

# **16th Annual Meeting of the North American Membrane Society 2005**

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**(1) Monday, Jun 10, 7:45 AM**  
**Plenary Session I**  
*Grove Hotel, Ballroom*

**Frederick F. Stewart, Chair**  
Idaho National Laboratory,  
Idaho Falls, ID  
**Jerry Lin, Co-Chair**  
Arizona State University,  
Tempe, AZ

**Forward Osmosis and  
Pressure Retarded Osmosis:  
Recent Progress and  
Challenges 1**  
7:45 AM, Paper 1a  
*Menachem Elimelech\**  
*Yale University, New Haven, CT*

**(2) Monday, Jun 10, 9:30 AM**  
**Novel Polymer Membranes - I**  
*Grove Hotel, Evergreen*

**S. Ranil Wickramasinghe,  
Chair**  
University of Arkansas,  
Fayetteville, AR  
**Xianghong Qian, Co-Chair**  
University of Arkansas,  
Fayetteville, AR

**The Effect of Structure and  
Synthesis Route On  
Transport Properties for  
Thermally Rearranged  
Polymers 2**  
9:30 AM, Paper 2a  
*Zachary P. Smith\* (1), Katrina  
M. Czenkusch (1), David F.  
Sanders (1), Kristofer L.  
Gleason (1), Ruilan Guo (2),  
James E. McGrath (3), Benny  
D. Freeman (1), Donald R. Paul  
(1)*  
*(1) The University of Texas at  
Austin, Austin, TX*  
*(2) The University of Notre  
Dame, Notre Dame, IN*  
*(3) Virginia Tech, Blacksburg,  
VA*

**Blended Polybenzimidazole  
Thermosets**

10:00 AM, Paper 2b 4  
*John R. Klaehn\* (1),  
Christopher J. Orme (1), Eric S.  
Peterson (1), C. A. Quarles (2)*  
*(1) Idaho National Laboratory,  
Idaho Falls, ID*  
*(2) Texas Christian University,  
Fort Worth, TX*

**Polymer-Graphene Oxide  
Nanobrick Wall Gas  
Separation Membranes 5**  
10:30 AM, Paper 2c  
*Jaime C. Grunlan\*, You-Hao  
Yang*  
*Texas A&M University, College  
Station, TX*

**Novel Organic-Inorganic Thin  
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With Separation Performance  
Surpassing Ceramic  
Membranes for Isopropanol  
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11:00 AM, Paper 2d  
*Jian Zuo\*, Yan Wang, Tai-  
Shung Chung*  
*National University of  
Singapore, Singapore,  
Singapore*

**Development of Polymeric  
Multimodal Membrane  
Adsorbers for Protein  
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11:30 AM, Paper 2e  
*Juan Wang\*, Scott M. Husson*  
*Clemson University, Clemson,  
SC*

**Novel Membranes for  
Hydrophobic Interaction  
Chromatography 8**  
12:00 PM, Paper 2f  
*Anh Vu\* (1), Heath Himstedt (2),  
Xianghong Qian (1), S. Ranil  
Wickramasinghe (1)*  
*(1) University of Arkansas,  
Fayetteville, AR*  
*(2) University of Minnesota,  
Minneapolis, MN*

**(3) Monday, Jun 10, 9:30 AM**  
**Membrane Fouling - I**

*Grove Hotel, Aspen*  
**Uwe Beuscher, Chair**  
W.L. Gore & Associates  
**Hassan Arafat, Co-Chair**  
Masdar Institute of Science and  
Technology, Abu Dhabi, United  
Arab Emirates

**Location and Quantification  
of Biological Foulants in a  
Wet Membrane Structure By  
Cross-Sectional Confocal  
Laser Scanning Microscopy 9**  
9:30 AM, Paper 3a  
*Milagro Marroquin\* (1), Anh Vu  
(2), S. Ranil Wickramasinghe  
(2), Terri Bruce (1), Scott M.  
Husson (1)*  
*(1) Clemson University,  
Clemson, SC*  
*(2) University of Arkansas,  
Fayetteville, AR*

**ATR-FTIR and XPS  
Spectroscopy Reveals  
Specific Interactions Between  
(Electro)Chemically  
Generated Aluminum  
Coagulants and PVDF  
Microfilters Causing  
Irreversible Fouling 10**  
10:00 AM, Paper 3b  
*Neranga Gamage\*, Shankar  
Chellam*  
*University of Houston, Houston,  
TX*

**Engineering Chemically  
Hierarchical Surfaces With  
Superior Antifouling, Self-  
Cleaning and Multi-  
Responsive Properties 12**  
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*Xueting Zhao, Yanlei Su,  
Wenjuan Chen, Yafei Li,  
Zhongyi Jiang\**  
*Tianjin University, Tianjin, China*

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11:00 AM, Paper 3d 13

Yifu Ding\* (1), Sajjad Maruf (1),  
John Pellegrino (1), Alan R.  
Greenberg (2)  
(1) University of Colorado at  
Boulder, Boulder, CO  
(2) University of Colorado  
Boulder, Boulder, CO

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Means for Mitigating Fouling  
of Ultrafiltration and Reverse  
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Satish Muthu\*, Jonathan Brant  
University of Wyoming, Laramie,  
WY

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Hyun-Suk Oh\* (1), Sang-  
Ryoung Kim (1), Won-Suk  
Cheong (1), Sung Jun Jo (1),  
Kibaek Lee (1), Seonki Lee (1),  
Chung-Hak Lee (1), Jung-Kee  
Lee (2)  
(1) Seoul National University,  
Seoul, South Korea  
(2) Paichai University, Daejeon,  
South Korea

**(4) Monday, Jun 10, 9:30 AM  
Forward Osmosis - I  
Grove Hotel, Cedar**

**Tzahi Cath, Chair**

Colorado School of Mines,  
Golden, CO

**William Phillip, Co-Chair**

University of Notre Dame, Notre  
Dame, IN

**Forward Osmosis Membrane  
Characterization By  
Microscopic Methods – a  
Comparative Study of Optical  
Microscopy (OM), Clsm, SEM  
and TEM 18**

9:30 AM, Paper 4a  
Yi-Ning Wang\* (1), Jing Wei (2),  
Qianhong She (1), Federico  
Pacheco (3), Chuyang Y. Tang  
(1)  
(1) Nanyang Technological

University, Singapore,  
Singapore  
(2) Nanyang Technological  
University, Singapore  
Membrane Technology Centre,  
Singapore, Singapore  
(3) Stanford University, Stanford

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Characteristic of Osmotically  
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10:00 AM, Paper 4b  
Andrea Achilli\* (1), Amy  
Childress (2)  
(1) Humboldt State University,  
Arcata, CA  
(2) University of Nevada, Reno,  
NV

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Formation of Layer-By-Layer  
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Yue Cui\*, Tai-Shung Chung  
National University of  
Singapore, Singapore,  
Singapore

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Assisted Forward Osmosis:  
Impacts and Implications 22**

11:00 AM, Paper 4d  
Bryan Coday\* (1), Dean Heil (1),  
Pei Xu (2), Tzahi Cath (1)  
(1) Colorado School of Mines,  
Golden, CO  
(2) New Mexico State  
University, Las Cruces, NM

**Novel Hydrophilic Nylon 6,6  
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Composite Membranes  
Designed for Engineered  
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Liwei Huang\* (1), Mark T.  
Meyering (2), Thomas J. Hamlin  
(2), Jeffrey R. McCutcheon (1)  
(1) University of Connecticut,  
Storrs, CT  
(2) 3M Purification INC.,  
Meriden, CT

**Grafting Zeolite Nanoparticles  
Onto Polyamide Membranes  
for Enhanced Antifouling**

**Performance in Forward  
Osmosis Membrane 25  
Processes**

12:00 PM, Paper 4f  
Yaolin Liu\* (1), Baoxia Mi (2),  
Laleh Emdadi (2), Dongxia Liu  
(2)  
(1) University of Maryland,  
College park, MD  
(2) University of Maryland,  
College Park, MD

**(5) Monday, Jun 10, 9:30 AM  
Membrane Reactors  
Grove Hotel, Riverfork**

**Jay Kniep, Chair**

MTR, Newark, CA

**Federico Guazzone, Co-Chair**  
Worcester Polytechnic Institute,  
Worcester, MA

**Nb<sub>2</sub>O<sub>5</sub> Doped SrCo<sub>0.8</sub>Fe<sub>0.2</sub>O<sub>3-δ</sub>  
Membrane for Oxygen  
Separator and Membrane  
Reactor 26**

9:30 AM, Paper 5a  
Guangru Zhang\*, Zhengkun Liu,  
Wei Jiang, Wanqin Jin  
Nanjing University of  
Technology, Nanjing, China

**Tubular SDC-Carbonate Dual-  
Phase Membrane Reactor for  
Steam Reforming of Methane  
With in Situ CO<sub>2</sub> Removal 27**

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Xueliang Dong\*, Jerry Lin  
Arizona State University,  
Tempe, AZ

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Membranes for Pollutants  
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Minghui Gui\*, Lindell Ormsbee,  
Dibakar Bhattacharyya  
University of Kentucky,  
Lexington, KY

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Membrane/Membrane  
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For The Destruction Of  
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11:00 AM, Paper 5d  
Majid Monji (1), Yousef  
Motamedhashemi (1), Doug

\* Denotes Speaker

Parsley (2), Paul K.T. Liu (2),  
Fokion Egolfopoulos (1),  
Theodore Tsotsis\* (1)  
(1) University of Southern  
California, Los Angeles, CA  
(2) Media and Process  
Technology Inc, Pittsburgh, PA

#### **Sequential**

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Zhiqiang Chen\*, Jianjun Zhang,  
Shanteri Singh, Jon S. Thorson,  
Bruce J. Hinds III  
University of Kentucky,  
Lexington, KY

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Merlin L. Bruening\* (1), Yujing  
Tan (2), Yongle Pang (2),  
Wenjing Ning (2)  
(1) Michigan State University,  
East Lansing, MI  
(2) Michigan State University,  
East Lansing

#### **(6) Monday, Jun 10, 2:00 PM Novel Inorganic Membranes Grove Hotel, Cedar**

#### **Moises A. Carreon, Chair**

University of Louisville,  
Louisville, KY

#### **Shiguang Li, Co-Chair**

Gas Technology Institute, Des  
Plaines, IL

#### **Asymmetric Carbon Molecular Sieve (CMS) Hollow Fiber Membranes 35**

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Nitesh Bhuwania\* (1), William J.  
Koros (1), P. Jason Williams (2)  
(1) Georgia Institute of  
Technology, Atlanta, GA  
(2) Shell International  
Exploration and Production (US)  
Inc, Houston, TX

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Meng Hu\*, Baoxia Mi  
University of Maryland, College  
Park, MD

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Hatem M. Alsyouri\* (1), Ayoup  
Ghreir (2), Malyuba Abu Daabes  
(3)  
(1) The University of Jordan,  
Amman 11942, Jordan  
(2) Royal Scientific Society,  
Amman 11941, Jordan  
(3) German Jordanian  
University, Amman 11180,  
Jordan

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Jeroen Ploegmakers\*, Susilo  
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University of Twente, Enschede,  
Netherlands

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Jie Feng\* (1), Wei Shi (2), David  
Hopkinson (3), David Luebke (4)  
(1) National Energy Technology  
Laboratory, pittsburgh, PA  
(2) National Energy Technology  
Laboratory, U.S. Department of  
Energy, Pittsburgh, PA  
(3) National Energy Technology  
Laboratory, Morgantown, WV  
(4) National Energy Technology  
Laboratory, Pittsburgh, PA

#### **Developing Highly-Permeable Membranes for Air Dehumidification 42**

5:00 PM, Paper 6f  
Wei Liu\*  
Pacific Northwest National  
Laboratory, Richland, WA

#### **(7) Monday, Jun 10, 2:00 PM Ultrafiltration/Microfiltration**

#### **Grove Hotel, Aspen**

#### **Pei Xu, Chair**

New Mexico State University,  
Las Cruces, NM

#### **Stephen M. Ritchie, Co-Chair**

University of Alabama,  
Tuscaloosa, AL

#### **Inside-Out Vs. Outside-in – A Pilot-Scale Evaluation of UF/MF Membranes for Seawater Desalination Pretreatment 43**

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Xing Wang\*, Gyu Dong Kim,  
Russell R. Ferlita, Ryan C. Eck,  
Hyung Keun Roh  
Doosan Hydro Technology,  
Tampa, FL

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Mahsa Hadidi\* (1), Andrew L.  
Zydney (2)  
(1) Penn State University, State  
College, PA  
(2) The Pennsylvania State  
University, University Park, PA

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Lukai Yang\*, Stephen M. Ritchie  
University of Alabama,  
Tuscaloosa, AL

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Christina Kappel (1), Arie  
Zwijnenburg (1), Hardy  
Temmink (2), Huub Rijnaarts  
(2), Antoine Kemperman\* (3),  
Kitty Nijmeijer (3)  
(1) Wetsus, Leeuwarden,  
Netherlands  
(2) Wageningen University,  
Wageningen, Netherlands  
(3) University of Twente,  
Enschede, Netherlands

\* Denotes Speaker

**Aggregated Nanoparticle Morphology Effects in Membrane Filtration 50**

4:30 PM, Paper 7e

*Xuemei Feng, Drew Johnson\**  
*University of Texas at San Antonio, San Antonio, TX*

**Effect of Charge On Filtration Rejection Coefficients of Capsule-Shaped Particles in Porous Membranes 51**

5:00 PM, Paper 7f

*Basavaraju Agasanapur\*, Ruth E. Baltus*  
*Clarkson University, Potsdam, NY*

**(8) Monday, Jun 10, 2:00 PM Pervaporation/Vapor Separation**

*Grove Hotel, Evergreen*

**Leland M. Vane, Chair**

U.S. Environmental Protection Agency, Cincinnati, OH  
**Ivy Huang, Co-Chair**  
Membrane Technology and Research

**Novel PTMSP-Silica Pervaporation Membranes for Bio-Alcohol Recovery 52**

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*Chris Dotremont\*, Marjorie Dubreuil, Pieter Vandezande, Wouter Van Hecke*  
*Flemish Institute for Technological Research (VITO), Mol, Belgium*

**High-Temperature Ethanol and Water Vapor Permeation in Thermally Rearranged (TR) Polymers 54**

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*Kristofer L. Gleason\*, D. R. Paul, Benny D. Freeman*  
*The University of Texas at Austin, Austin, TX*

**Nanometric Thin Skinned Dual-Layer Hollow Fiber Membranes for Dehydration of Isopropanol 55**

3:00 PM, Paper 8c

*Yu Pan Tang\* (1), Natalia Widjojo (2), Tai-Shung Chung*

*(1), Martin Weber (3), Christian Maletzko (3)*

*(1) National University of Singapore, Singapore, Singapore*

*(2) BASF South East Asia Pte Ltd, Singapore, Singapore*

*(3) BASF SE, Ludwigshafen, Germany*

**The Development of High-Performance 6FDA-NDA/Daba/POSS/Ultem® Dual-Layer Hollow Fibers for Pervaporation Dehydration of Aqueous Ethanol Solutions 56**

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*Ngoc Lieu Le\*, Yu Pan Tang, Tai-Shung Chung*  
*National University of Singapore, Singapore, Singapore*

**Dehydration and Permeation of Various Aqueous-Organic and Organic-Organic Mixtures Using a Perfluorinated Polymeric Membrane in Pervaporation 57**

4:30 PM, Paper 8e

*John Tang\* (1), Sudipto Majumdar (2), Kamalesh K. Sirkar (1)*

*(1) New Jersey Institute of Technology, Newark, NJ*

*(2) Compact Membrane Systems, Inc, Wilmington, DE*

**Enhanced Swelling Resistance and Dehydration Performance of Ultrathin Hybrid Membrane By Incorporating Bioinspired Multifunctional Modifier 58**

5:00 PM, Paper 8f

*Jing Zhao, Fei Wang, Fusheng Pan, Mingxuan Zhang, Zhongyi Jiang\**

*Tianjin University, Tianjin, China*

**(9) Monday, Jun 10, 2:00 PM Fuel Cell and Battery Membranes**

*Grove Hotel, Riverfork*

**Peter Pintauro, Chair**

Vanderbilt University, Nashville, TN

**Ryszard Wycisk, Co-Chair**

Vanderbilt University, Nashville, TN

**Proton Exchange Membranes (PEM)s Based Upon Increased Hydrophilicity Poly(arylene ether sulfone) Multiblock Copolymers 59**

2:00 PM, Paper 9a

*Jarrett Rowlett\*, Andy Shaver, Yu Chen, James E. McGrath*  
*Virginia Tech, Blacksburg, VA*

**Reinforced Hydrocarbon-Based Ion-Exchange Membranes for Fuel Cell Applications 60**

2:30 PM, Paper 9b

*Jochen Meier-Haack\*, Kornelia Schlenstedt, Wladimir Butwilowski*

*Leibniz-Institut fuer Polymerforschung Dresden e.V., Dresden, Germany*

**Synergistic Effects of Self-Assembled Zeolite/Nafion Nano-Composite Proton Conducting Thin-Film Membrane 62**

3:00 PM, Paper 9c

*Wei Liu\**  
*Pacific Northwest National Lab, Richland, WA*

**DMFC Membranes Based On Polymer-Modified Silica Colloidal Crystals 63**

4:00 PM, Paper 9d

*Amir Khabibullin\*, Ilya Zharov*  
*University of Utah, SALT LAKE CITY, UT*

**Pore-Filling Anion Exchange Membranes for Non-Aqueous Redox Flow Batteries (RFBs) 64**

4:30 PM, Paper 9e

*Myung-Jin Lee\* (1), Moon-Sung Kang (2), Do-Hyeong Kim (2), Ji-Young Jeong (3), Joung-Won Park (3), Duk-Jin Oh (3), Doo-Yeon Lee (3), Seok-Gwang Doo (3)*

*(1) Samsung Advanced Institute of Technology, Yongin-si, Gyeonggi-do, South Korea*

*(2) Sangmyung University*

\* Denotes Speaker

(3) *Samsung Advanced Institute of Technology*

**Lithium Ion Conductive Membrane for Lithium-Air Batteries 65**

5:00 PM, Paper 9f

*Wonsung Choi\* (1), Dong Joon Lee (2), Dongmin Im (3), Seok-Gwang Doo (2)*

(1) *Samsung Advanced Institute of Technology, Yongin, South Korea*

(2) *Samsung Advanced Institute of Technology*

(3) *Samsung Advanced Institute of Technology*

**(10) Tuesday, Jun 11, 7:45 AM Plenary Session II**

*Grove Hotel, Ballroom*

**Jerry Lin, Chair**

*Arizona State University, Tempe, AZ*

**Frederick F. Stewart, Co-Chair**

*Idaho National Laboratory, Idaho Falls, ID*

**Ion Transport Membranes: Gas Separation Technology for the 21st Century 66**

7:45 AM, Paper 10a

*Michael Carolan\**

*Air Products and Chemicals, Inc., Allentown, PA*

**(11) Tuesday, Jun 11, 9:30 AM Super-high flux membranes**

*Grove Hotel, Riverfork*

**Bruce Hinds, Chair**

*University of Kentucky, Lexington, KY*

**Francesco Fornasiero, Co-Chair**

*LLNL, Livermore, CA*

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9:30 AM, Paper 11a

*Seungju Kim, Kyung Taek Woo, Hye Jin Jo, Young Moo Lee\**  
*Hanyang University, Seoul, South Korea*

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*Patricia Gogojo, Santanu Karan\*, M. F. Jimenez-Solomon, H. C. Wong, J. T. Cabral, Andrew G. Livingston*  
*Imperial College London, London, United Kingdom*

**Tuning the Gaz-Diffusion Through Dynameric Membranes-Toward Rubbery Organic Frameworks-Rofs 72**

10:30 AM, Paper 11c

*Gihane Nasr (1), Thomas Macron (2), Mihai Barboiu\* (3)*  
(1) *Institut Europeen des Membranes, Montpellier, France*  
(2) *Institut Europeen des membranes, Montpellier, France*  
(3) *Institut Européen des Membranes, Montpellier, France*

**Unified Pressure and Electroosmotic Flow Enhancement Mechanism in Carbon Nanotube Membranes 74**

11:00 AM, Paper 11d

*Bruce J. Hinds III\**  
*University of Kentucky, Lexington, KY*

**Breathable and Protective Fabrics Based On Carbon Nanotube Membranes 75**

11:30 AM, Paper 11e

*Sangil Kim\* (1), Francesco Fornasiero (1), Yeny C. Hudiono (1), Phillip Gibson (2), Heidi Gibson (2)*  
(1) *Lawrence Livermore National Laboratory, Livermore, CA*  
(2) *U.S. Army Natick Soldier Research, Development and Engineering Center, Natick, MA*

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12:00 PM, Paper 11f

*Xueping Yao, Yong Wang\**  
*Nanjing University of Technology, Nanjing, China*

**(12) Tuesday, Jun 11, 9:30 AM Advances in Reverse Osmosis/Nanofiltration - I**  
*Grove Hotel, Cedar*

**Jamie A. Hestekin, Chair**

*University of Arkansas, Fayetteville, AR*

**Isabel C. Escobar, Co-Chair**

*The University of Toledo, Toledo, OH*

**Measuring the Volume-Averaged Charge Density of Active Layers of Thin-Film Composite and Nanocomposite Membranes Using a Quartz Crystal Microbalance 77**

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*Lamar A. Perry\*, Orlando Coronell*  
*University of North Carolina at Chapel Hill, Chapel Hill, NC*

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*Chao Cheng\* (1), Andriy Yaroshchuk (2), Merlin L. Bruening (1)*  
(1) *Michigan State University, East Lansing, MI*  
(2) *Polytechnic University of Catalonia, Barcelona, Spain*

**Electrically Conducting Carbon Nanotube Polymer Composite Nanofiltration Membranes for Biofouling and Scaling Control 79**

10:30 AM, Paper 12c

*David Jassby\**  
*UC Riverside, Riverside, CA*

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11:00 AM, Paper 12d

*Mavis C.Y. Wong\* (1), Guy Z. Ramon (2), Eric M.V. Hoek (3)*

\* Denotes Speaker

(1) *University of California, Los Angeles, Los Angeles, CA*  
(2) *Princeton University, Princeton, NJ*  
(3) *UCLA, Los Angeles, CA*

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*Moshe Ben-Sasson\* (1), Katherine R. Zodrow (1), Qi Genggeng (2), Yang Kang (2), Emmanuel P. Giannelis (2), Menachem Elimelech (1)*  
(1) *Yale University, New Haven, CT*  
(2) *Cornell University, Ithaca, NY*

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12:00 PM, Paper 12f  
*Irina Valtcheva, Santosh Kumbharkar, Jeong Kim, Andrew G. Livingston\**  
*Imperial College London, London, United Kingdom*

**(13) Tuesday, Jun 11, 9:30 AM Membranes for Carbon Dioxide Capture - I**  
*Grove Hotel, Aspen*

**Xiaotong Wei, Chair**  
*Membrane Technology and Research, Inc., Newark, CA*  
**Ho Bum Park, Co-Chair**  
*Hanyang University, Seoul, South Korea*

**Techno-Economic Assessment for a Composite Hollow Fiber Membrane Process for Post Combustion CO<sub>2</sub> Capture 84**

9:30 AM, Paper 13a  
*Surinder Singh\*, Dhaval Bhandari*  
*GE Global Research, Niskayuna, NY*

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10:00 AM, Paper 13b  
*Pingjiao Hao\* (1), Jay Kniep (1), Ken Chan (1), Karl D. Amo (2), Richard Baker (1), Vincent Nguyen (1)*  
(1) *MTR, Newark, CA*  
(2) *Membrane Technology and Research, Inc., Newark, CA*

**Mixed Matrix Membranes With Modified MOFs for Post-Combustion CO<sub>2</sub> Capture 87**

10:30 AM, Paper 13c  
*Surendar Reddy Venna\* (1), Michael Lartey (2), Tao Li (3), Nathaniel L. Rosi (4), Erik Albenze (5), Hunaid Nulwala (2), David Luebke (2)*  
(1) *West Virginia University Research Corporation, Morgantown, WV*  
(2) *National Energy Technology Laboratory, Pittsburgh, PA*  
(3) *Chemistry, University of Pittsburgh, Pittsburgh, PA*  
(4) *University of Pittsburgh, Pittsburgh, PA*  
(5) *URS Corporation, Pittsburgh, PA*

**Unusual CO<sub>2</sub> Transport Through Ultrathin Graphene Oxide Membranes 88**

11:00 AM, Paper 13d  
*Hyo Won Kim\*, Hee Wook Yoon, Byung Min Yoo, Ho Bum Park*  
*Hanyang University, Seoul, South Korea*

**Synthesis and Characterization of Thin Samarium Doped Ceria/Carbonate Dual-Phase Membranes for High Temperature Carbon Dioxide Separation 89**

11:30 AM, Paper 13e  
*Bo Lu\*, Jerry Lin*  
*Arizona State University, Tempe, AZ*

**Mechanical Strength and Bubble Point of Hollow Fiber**

**Supported Ionic Liquid Membranes 90**

12:00 PM, Paper 13f  
*David Hopkinson\* (1), Shan Wickramanayake (2), David Luebke (3)*  
(1) *National Energy Technology Laboratory, Morgantown, WV*  
(2) *US DOE /NETL/URS Energy and Construction, Pittsburgh, PA*  
(3) *National Energy Technology Laboratory, Pittsburgh, PA*

**(14) Tuesday, Jun 11, 9:30 AM Novel Polymer Membranes - II**  
*Grove Hotel, Evergreen*

**S. Ranil Wickramasinghe, Chair**

*University of Arkansas, Fayetteville, AR*  
**Xianghong Qian, Co-Chair**  
*University of Arkansas, Fayetteville, AR*

**Catalytically Responsive Membranes for Simultaneous Biomass Hydrolysis and Separation 91**

9:30 AM, Paper 14a  
*S. Ranil Wickramasinghe\*, Jing Lei, Alexandru Avram, Andre Beier, Xianghong Qian*  
*University of Arkansas, Fayetteville, AR*

**Improved Membrane Performance Via Photothermal Heating Through Incorporation of Noble Metal Nanoparticles 92**

10:00 AM, Paper 14b  
*Yanbo Li\* (1), Thierry Verbiest (2), Ivo Vankelecom (1)*  
(1) *Centre for Surface Chemistry and Catalysis, K.U. Leuven, Heverlee, Belgium*  
(2) *Molecular and Nanomaterials, KU Leuven, Heverlee, Belgium*

**Effect of Backbone Structure, Degree of Sulfonation and Crosslinking On Water Permeability and Salt Selectivity for Poly(arylene**

\* Denotes Speaker

**ether sulfone) Random Copolymers 94**

10:30 AM, Paper 14c

*Benjamin J Sundell\** (1), *Joseph R. Cook* (2), *Chang Hyun Lee* (3), *Kwansoo Lee* (4), *Benny D. Freeman* (2), *James E. McGrath* (1)

(1) *Virginia Tech, Blacksburg, VA*

(2) *The University of Texas at Austin, Austin, TX*

(3) *Hanyang University, Seoul, South Korea*

(4) *Virginia Tech*

**Exploration of N-Doped Graphene Incorporated Polyethersulfone (PES) Hollow Fiber Membranes 95**

11:00 AM, Paper 14d

*Laurentia Setiawan\**, *Rong Wang*, *Jilei Liu*, *Zexiang Shen*  
*Nanyang Technological University, Singapore, Singapore*

**Controlled Fabrication of Hydrophilic Nanofiber Membranes 97**

11:30 AM, Paper 14e

*Laura H. Arias Chavez\**, *Yunxia Hu*, *Menachem Elimelech*  
*Yale University, New Haven, CT*

**Deconvoluting the Forward Osmosis Structural Parameter Using a "Model" Thin Film Composite Membrane 98**

12:00 PM, Paper 14f

*Seetha Soundara Manickam\**, *Jeffrey R. McCutcheon*  
*University of Connecticut, Storrs, CT*

**(15) Tuesday, Jun 11, 2:00 PM Gas Separation - I**

*Grove Hotel, Evergreen*

**Ingo Pinnau, Chair**

*KAUST, Thuwal, Saudi Arabia*

**Zhiping Lai, Co-Chair**

*KAUST, Saudi Arabia*

**Synthesis and Characterization of Two Isomeric Thermal Rearrangable (TR) Polyimides**

**for Gas Separation Membranes 99**

2:00 PM, Paper 15a

*Hailun Borjigin\** (1), *Qiang Liu* (2), *Donghoon Lee* (1), *Kyle Gaines* (1), *Benny Freeman* (3), *Sue Mecham* (1), *James E. McGrath* (1)

(1) *Virginia Tech, Blacksburg, VA*

(2) *The University of Texas at Austin, Austin, TX*

(3) *University of Texas at Austin*

**Sorption and Transport of Small Gas Molecules in Thermally Rearranged Polymer Membranes: Experimental and Simulation Aspects 101**

2:30 PM, Paper 15b

*Seungju Kim\** (1), *Chi Hoon Park* (2), *Elena Tocci* (2), *Young Moo Lee* (1)

(1) *Hanyang University, Seoul, South Korea*

(2) *Institute on Membrane Technology (ITM-CNR), Rende, Italy*

**Carbon Molecular Sieve Gas Separation Membranes Derived From An Intrinsically Microporous Polyimide Precursor 103**

3:00 PM, Paper 15c

*Raja Swaidan\**, *Xiaohua Ma*, *Octavio Salinas*, *Eric Litwiller*, *Ingo Pinnau*  
*KAUST, Thuwal, Saudi Arabia*

**Gas Permeability and Characterization of Thermally Rearranged Polymers Based On 3,3'-Diamino-4,4'-**

**Dihydroxy Biphenyl (AHB)**

**and 2,2'-Bis-(3,4-decarboxyphenyl)**

**Hexafluoropropane**

**Dianhydride (6FDA) 104**

4:00 PM, Paper 15d

*Qiang Liu\** (1), *Hailun Borjigin* (2), *Donald R. Paul* (1), *James E. McGrath* (2), *Benny D. Freeman* (1)

(1) *The University of Texas at Austin, Austin, TX*

(2) *Virginia Tech, Blacksburg, VA*

**Thin Carbon Molecular Sieve Membrane for Propylene/Propane Mixture Separation 105**

4:30 PM, Paper 15e

*Xiaoli Ma\** (1), *Xiaotong Wei* (2), *Jay Kniep* (3), *Jerry Lin* (1)

(1) *Arizona State University, Tempe, AZ*

(2) *Membrane Technology and Research, Inc., Newark, CA*

(3) *MTR, Newark, CA*

**Propylene/Propane Separation Properties Through Bis (triethoxysilyl) Methane (BTESM)-Derived Silica Membranes With Controlled Silica Network Size 106**

5:00 PM, Paper 15f

*Masakoto Kanezashi\**, *W. N. Shazwani*, *Hiroki Nagasawa*, *Tomohisa Yoshioka*, *Toshinori Tsuru*  
*Hiroshima University, Higashi-Hiroshima, Japan*

**(16) Tuesday, Jun 11, 2:00 PM Membrane Contactors/Membrane Distillation**

*Grove Hotel, Cedar*

**Kamalesh K. Sirkar, Chair**

*New Jersey Institute of Technology, Newark, NJ*

**Enrico Drioli, Co-Chair**

*Institute on Membrane Technology of the National Research Council - (ITM-CNR), Rende, Italy*

**Pore Structure Control of PVDF Membranes Using Dual Coagulation Bath Phase Inversion Process for Application in Membrane Distillation (MD) 108**

2:00 PM, Paper 16a

*Rinku Thomas*, *Elena Guillen-Burrieza*, *Hassan Arafat\**  
*Masdar Institute of Science and Technology, Abu Dhabi, United Arab Emirates*

\* Denotes Speaker

**Membrane Fouling Control in Treatment of Seawater Reverse Osmosis On Membrane Distillation 110**  
 2:30 PM, Paper 16b  
*Chang-Kyu Lee\**, *June-Seok Choi*  
*Korea Institute of Construction Technology, Goyang-Si, South Korea*

**Field Studies Showing Effects of Membrane Distillation Operations On Membrane Fouling 111**  
 3:00 PM, Paper 16c  
*Elena Guillen-Burrieza (1)*, *Alba Ruiz-Aguirre (2)*, *Guillermo Zaragoza (2)*, *Hassan Arafat\* (1)*  
*(1) Masdar Institute of Science and Technology, Abu Dhabi, United Arab Emirates*  
*(2) Plataforma Solar de Almeria, Almeria, Spain*

**Pressure Swing Membrane Absorption Process for CO<sub>2</sub> Removal From Precombustion Syngas 113**  
 4:00 PM, Paper 16d  
*Xingming Jie*, *John Chau\**, *Gordana Obuskovic*, *Kamalesh K. Sirkar*  
*New Jersey Institute of Technology, Newark, NJ*

**Solventless Extraction of Phenol Using TOPO-Impregnated Hollow Fiber Membranes 114**  
 4:30 PM, Paper 16e  
*Prashant Praveen\**, *Kai-Chee Loh*  
*National University of Singapore, Singapore, Singapore*

**Onboard Gasoline Separation for Improved Vehicle Efficiency 115**  
 5:00 PM, Paper 16f  
*Randall Partridge\**  
*ExxonMobil Research and Engineering Company, Annandale, NJ*

**(17) Tuesday, Jun 11, 2:00 PM**

**Membranes for Environmental Applications**  
*Grove Hotel, Riverfork*  
**D.B. Bhattacharyya, Chair**  
*University of Kentucky, Lexington, KY*  
**Rong Wang, Co-Chair**  
*Nanyang Technological University, Singapore, Singapore*

**Development of Novel Hydrophobic Composite Hollow Fiber Membranes Intended for Use in Membrane Contactor for CO<sub>2</sub> Capture (Keynote Talk) 116**  
 2:00 PM, Paper 17a  
*Rong Wang\* (1)*, *Yuan Zhang (2)*  
*(1) Nanyang Technological University, Singapore, Singapore*  
*(2) NTU, Singapore, Singapore*

**Towards Filtration of Oil-Water Mixtures Using Rotating Flow and Hydrophilic Membranes 117**  
 2:30 PM, Paper 17b  
*Merlin L. Bruening\* (1)*, *Seth Hogg (2)*, *Pengyu Ji (2)*, *Abdul Motin (2)*, *André Bénard (1)*, *Volodymyr Tarabara (1)*  
*(1) Michigan State University, East Lansing, MI*  
*(2) Michigan State University, East Lansing*

**Effects of Feed Water Inorganic Chemistry On Polyamide NF/RO Membrane Structure, Interfacial Properties and Removal of Trace Organics 118**  
 3:00 PM, Paper 17c  
*Jinwen Wang\**, *Yibing Mo*, *Shaily Mahendra*, *Eric M.V. Hoek*  
*UCLA, Los Angeles, CA*

**Polymer/Ionic Liquid Blends With Superior Separation Performance for Removing CO<sub>2</sub> From Hydrogen and Flue Gas 119**  
 4:00 PM, Paper 17d

*Hang Zheng Chen\* (1)*, *Pei Li (2)*, *Tai-Shung Chung (3)*  
*(1) National University of Singapore, Singapore, Singapore*  
*(2) national university of singapore, singapore, Singapore*  
*(3) National University of Singapore, Singapore, Singapore*

**Virus Enmeshment Onto Electrochemically Generated Aluminum Precipitates Prior to Microfiltration 122**  
 4:30 PM, Paper 17e  
*Charan Tej Tanneru\**, *Shankar Chellam*  
*University of Houston, Houston, TX*

**Synthesis and Characterization of Novel Anti-Biofouling Nanocomposite Membrane With Versatile Environmental Applications 124**  
 5:00 PM, Paper 17f  
*Xin Liu\**, *Li-Xian Foo*, *Ye Li*, *Jian-Yuan Lee*, *Bin Cao*, *Chuyang Y. Tang*  
*Nanyang Technological University, Singapore, Singapore*

**(18) Tuesday, Jun 11, 2:00 PM Forward Osmosis- II**  
*Grove Hotel, Aspen*  
**Tzahi Cath, Chair**  
*Colorado School of Mines, Golden, CO*  
**William Phillip, Co-Chair**  
*University of Notre Dame, Notre Dame, IN*

**Forward Osmosis for the Water Removal From the Aqueous Phase of Pyrolysis Oil 125**  
 2:00 PM, Paper 18a  
*Divina Kaombe\* (1)*, *May-Britt Hägg (2)*  
*(1) Norwegian University of Science and Technology, NTNU, Trondheim, Norway*  
*(2) NTNU, Trondheim, Norway*

\* Denotes Speaker

**Assessment of Commercial Thin Film Composite Membranes in Forward Osmosis: Osmotic Flux and Ammonia-Carbon Dioxide Desalination Performance** 127

2:30 PM, Paper 18b  
*Jason T. Arena\* (1), Seetha S Manickam (1), Kevin K. Reimund (1), Benny D. Freeman (2), Jeffrey R. McCutcheon (1)*  
 (1) *University of Connecticut, Storrs, CT*  
 (2) *The University of Texas at Austin, Austin, TX*

**UFO MBR – A NOVEL Potable Reuse and Nutrient Recovery System** 129

3:00 PM, Paper 18c  
*Ryan Holloway\*, Tzahi Cath*  
*Colorado School of Mines, Golden, CO*

**New Forward Osmosis Polyamide Thin Film Composite Membrane Based On Moderate Hydrophilic Support Layer** 131

4:00 PM, Paper 18d  
*Young Hoon Cho\* (1), Michael D. Guiver (2), Ho Bum Park (1)*  
 (1) *Hanyang University, Seoul, South Korea*  
 (2) *National Research Council Canada, Ottawa, ON, Canada*

**Switchable Polarity Solvent (SPS) As Draw Solutes for Forward Osmosis** 132

4:30 PM, Paper 18e  
*Aaron D. Wilson\*, Frederick F. Stewart, Mark L. Stone*  
*Idaho National Laboratory, Idaho Falls, ID*

**Tunability of Polyaniline Phase-Inverted Membranes for Forward Osmosis Applications** 133

5:00 PM, Paper 18f  
*Mavis C.Y. Wong\* (1), Eric M.V. Hoek (2), Richard Kaner (3)*  
 (1) *University of California, Los Angeles, Los Angeles, CA*  
 (2) *UCLA, Los Angeles, CA*

(3) *University of California, Los Angeles, CA*

**(19) Wednesday, Jun 12, 8:00 AM**

**Gas Separation - II**

*Grove Hotel, Evergreen*

**Ingo Pinnau, Chair**

*KAUST, Thuwal, Saudi Arabia*  
**Zhiping Lai, Co-Chair**  
*KAUST, Saudi Arabia*

**Acid Gas Purification Using Silane-Modified Cellulose Acetate Dense Film Membranes** 134

8:00 AM, Paper 19a  
*Carine Achoundong\*, William J. Koros*  
*Georgia Institute of Technology, Atlanta, GA*

**Optimization of Polyvinylamine/ Polysulfone Hollow Fibers for Natural Gas Sweetening** 135

8:30 AM, Paper 19b  
*Marius Sandru\* (1), Maria T. G. Gutierrez (2), May-Britt Hagg (2)*  
 (1) *SINTEF, Trondheim, Norway*  
 (2) *NTNU, Trondheim, Norway*

**Performance and Plasticization of Polymer-MOF Membranes for Gas Separation At Elevated Pressures** 138

9:00 AM, Paper 19c  
*Salman Shahid\*, Kitty Nijmeijer*  
*University of Twente, Enschede, Netherlands*

**Mixed Matrix Membranes Comprising Of Matrimid and – SO3 Funtionalized Mesoporous MCM-41 For Gas Separation** 139

10:00 AM, Paper 19d  
*Asim Khan\* (1), Chalida Klaysom (2), Ivo Vankelecom (2)*  
 (1) *COMSATS Institute of Information Technology, Lahore, Pakistan*  
 (2) *KU Leuven, Leuven, Belgium*

**Alpo-18 Zeolite Membranes for Carbon Dioxide Separation** 140

10:30 AM, Paper 19e  
*Moises A. Carreon\* (1), Maria Carreon (2), Shiguang Li (3)*  
 (1) *University of Louisville, Louisville, KY*  
 (2) *University of Louisville, Louisville*  
 (3) *Gas Technology Institute, Des Plaines, IL*

**Thermodynamic Analysis of CO2 Permeability in Glassy Polymer With and Without Plasticization** 141

11:00 AM, Paper 19f  
*Matteo Minelli, Giulio C. Sarti\**  
*Alma Mater Studiorum - Università di Bologna, Bologna, Italy*

**Gas Separation Using Cross-Linkable 6FDA-Based Co-Polyimides Grafted With Cyclodextrins** 142

11:30 AM, Paper 19g  
*Mohammad Askari\* (1), You Chang Xiao (2), Tai Shung Chung (1)*  
 (1) *National University of Singapore, Singapore, Singapore*  
 (2) *Suzhou Faith and Hope Membrane Technology Co. Ltd., Jiangsu Province, China*

**Influence of Skin Morphology On CO2/N2 Separation At Sub-Ambient Temperature** 143

12:00 PM, Paper 19h  
*Lu Liu\**  
*Georgia Institute of Technology, Atlanta, GA*

**(20) Wednesday, Jun 12, 8:00 AM**

**Membrane Fouling - II**

*Grove Hotel, Cedar*

**Uwe Beuscher, Chair**

*W.L. Gore & Associates*  
**Hassan Arafat, Co-Chair**  
*Masdar Institute of Science and Technology, Abu Dhabi, United Arab Emirates*

**Binding Polymer Particles With Encapsulated Antibacterial Compounds to Thin-Film Composite Membranes for Enhanced Biofouling Resistance 144**

8:00 AM, Paper 20a  
*Katherine R. Zodrow\*, Marissa E. Tousley, Menachem Elimelech*  
Yale University, New Haven, CT

**Brackish Water Desalination With Hybrid Ion Exchange – Reverse Osmosis (HIX-RO) Process for Enhanced Recovery and Elimination of Anti-Scaling Agents 145**

8:30 AM, Paper 20b  
*Ryan C. Smith\*, Arup K. Sengupta*  
Lehigh University, Bethlehem, PA

**Oxidative Pretreatment to Reverse Osmosis Membranes for Fouling Control: Results From a Pilot-Scale Study of MF MBR-O<sub>3</sub>-RO System for Water Reuse 147**

9:00 AM, Paper 20c  
*Aleksey Pisarenko\* (1), Pei Xu (2), Yue Wang (1), Kathleen Whysner (3), Benjamin Stanford (4)*  
(1) Southern Nevada Water Authority, Las Vegas, NV  
(2) New Mexico State University, Las Cruces, NM  
(3) Denver Water, Denver, CO  
(4) Hazen and Sawyer, P.C., Raleigh, NC

**NF/RO Fouling By Organic Macromolecules and Their Mixture – Exploration of Dominant Force in Fouling 148**

10:00 AM, Paper 20d  
*Yi-Ning Wang\*, Chuyang Y. Tang*  
Nanyang Technological University, Singapore, Singapore

**Direct Observation of Particle Deposition in Membrane Feed Channels: Experiment and Model 149**

10:30 AM, Paper 20e  
*Andrea Radu\*, Mathijs van Steen, M.C.M. van Loosdrecht, Cristian Picioreanu*  
Delft University of Technology, Delft, Netherlands

**Surface Modification of RO Membranes for Fouling Reduction 151**

11:00 AM, Paper 20f  
*Jochen Meier-Haack\* (1), Christian Langner (1), Mona Abdel Rehim (2)*  
(1) Leibniz-Institut fuer Polymerforschung Dresden e.V., Dresden, Germany  
(2) National Research Center Cairo, Cairo, Egypt

**Silver-Pegylated Dendrimer Nanocomposite Coating for Anti-Fouling Thin Film Composite Membranes 153**

11:30 AM, Paper 20g  
*Sui Zhang\* (1), Tai-Shung Chung (2)*  
(1) National University of Singapore, Singapore, SC, Singapore  
(2) National University of Singapore, Singapore, Singapore

**Forward Osmosis Membrane Surface Modification By In Situ Peg-Ylation for Enhanced Organic Fouling Resistance 154**

12:00 PM, Paper 20h  
*Xinglin Lu\*, Santiago Romero-Vargas Castrillon, Devin Shaffer, Menachem Elimelech*  
Yale University, New Haven, CT

**(21) Wednesday, Jun 12, 8:00 AM**

**Membranes for CO<sub>2</sub> Capture - II**

*Grove Hotel, Aspen*  
**Xiaotong Wei, Chair**  
Membrane Technology and Research, Inc., Newark, CA  
**Ho Bum Park, Co-Chair**  
Hanyang University, Seoul, South Korea

**Effect of the Ceramic Phase On the CO<sub>2</sub> Permeation Properties of the Ceramic-Carbonate Dual-Phase Membrane At High 155 Temperature**

8:00 AM, Paper 21a  
*Tyler T. Norton\*, Jerry Lin*  
Arizona State University, Tempe, AZ

**Mixed-Gas Permeation Study of CO<sub>2</sub>/CH<sub>4</sub> and CO<sub>2</sub>/N<sub>2</sub> in Thermally Rearranged (TR) Polymers 156**

8:30 AM, Paper 21b  
*Kristofer L. Gleason\*, Zachary P. Smith, Qiang Liu, D. R. Paul, Benny D. Freeman*  
The University of Texas at Austin, Austin, TX

**CO<sub>2</sub> Sorption Behavior of 2D Nanocarbon Based Membranes 157**

9:00 AM, Paper 21c  
*Hee Wook Yoon\*, Hyo Won Kim, Jae Eun Shin, Byung Min Yoo, Ho Bum Park*  
Hanyang University, Seoul, South Korea

**CFD Simulation of Net Spacers in Membrane Modules for Carbon Dioxide Capture 158**

10:00 AM, Paper 21d  
*Yuecun Lou\*, Glenn Lipscomb*  
University of Toledo, Toledo, OH

**Room Temperature Ionic Liquid/ZIF-8 Mixed-Matrix Membranes for Natural Gas Sweetening and Post-Combustion CO<sub>2</sub> Capture 159**

10:30 AM, Paper 21e  
*Lin Hao\*, Pei Li, Tingxu Yang, Tai-Shung Chung*  
National University of Singapore, Singapore, Singapore

**A Study On Immobilization of Carbonic Anhydrase On TiO<sub>2</sub> Nano-Particles and TiO<sub>2</sub> Functionalized Membranes 160**

11:00 AM, Paper 21f

\* Denotes Speaker

Guangxi Dong\* (1), Charly Malassigne (2), Vicki Chen (1)  
(1) The University of New South Wales, Sydney, Australia  
(2) Universite de Nantes, Nantes, France

**Investigation of Novel Nano Nano Composite Membrane for CO<sub>2</sub> Capture 161**

11:30 AM, Paper 21g  
Vajiheh Nafisi\*, Maria Teresa Guzman Gutierrez, May-Britt Hägg  
NTNU, Trondheim, Norway

**Efficient CO<sub>2</sub> Capture By PEO-Based Polymer Electrolyte Membrane 164**

12:00 PM, Paper 21h  
Yifan Li, Zhizhang Tian, Hong Wu, Ye Liu, Shaofei Wang, Shixin Huang, Fusheng Pan, Zhongyi Jiang\*  
Tianjin University, Tianjin, China

**(22) Wednesday, Jun 12, 8:00 AM**

**Pressure Retarded Osmosis**  
Grove Hotel, Riverfork

**Tzahi Cath, Chair**

Colorado School of Mines, Golden, CO

**William Phillip, Co-Chair**

University of Notre Dame, Notre Dame, IN

**Modeling the Relationship Between Power Density and Energy Recovery in Large – Scale Application of Salinity Gradient Energy 165 Technologies**

8:00 AM, Paper 22a  
Benjamin J. Feinberg\* (1), Guy Z. Ramon (2), Eric M.V. Hoek (1)  
(1) UCLA, Los Angeles, CA  
(2) Princeton University, Princeton, NJ

**High Power Density Nanofiber Supported Thin Film Composite Membrane for Pressure Retarded Osmosis 166**  
8:30 AM, Paper 22b

Ngoc Bui\*, Jeffrey R. McCutcheon  
University of Connecticut, Storrs, CT

**Development of Thin Film Composite (TFC) Flat-Sheet and Hollow Fiber Pressure Retarded Osmosis (PRO) Membranes for Osmotic Power Generation 167**

9:00 AM, Paper 22c  
Gang Han Sr.\* (1), Xue Li (2), Sui Zhang (3), Tai-Shung Chung (2)  
(1) National University of Singapore, Singapore, Singapore  
(2) National University of Singapore, Singapore, Singapore  
(3) National University of Singapore, Singapore, SC, Singapore

**High Performance PRO Membrane Elements and the Future of PRO Development 169**

10:00 AM, Paper 22d  
Nathan Hancock\*, Marek Nowosielski, Eric Maxwell, Megan Slonski  
Oasys Water, Boston, MA

**Anti-Fouling Support Layer Modification of Pressure Retarded Osmosis Membranes 170**

10:30 AM, Paper 22e  
Yunxia Hu\* (1), Ngai Yin Yip (2), Menachem Elimelech (2)  
(1) Yantai Institute of Coastal Zone Research, Chinese Academy of Sciences, Yantai, China  
(2) Yale University, New Haven, CT

**Influence of Reverse Solute Diffusion On the Performance of Pressure Retarded Osmosis 171**

11:00 AM, Paper 22f  
Qianhong She\*, Xue Jin, Dianxun Hou, Chuyang Y. Tang  
Nanyang Technological University, Singapore, Singapore

**Development of Robust and High Performance Hollow Fiber Membranes Used in Pressure Retarded Osmosis Process 172**

11:30 AM, Paper 22g  
Rong Wang\* (1), Shuren Chou (2), Anthony G. Fane (1)  
(1) Nanyang Technological University, Singapore, Singapore  
(2) Singapore Membrane Technology Centre, Nanyang Technological University, Singapore

**A Novel Characterization Method for Determination of Transport and Structural Parameters of Forward Osmosis Membranes 173**

12:00 PM, Paper 22h  
Alberto Tiraferri, Ngai Yin Yip, Anthony Straub\*, Santiago Romero-Vargas Castrillón, Menachem Elimelech  
Yale University, New Haven, CT

**(23) Wednesday, Jun 12, 2:00 PM**

**Membrane Formation**  
Grove Hotel, Aspen

**Benny Freeman, Chair**

University of Texas at Austin  
**Edgar S. Sanders, Co-Chair**  
MEDAL - Air Liquide, Newport, DE

**Synthesis of ZIF-68 Crystals and Membranes On ZnO Supports Using Reactive Seeding Method 174**

2:00 PM, Paper 23a  
Alexandra Kasik\*, Jerry Lin  
Arizona State University, Tempe, AZ

**Development of Lotus-Root-Like Multi-Bore Hollow Fiber for Direct Contact Membrane Distillation and Vacuum Membrane Distillation 175**

2:30 PM, Paper 23b  
Peng Wang\* (1), Tai-Shung Chung (2)  
(1) National University of Singapore, Singapore, Singapore

\* Denotes Speaker

Singapore

(2) National University of  
Singapore, Singapore,  
Singapore

**Forever Young: Ending Aging  
in a Super-Glassy Polymer  
Membrane 176**

3:00 PM, Paper 23c

Richard Noble\* (1), Phuc Tien  
Nguyen (1), Matthew R. Hill (2),  
Kristina Konstas (2), Cara M.  
Doherty (3), Cher Hon Lau (4),  
Laure Bourgeois (5), Timothy J.  
Bastow (6), Anita J. Hill (7),  
Douglas Gin (1)

(1) University of Colorado,  
Boulder, CO

(2) CSIRO, Melbourne, Australia

(3) CSIRO Manufacturing  
Science and Technology,  
Clayton, Australia

(4) National University of  
Singapore, Singapore,  
Singapore

(5) Monash University, Clayton  
Victoria, Australia

(6) CSIRO Manufacturing  
Science and Technology,  
Australia

(7) CSIRO Manufacturing  
Science and Technology,  
Clayton, VIC, Australia

**PDMS Mixed Matrix  
Membranes With Molecular  
Interaction-Driven Tunable  
Free Volumes: Breaking the  
Trade-Off Between  
Permeability and Selectivity  
for Pervaporation 178**

4:00 PM, Paper 23d

Gongping Liu\* (1), Wanqin Jin  
(1), Kueir-Rarn Lee (2), Juin-Yih  
Lai (2)

(1) Nanjing University of  
Technology, Nanjing, China

(2) Chung Yuan University,  
Chung-Li, Taiwan

**Conversion of Boehmite  
Precursor to  $\gamma$ -Alumina  
Membranes 180**

4:30 PM, Paper 23e

Ioannis A. Mergos\*, Matthew T.  
Snider, Hendrik Verweij  
The Ohio State University,  
Columbus, OH

**The Role of Templating  
Agents in the Membrane  
Distillation Performance of  
Superhydrophobic PVDF  
Membranes 181**

5:00 PM, Paper 23f

Suwan Meng\* (1), Jaleh  
Mansouri (2), Yun Ye (1), Vicki  
Chen (1)

(1) The University of New South  
Wales, Sydney, Australia

(2) Cooperative Research  
Centre for Polymers, Notting  
Hill, Australia

**(24) Wednesday, Jun 12, 2:00  
PM**

**Membranes for Hydrogen  
Separation**

Grove Hotel, Cedar

**Eric S. Peterson, Chair**

Idaho National Laboratory,  
Idaho Falls, ID

**Ramesh Bhawe, Co-Chair**

Oak Ridge National Laboratory,  
Oak Ridge, TN

**Identification of Novel  
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Hani Abu El Hawa\* (1), Stephen  
N. Paglieri (2), Aadesh X.  
Harale (3), J. Douglas Way (1)  
(1) Colorado School of Mines,  
Golden, CO

(2) TDA Research, Inc., Wheat  
Ridge, CO

(3) Saudi Arabian Oil Company,  
Dhahran, Saudi Arabia

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Nicla Vicinanza\* (1), Live Nova  
Næss (1), Ingeborg-Helene  
Svenum (1), Thijs Peters (2),  
Rune Bredesen (2), Anne Borg  
(1), Hilde J. Venvik (1)

(1) Norwegian University of  
Science and Technology,  
Trondheim, Norway

(2) SINTEF, Oslo, Norway

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Hydrocarbon-Based Polymers  
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Zachary P. Smith\*, Rajkiran R.  
Tiwari, Thomas M. Murphy,  
David F. Sanders, Kristofer L.  
Gleason, Donald R. Paul, Benny  
D. Freeman

The University of Texas at  
Austin, Austin, TX

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Xingming Jie, John Chau\*,  
Gordana Obuskovic, Kamalesh  
K. Sirkar

New Jersey Institute of  
Technology, Newark, NJ

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Daejin Kim, Ping Tzeng, Kevin  
J. Barnett, You-Hao Yang,  
Jaime C. Grunlan, Benjamin A.  
Wilhite\*

Texas A&M University, College  
Station, TX

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Doug Parsley (1), Richard J.  
Ciora (1), Paul K.T. Liu (1),  
Jiang Yu (2), Muhammad  
Sahimi (2), Theodore T. Tsotsis\*  
(2)

(1) Media and Process  
Technology Inc, Pittsburgh, PA  
(2) University of Southern  
California, Los Angeles, CA

\* Denotes Speaker

**(25) Wednesday, Jun 12, 2:00 PM**

**Responsive Membranes and Biomembranes**

*Grove Hotel, Riverfork*

**Mihai Barboiu, Chair**

Institut Européen des Membranes, Montpellier, France

**Joao Crespo, Co-Chair**

UNL

**Temperature Responsive Membranes for Separations and Water Detoxification 197**

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*Li Xiao\**, Krysta Waldrop, Austin Isner, Dibakar Bhattacharyya  
University of Kentucky, Lexington, KY

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*Yves-Marie Legrand\** (1), Mihai Barboiu (1), Arnaud Gilles (1), Mathieu Michau (2), Yann Le Duc (1), Tom Fyles (3), Benoit Coasne (4), Pierre-André Cazade (4), Joshua Post (3), Arie van der Lee (1)

(1) Institut Européen des Membranes, Montpellier, France

(2) IFP, Lyon, France

(3) University of Victoria, Victoria, BC, Canada

(4) CNRS/ENSCM/UM II, Montpellier, France

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*Sneha Chede\** (1), Geoffrey Bothun (2), Isabel C. Escobar (3)

(1) The University of Toledo, Toledo, OH

(2) University of Rhode Island, Kingston, RI

(3) University of Toledo, Toledo, OH

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*Carla Daniel* (1), *Esther Santos* (2), *Jonathan Albo* (2), *Carlos A. M. Afonso* (3), *Fabián Vaca Chávez* (4), *Pedro José Sebastião* (5), *Angel Irabien* (6), *Carla A. M. Portugal\** (1), *João G. Crespo* (1)

(1) REQUIMTE/CQFB, Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa, Caparica, Portugal

(2) Universidad de Cantabria, Santander, Spain

(3) iMed.UL, Faculdade de Farmácia, Universidade de Lisboa, Lisboa, Portugal

(4) Condensed Matter Physics Centre, University of Lisbon, Lisboa, Portugal

(5) Instituto Superior Técnico, Technical University of Lisbon, Lisboa, Portugal

(6) Cantabria University, Santander, Spain

**Continuous Affinity Protein Separation With Dynamic Electrochemical Membranes 207**

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*Zhiqiang Chen\**, *Bruce J. Hinds III*

University of Kentucky, Lexington, KY

**Surface Biochemical and Physical-Chemical Properties of Artificial Membranes Functionalized With Lipase 209**

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*Lidietta Giorno\**, *Emma Piacentini*, *Alessandra Imbrogno*  
Institute on Membrane Technology, National Research Council of Italy, ITM-CNR, Rende (CS), Italy

**(26) Wednesday, Jun 12, 2:00 PM**

**Advances in Reverse Osmosis/Nanofiltration - II**

*Grove Hotel, Evergreen*

**Jamie A. Hestekin, Chair**

University of Arkansas, Fayetteville, AR

**Isabel C. Escobar, Co-Chair**

University of Toledo, Toledo, OH

**Andrew G. Livingston, Co-Chair**

Imperial College London, London, United Kingdom

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*Jeong Kim*, *Gyorgy Szekely*, *Irina Valtcheva*, *Ana Freitas da Silva*, *Andrew G. Livingston\**  
Imperial College London, London, United Kingdom

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*Lin Zhao\**, *W. S. Winston Ho*  
The Ohio State University, Columbus, OH

**Copper-Charged Antimicrobial Membranes for Biofouling Control 215**

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*Sunitha Asapu\** (1), *Melissa Seedorf* (2), *Isabel C. Escobar* (2)

(1) University of Toledo, Toledo, OH

(2) The University of Toledo, Toledo, OH

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*Andrea Radu\**, *M.C.M. van Loosdrecht*, *Cristian Picioreanu*  
Delft University of Technology, Delft, Netherlands

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\* Denotes Speaker

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*Clemson University, Anderson, SC*

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*Hee-Ro Chae\*, Jaewoo Lee, Chung-Hak Lee*  
*Seoul National University, Seoul, South Korea*

**Poster Papers**  
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**(27) Monday, Jun 10, 8:00 PM**  
**Poster Session: Membrane Synthesis**  
*Grove Hotel, Ballroom*

**Mary Laura Lind, Chair**  
Arizona State University,  
Tempe, AZ  
**Dongmei Li, Co-Chair**  
University of Wyoming, Laramie,  
WY  
**Lauren F. Greenlee, Co-Chair**  
National Institute of Standards &  
Technology, Boulder, CO

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*UCLA, Los Angeles, CA*

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*Michael Loy\* (1), Anthony Chung (1), Jean-Claude de Sugny (1), Tuan Nguyen (1), Edward Ruan (1), Ethan Suska (1), Nikki Peck (2), Nancy K.*

*Lape (1)*  
*(1) Harvey Mudd College, Claremont, CA*  
*(2) California Institute of Technology, Pasadena, CA*

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*Yaolin Liu\* (1), Baoxia Mi (2), Laleh Emdadi (2), Dongxia Liu (2)*  
*(1) Department of Civil and Environmental Engineering, A. James Clark School of Engineering, University of Maryland, College Park, MD*  
*(2) University of Maryland, College Park, MD*

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*(1) Pennsylvania State University, University Park, PA*  
*(2) Institut Europeen des Membranes, Montpellier, France*  
*(3) Institut Européen des Membranes, Montpellier, France*  
*(4) The Pennsylvania State University, University Park, PA*

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*(1) Pennsylvania State University, University Park, PA*  
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*(3) The Pennsylvania State University, University Park, PA*

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*(1) Pennsylvania State University, University Park, PA*  
*(2) Pennsylvania State University, University Park, PA*  
*(3) The Pennsylvania State University, University Park, PA*

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*(1) COMSATS Institute of Information Technology, Lahore, Pakistan*  
*(2) KU Leuven, Leuven, Belgium*

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*University of Utah, SALT LAKE CITY, UT*

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*University of Utah, SALT LAKE CITY, UT*

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\* Denotes Speaker

Jung Im Han\* (1), Young Hoon Cho (2), Hyeyoung Kong (1), Sung Soo Han (1), Ho Bum Park (2)

(1) Samsung Advanced Institute of Technology, Suwon, South Korea

(2) Hanyang University, Seoul, South Korea

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Pennsylvania State University, State College, PA

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(1) University of Arkansas, Fayetteville, AR

(2) Colorado State University, Fort Collins, CO

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Kuo-Lun Tung\* (1), Chia-Chieh Ko (2), Yi-Feng Lin (3)

(1) Chung Yuan Christian University, Chungli, Taiwan

(2) Chung Yuan Christian University, Chungli, 32023, Taiwan (R.O.C.).

(3) National Tsing-Hua University, Hsin-Chu, NV, Taiwan

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Ying Zhang\* (1), Ji Won Rhim (2), Darren Lawless (3), Xianshe Feng (1)

(1) University of Waterloo, Waterloo, ON, Canada

(2) Hannam University, Daejeon, South Korea

(3) Sheridan Institute of Technology, Oakville, ON, Canada

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(1) University of Minnesota Duluth, Duluth, MN

(2) The University of Texas at Austin, Austin, TX

(3) University of Texas at Austin, Austin, TX

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Wei Liu\*

Pacific Northwest National Laboratory, Richland, WA

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(1) Dpoint Technologies, Vancouver, BC, Canada

(2) University of British Columbia

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Yiqun Liu\*, Yang Zhang, Hao Yan

SINOPEC Beijing Research Institute of Chemical Industry, Beijing, China

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Qianqian Wang (1), Yong Wang\* (2)

(1) Nanjing University of Technology, Nanjing University of Technology, China

(2) Nanjing University of Technology, Nanjing, China

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SE Jong KIM\* (1), Hyung Chul KOH (1), Chung Seop Lee (1), Seong Yong Ha (2)

(1) Airrane Co., Ltd., Daejeon, South Korea

(2) Airrane, Daejeon, South Korea

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University of Alabama,  
Tuscaloosa, AL

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(1)  
(1) The University of Toledo,  
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(2) University of Rhode Island,  
Kingston, RI

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Tae-Hyun Kim\*, Irshad  
Kammakakam  
University of Incheon, Incheon,  
South Korea

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University of Incheon, Incheon,  
South Korea

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(1) Korea Research Institute of  
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South Korea  
(2) University of Waterloo,  
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University of Wyoming, Laramie,  
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Balamurugan Ramalingam\*  
Mann+Hummel Ultra-Flo Pte  
Ltd, Singapore, Singapore

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University of Maryland, College  
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Liwei Huang\* (1), Mark T.  
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(2), Jeffrey R. McCutcheon (1)  
(1) University of Connecticut,  
Storrs, CT  
(2) 3M Purification INC.,  
Meriden, CT

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Los Alamos National  
Laboratory, Los Alamos, NM

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Mehtap Safak Boroglu\* (1),  
Sennur Deniz (2)  
(1) Istanbul University, Istanbul,  
Turkey  
(2) Yildiz Technical University,  
Istanbul, Turkey

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Storrs, CT

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\* Denotes Speaker

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Perera Mercado  
Centro de Investigación en  
Química Aplicada, Saltillo,  
Mexico

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Zachary P. Smith\* (1), Katrina  
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James E. McGrath (3), Donald  
R. Paul (1), Benny D. Freeman  
(1)  
(1) The University of Texas at  
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(2) The University of Notre  
Dame, Notre Dame, IN  
(3) Virginia Tech, Blacksburg,  
VA

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Sangil Kim\* (1), Hyung Gyu  
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(1), Jung Bin In (2), Olgica  
Bakajin (3)  
(1) Lawrence Livermore  
National Laboratory, Livermore,  
CA  
(2) University of California,  
Berkeley, Berkeley, CA  
(3) Porifera, Hayward, CA

**(28) Monday, Jun 10, 8:00 PM  
Poster Session: Membrane  
Properties**

*Grove Hotel, Ballroom*

**Mary Laura Lind, Chair**  
Arizona State University,  
Tempe, AZ

**Dongmei Li, Co-Chair**  
University of Wyoming, Laramie,  
WY

**Lauren F. Greenlee, Co-Chair**

National Institute of Standards &  
Technology, Boulder, CO

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Sunitha Asapu\* (1), Melissa  
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(2)  
(1) University of Toledo, Toledo,  
OH  
(2) The University of Toledo,  
Toledo, OH

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Sajjad Maruf\* (1), Alan R.  
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(1), Yifu Ding (1)  
(1) University of Colorado at  
Boulder, Boulder, CO  
(2) University of Colorado  
Boulder, Boulder, CO

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(1)  
(1) The University of Toledo,  
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(2) University of Toledo, Toledo,  
OH

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The Ohio State University,  
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Luc Stoops (1), Chris Dotremont  
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(1) Flemish Institute for  
Technological Research (VITO),  
Mol, Belgium  
(2) POROMETER n.v., Eke,  
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Byung-Jae Park\*  
Synopex Inc., Pohang-City,  
South Korea

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Alma Mater Studiorum -  
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Italy

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Hyung Chul KOH\* (1), Se Jong  
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Seong Yong Ha (2)  
(1) Airrane Co., Ltd., Daejeon,  
South Korea  
(2) Airrane, Daejeon, South  
Korea

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Tianjin University, Tianjin, China

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(1), Guangxi Dong\* (2), Vicki  
Chen (2)  
(1) UNESCO Centre for  
Membrane Science and  
Technology, The University of  
New South Wales, Sydney,  
Australia  
(2) The University of New South  
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Dallas, Richardson, TX

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**Mary Laura Lind, Chair**

Arizona State University, Tempe, AZ

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