FINE Refuse and Ultrafine Coal Dewatering Utilizing an Osmotic Gradient

Hafiz Salih, Lixia Wang, Vinod Patel, Kishore Rajagopalan and Vasudevan Namboodiri

Water Gas Shift Membrane Reactor Module: A Heat Transfer Analysis

Rui Ma, Bernardo Castro Dominguez, Anthony G. Dixon and Yi Hua Ma

Advances in Membrane Materials for the Forward Osmosis Membrane Brine Concentrator

Homayoun Moaddel, Zac Helm and Nathan T. Hancock

An Economic Performance Evaluation Study of Membrane Steam Reformer Modules Used in H2 Production

Liang-Chih Ma, Bernardo Castro Dominguez, Nikolaos Kazantzis and Yi Hua Ma

Biomimetic Membrane, Challenges in Directional Immobilization of Protein Channels

Xinyi Zhang, Minghui Gui, Dibakar Bhattacharyya and Yinan Wei
Correlation Between Microstructure and Magnetic Properties in Mechanically Alloyed Nanogranular FeAlSn
Zineb Hamlati, Warda Laslouni, David Martinez-Blanco, Jesus Blanco, Pedro Gorria, and Mohamed Azzaz

Characterization of the Partitioning of Alkali Metal Salts and Boric Acid from Aqueous Solution into the Active Layers of RO/NF Membranes
Jingbo Wang and Orlando Coronell

Reactive Electrochemical Membranes for Contaminant Removal and Fouling Regeneration
Yin Jing, Lun Guo and Brian Chaplin

Development of Weak Cation Exchange Membrane Adsorber Materials for Protein Capture
Yung Priscilla Lai, Christine Moresoli and Mario Gauthier

Novel Polyether Based Membrane Materials for CO₂ Capture
Junyi Liu, Cheng Kee Lai, Chong Cheng and Haiqing Lin

Thiol-Ene Based Polymer Networks for Reverse Osmosis
Shawreen Shah, Kaipin Huang, Norman Ng and Haiqing Lin

Carbon Molecular Sieve Membranes Derived from Small Molecule Compatibilized Immiscible Polymer Blends
Nimanka Panapitiya, Sumudu Wijenayake, Nimali Abeykoon, Chamaal Karunaweera, Sejin Kim, Do Nguyen, Inga H. Musselman, Kenneth J. Balkus Jr. and John P. Ferraris

Novel Staged Configurations for CO₂ Capture
Norfamila Che Mat, Glenn Lipscomb and David Willson

Transport through Composite Membranes: Impact of Liquid-Filled Voids in the Thin Film
Mavis C.Y. Wong, Guy Z. Ramon, Lin Lin, Orlando Coronell and Eric M.V. Hoek

Developing New Multilayer Polyelectrolyte Charge Mosaic Membranes
Ghazaleh Vaseghi

Density Functional Theory Analysis of Switchable Polarity Solvent (SPS) Structure-Function Model
Aaron D. Wilson, Christopher J. Orme, Xiaoping Wang, Christina Hoffmann, Bruce Noll and Joshua McNally

Energy and Cost Implications of Membrane Separation of Nitrogen for Power Plant Emissions Controls
Mengyao Yuan, Praveen Bains and Jennifer Wilcox
Poster presentations

**Cellulose Acetate Hollow Fibers for ECM Production**  
*Kevin Roberts*

**Novel Energy-Efficient GO-ZnO/PES Membranes for Wastewater Reclamation**  
*Oranso T. Mahlangu, Justice M. Thwala, Bhekie B. Mamba* and *Arne R. Verliefde*

**Characterization of the Porous Structure of Surface Polyamide Film in Composite Reverse Osmosis Membranes**  
*Yiqun Liu* and *Hao Yan*

**Functional Characterization of Artificial Proton Channels**  
*Yuexiao Shen*, *Erol Licsandru*, *Mihai Barboiu* and *Manish Kumar*

**Hydrophobic Organic-Inorganic Hybrid Microporous Silica Membranes for Hydrogen Separation**  
*Qi Wei*

**Water-Filled Pores Exist in the Active Layers of Polyamide Thin-Film Composite Membranes**  
*Lin Lin*, *Rene Lopez*, *Guy Z. Ramon* and *Orlando Coronell*

**pH Responsive PVDF Microfiltration Membranes: Synthesis, Water Transport, and Reactive Aspects**  
*Hongyi Wan*, *Minghui Gui* and *Dibakar Bhattacharyya*

**Pnipam Functionalized Membranes: Tunability and Pollutant Partitioning/Degradation**  
*Anthony Saad*, *Minghui Gui*, *Li Xiao* and *Dibakar Bhattacharyya*

**Developing Thin Film Composite Membrane on a Compacted Woven Fabric Mesh Support for Pressure Assisted Osmosis**  
*Soleyman Sahebi*

**Separation and Recovery of SF6 Gas from Perfluoro Compound Gases By Using a CMS Hollow Fiber Membrane**  
*Min Jae Jo*, *Se Jong Kim*, *Hyung Chul Koh*, *SangYong Nam* and *Seong Yong Ha*

**Molecular Modeling of Ion Transport of Hydrocarbon Based Polymeric Membrane**  
*SangYong Nam*, *Chihoon Park* and *DeukJu Kim*

**Permeation Properties of Poly (ethylene glycol)-Containing Polyimide Copolymer Membrane for Capturing Carbon Dioxide**  
*TaeYang Son*, *JeongHo Park* and *SangYong Nam*
Gas Transport Properties of Novel Polyimide Membrane Containing Cardo Moiety for Obiggs

JeongHo Park, SangYong Nam, Hyung Chul KOH, Seong Yong Ha and JungMoo Lee

Characterization of Sulfonated Sebs Copolymer Membrane for Electrodialysis

SangYong Nam and TaeYang Son

Solution-Cast Membranes for Wastewater Recovery: A New Chemical-Resistant Nanocomposite Design

Sofia Herrera, Mary Laura Lind and Heather Jamieson

Influence of Different Osmotic Agents on Ethanol Removal from Dilute Solutions By Forward Osmosis

Alan Ambrosi, Guilherme L. Correa, Natieli S. de Vargas, Lucas M. Gabe, Nilo Séro M. Cardozo and Isabel Cristina Tessaro

Development of Chiral Membranes for Purification of Proteins and Chiral Small Molecules

Joseph Imbrogno, Victor Schultz, Robert J. Linhardt and Georges Belfort

Development and Characterization of Gas Separation Hollow Fiber Membrane Using a Polyimide

Se Jong Kim, Min Jae Jo, Hyung Chul Koh, SangYong Nam and Seong Yong Ha

Development of Low-Fouling Membranes Grafted with Poly(2-methoxyethylacrylate) By Plasma Graft Polymerization Method

Kazuki Akamatsu, Takaaki Furue, Fang Han and Shin-ichi Nakao

Fabrication and Characterization of PES-TFC Hollow Fiber Membranes for Forward Osmosis Process

Lijo Francis

Polythiosemicarbazide Membranes for Organic Solvent Nanofiltration

Jamaliah Aburabie

Proton Exchange Membranes from Grafting Polymerization of Neutral (meth)Acrylate Monomers on Efte Films - Synthesis and Fuel Cell Application

Xin Li, Marco Drache, Uwe Gohs and Sabine Beuermann

Interfacial Polymerization of Electrospun Polysulfone Nanofibrous Membranes for Micro- and Ultra-Filtration: Irreversible Fouling Study

P. Arribas, M. Khayet, M.C. Garcia-Payo and L. Gil
Poster presentations

Water Vapor and CO\textsubscript{2} Permeation through Amine-Containing Facilitated Transport Membranes and Their Modeling for Post-Combustion Carbon Capture

**Varun Vakharia**, Zi Tong and W.S. Winston Ho

Functionalization of Composite Thin Film Silica Membranes with Lipid Bilayers

**Shanshan Zhou**, Daniel Schlipf, Stephen E. Rankin and Barbara L. Knutson

Closed Loop Osmotic Heat Engine with Methanol for Enhanced Efficiency

**Evyatar Shaulsky**

Affinity Membrane Adsorbers for Binding Arginine-Rich Proteins

**Heather C. S. Chenette**, Scott M. Husson and James M. Welsh

Effects of Heat Treatment on the Characteristics of Self-Sustained Electrospun Polysulfone Nanofibrous Membranes

**P. Arribas**, M. Khayet, M.C. García-Payo and L. Gil

Forward Osmosis for Water Purification Using Impregnated Membranes

**Shizhong Zhao**, Kaipin Huang, Ananthan Balachandran and Haiqing Lin

Physical Aging of Perfluoropolymers in Ultrathin Film Composite Membranes

**Milad Yavari**, Tho Le, Sajjad Maruf, Yifu Ding and Haiqing Lin

Sub-Ambient Transport and Thermodynamics of Gas Adsorption in Zeolitic Imidazolate Frameworks

**Brian Pimentel**, and Ryan Lively

Evaluation of Combined Process of Coagulation and Forward Osmosis for Algal Biomass Concentration

**Gabriela L. de Jesus**, Isabel C. Tessaro, Nilson R. Marcílio and Rosane Rech

Magnetic Nanotube Composite Membranes

**Patricia Ignacio-de Leon**, Emily Rabe, Meltem Urgun-Demirtas, Richard Brotzman and Xing Chen

Mesoporous Silica Gel–Based Mixed Matrix Membranes for Improving Mass Transfer in Forward Osmosis: Effect of Pore Size of Silica Gel

**Jian-Yuan Lee**
## NAMS 2015 Sponsors

### GOLD LEVEL
- Air Liquide
- Air Products – Prism Membranes
- Chevron
- EMD Millipore

### SILVER LEVEL
- Dow Water & Process Solutions
- Evonik
- Genentech
- GE Global Research and GE Power & Water Membrane Technology & Research
- Shell International Exploration and Production
- W.L. Gore & Associates
- 3M Purification

### BRONZE LEVEL
- Nagare
- University of Kentucky, Center of Membrane Sciences
MEDAL
Robust, high performance hollow fiber membranes for gas separation

- Natural Gas Sweetening and Biogas: Superior selectivity with high flux for optimized performance in CO₂ removal and He recovery
- Hydrogen: High purity/recycle solutions, optimized syngas ratio control, and minimum olefin losses for a broad range of refinery, GTL, and petrochemical applications
- Nitrogen: Solutions for diverse inerting applications in aerospace, mining, marine, energy, food processing, and on-site N₂ generation

Encouraging a greener future through biomethane membrane separation and student development.

Air Products PRISM™ Membranes
11444 Lackland Road
St. Louis, MO 63146
314-995-3300
www.airproducts.com/membranes
membranelnside.com
WE AGREE.
Solving tomorrow’s energy challenges will require our best thinking. At Chevron, technology and innovation are essential to our operations. So we’re partnering with universities and research institutions to help develop the energy advancements that will keep our company moving forward and help meet the world’s energy demands for decades to come.
Learn more at chevron.com.
Park Plaza Hotel Map of Meeting Rooms
NAMS 2015 Social Media Links

Scan for more information!
Share your conference experience online on Facebook and Twitter. Find abstract and schedule information using these scan codes.

Like us on Facebook!

Connect on LinkedIn!

Follow us on Twitter!

View Overview Schedule!

View Confex Schedule! Find abstract information here.

Visit the NAMS Website!

Use an app such as QR Reader or Microsoft Tag to access these codes!