North American Membrane Society 28th Annual Meeting
Membrane Separations for Emerging Water, Energy, and Health Applications

Program Book

Conference Chairs:
David Latulippe, McMaster University
Meagan Mauter, Carnegie Mellon University
Andrew Zydney, Penn State University

www.nams2019.org
@NAMS2019

May 11-15, 2019
Pittsburgh, PA
## Program at a Glance

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td><strong>Saturday</strong></td>
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<tr>
<td><strong>May 11</strong></td>
<td>8:00 am - 5:00 pm</td>
<td>Workshop 1: Measurement Methods for Membranes (Benedum Room)</td>
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<td></td>
<td>8:00 am - 5:00 pm</td>
<td>Workshop 2: Membranes for Water Treatment Applications (Duquesne Room)</td>
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<td><strong>Sunday</strong></td>
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<tr>
<td><strong>May 12</strong></td>
<td>8:00 am - 5:00 pm</td>
<td>Workshop 3: Membranes for Gas Separations (Birmingham/Smithfield Room)</td>
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<td>8:00 am - 5:00 pm</td>
<td>Workshop 4: Polymeric and Inorganic Membrane Materials and Membrane Formation (Benedum Room)</td>
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<td>8:00 am - 5:00 pm</td>
<td>Workshop 5: Membranes for Bioprocessing (Duquesne Room)</td>
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<td>12:00 pm - 6:00 pm</td>
<td>Registration (Lobby)</td>
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<td></td>
<td>1:30 pm - 4:30 pm</td>
<td>NAMS Student Workshop (Sterlings Room)</td>
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<td></td>
<td>6:00 pm - 9:00 pm</td>
<td>Welcome Reception (Carnegie Science Center, 1 Allegheny Avenue)</td>
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<tr>
<td><strong>Monday</strong></td>
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<tr>
<td><strong>May 13</strong></td>
<td>7:00 am - 7:00 pm</td>
<td>Registration (Ballroom Foyer)</td>
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<td>7:00 am - 9:00 pm</td>
<td>Exhibitors (Ballroom Foyer)</td>
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<td>7:45 am - 9:00 am</td>
<td>Plenary Lecture - Dr. Peter Fiske (Ballroom 1)</td>
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<td>9:00 am - 9:30 am</td>
<td>Coffee Break</td>
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<td>9:30 am - 12:30 pm</td>
<td>Parallel Technical Sessions I</td>
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<td>12:30 pm - 2:00 pm</td>
<td>Lunch With Legends (Commonwealth Room) – Pre-registration required</td>
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<td>2:00 pm - 5:00 pm</td>
<td>Parallel Technical Sessions II</td>
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<td>7:00 pm - 10:00 pm</td>
<td>Poster Session (Ballrooms 1 &amp; 2)</td>
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<td><strong>Tuesday</strong></td>
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<td><strong>May 14</strong></td>
<td>7:30 am - 7:00 pm</td>
<td>Registration (Ballroom Foyer)</td>
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<td>7:00 am - 9:00 pm</td>
<td>Exhibitors (Ballroom Foyer)</td>
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<td></td>
<td>7:45 am - 9:00 am</td>
<td>Plenary Lecture - Dr. Tim Merkel (Ballroom 1)</td>
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<td>9:00 am - 9:30 am</td>
<td>Coffee Break</td>
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<td></td>
<td>9:30 am - 12:30 pm</td>
<td>Parallel Technical Sessions III</td>
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<td>2:00 pm - 5:00 pm</td>
<td>Parallel Technical Sessions IV</td>
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<td>5:30 pm - 6:30 pm</td>
<td>NAMS Business Meeting (Kings Garden 5)</td>
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<td>6:30 pm - 7:30 pm</td>
<td>Happy Hour (Ballroom Foyer)</td>
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<td>7:30 pm - 11:00 pm</td>
<td>Banquet &amp; Awards Ceremony (Ballroom 1)</td>
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<td><strong>Wednesday</strong></td>
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<td><strong>May 15</strong></td>
<td>7:30 am - 12:00 pm</td>
<td>Registration (Ballroom Foyer)</td>
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<td>7:00 am - 5:00 pm</td>
<td>Exhibitors (Ballroom Foyer)</td>
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<td></td>
<td>7:45 am - 9:00 am</td>
<td>Plenary Lecture - Dr. Rachel Segalman (Ballroom 1)</td>
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<td>9:00 am - 9:30 am</td>
<td>Coffee Break</td>
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<td></td>
<td>9:30 am - 12:30 pm</td>
<td>Parallel Technical Sessions V</td>
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<td>2:00 pm - 5:00 pm</td>
<td>Parallel Technical Sessions VI</td>
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### Get Connected!

**Wyndham WiFi** – Username: **NAMS1**  Password: **CONF19**  
#NAMS2019
<table>
<thead>
<tr>
<th>Session Grid</th>
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<tr>
<td><strong>SATURDAY, MAY 11</strong></td>
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<tr>
<td><strong>Time</strong></td>
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<td>8:00 am - 5:00 pm</td>
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<td>8:00 am - 5:00 pm</td>
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| **SUNDAY, MAY 12** |
| **Time** | **Workshop #** | **Workshop Title** | **Room** |
| 8:00 am - 5:00 pm | 3 | Membranes for Gas Separations | Birmingham/Smithfield |
| 8:00 am - 5:00 pm | 4 | Polymeric and Inorganic Membrane Materials and Membrane Formation | Benedum |
| 8:00 am - 5:00 pm | 5 | Membranes for Bioprocessing | Duquesne |

| **MONDAY, MAY 13** |
| **Time** | **Session #** | **Session Title** | **Room** |
| 7:45 am - 9:00 am | Plenary 1 | Peter S. Fiske - Innovation Pathways in the Water Ecosystem: The PAX Water Story | Ballroom 1 |
| 9:30 am - 12:30 pm | 1 | Processes: Fundamentals of Predicting and Preventing Membrane Fouling | Kings Garden 4 |
| 9:30 am - 12:30 pm | 2 | Processes: Membrane Distillation and Pervaporation: Innovations in Process Design and Scalability | Ballroom 3 |
| 9:30 am - 12:30 pm | 3 | Applications: Seawater Desalination | Kings Garden 3 |
| 9:30 am - 12:30 pm | 4 | Materials: Selective Polymeric and Mixed-Matrix Materials - Liquid Separations | Ballroom 4 |
| 9:30 am - 12:30 pm | 5 | Materials: Inorganic Materials | Kings Garden 1 |
| 9:30 am - 12:30 pm | 6 | Applications: Assessing Performance, Robustness, and Scalability for Carbon Capture | Kings Garden 5 |
| 2:00 pm - 5:00 pm | 7 | Applications: Assessing Performance, Robustness, and Scalability for Carbon Capture (continued) | Kings Garden 5 |
| 2:00 pm - 5:00 pm | 8 | Processes: Innovations in Module Modeling and Design | Ballroom 3 |
| 2:00 pm - 5:00 pm | 9 | Processes: Osmotically-Driven Membrane Processes for Water and Energy | Ballroom 4 |
| 2:00 pm - 5:00 pm | 10 | Applications: Water Reuse | Kings Garden 4 |
| 2:00 pm - 5:00 pm | 11 | Materials: Ion-Exchange and Electrofunctional Materials | Kings Garden 1 |
| 2:00 pm - 5:00 pm | 12 | Materials: Membrane Material and Transport Simulation: Molecular & Process Modeling of Membranes | Kings Garden 3 |

| **TUESDAY, MAY 14** |
| **Time** | **Session #** | **Session Title** | **Room** |
| 7:45 am - 9:00 am | Plenary 2 | Tim Merkel - Development of Membranes for CO₂ Capture | Ballroom 1 |
| 9:30 am - 12:30 pm | 13 | Processes: Process Innovations in Electrofunctional and Electrocatalytic Membrane Processes | Kings Garden 4 |
| 9:30 am - 12:30 pm | 14 | Applications: Contaminant Removal from Water Sources | Ballroom 3 |
| 9:30 am - 12:30 pm | 15 | Materials: Materials for Organic Solvent Separations | Ballroom 4 |
| 9:30 am - 12:30 pm | 16 | Materials: Catalytic and Responsive Materials | Kings Garden 3 |
| 9:30 am - 12:30 pm | 17 | Materials: Selective Polymeric and Mixed-Matrix Materials - Gas Separations | Kings Garden 5 |
| 2:00 pm - 5:00 pm | 18 | Materials: Selective Polymeric and Mixed-Matrix Materials - Gas Separations (continued) | Kings Garden 5 |
| 2:00 pm - 5:00 pm | 19 | Processes: Process Scale-Up and Techno-Economic Assessment | Kings Garden 4 |
| 2:00 pm - 5:00 pm | 20 | Processes: New Concepts in Hybrid Processes and Process Integration | Kings Garden 3 |
| 2:00 pm - 5:00 pm | 21 | Applications: Brine Treatment for Minimal and Zero Liquid Discharge | Ballroom 3 |
| 2:00 pm - 5:00 pm | 22 | Materials: Innovations in Membrane Synthesis and Casting | Ballroom 4 |

| **WEDNESDAY, MAY 15** |
| **Time** | **Session #** | **Session Title** | **Room** |
| 7:45 am - 9:00 am | Plenary 3 | Rachel Segalman - Polymeric Ionic Liquids: A New Platform for Materials and Energy | Ballroom 1 |
| 9:30 am - 12:30 pm | 23 | Awards Session (Student Fellowship & Young Membrane Scientist Awards) | Kings Garden 4 |
| 9:30 am - 12:30 pm | 24 | Applications: Cell and Protein Purification, Harvesting, and Processing | Kings Garden 3 |
| 9:30 am - 12:30 pm | 25 | Processes: Innovations in Microfiltration and Ultrafiltration | Ballroom 3 |
| 9:30 am - 12:30 pm | 26 | Materials: Bio-inspired and Biomimetic Materials | Ballroom 4 |
| 9:30 am - 12:30 pm | 27 | Materials: Advances in Membrane and Materials Characterization | Kings Garden 5 |
| 2:00 pm - 5:00 pm | 28 | Materials: Bio-inspired and Biomimetic Materials (continued) | Ballroom 4 |
| 2:00 pm - 5:00 pm | 29 | Materials: Advances in Membrane and Materials Characterization (continued) | Kings Garden 5 |
| 2:00 pm - 5:00 pm | 30 | Processes: Fundamentals of Predicting and Preventing Membrane Fouling | Kings Garden 4 |
| 2:00 pm - 5:00 pm | 31 | Applications: Purification of Non-Protein Biologics | Kings Garden 3 |
| 2:00 pm - 5:00 pm | 32 | Applications: Fuel Cells and Batteries | Ballroom 3 |
Table of Contents

Welcome Messages......................................................................................................................................................................... 1
Sessions Summaries ........................................................................................................................................................................ 2
Conference Organizers .................................................................................................................................................................. 8
Session Chairs .............................................................................................................................................................................. 9
NAMS 2019 Fellows .................................................................................................................................................................. 10
NAMS 2019 Award Recipients .................................................................................................................................................. 11
Student Activities ...................................................................................................................................................................... 12
Membrane Workshops ............................................................................................................................................................... 13
Plenary Speakers ........................................................................................................................................................................ 14
Oral Sessions – Monday ........................................................................................................................................................... 17
Oral Sessions – Tuesday ............................................................................................................................................................ 26
Oral Sessions – Wednesday ....................................................................................................................................................... 33
Poster Sessions ......................................................................................................................................................................... 40
NAMS 2020 Information ........................................................................................................................................................... 54
NAMS 2019 Sponsors ................................................................................................................................................................. 55

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To view photos taken during the meeting, check out our Flickr profile at www.flickr.com/photos/nams2019/.
Welcome to NAMS 2019

Thank you for joining us in Pittsburgh and for your many contributions to make this the premier membrane science and engineering conference of the year. Membranes are the idealized chemical separations tool with applications ranging from energy/environment to medical devices; as is evidenced by over 30 in-depth sessions in diverse topics such as desalination, CO2 capture, natural gas separation, membrane materials, batteries and pharmaceutical biologics, among many. We pride ourselves on the 30-minute talk format which requires a rigorous treatment of technical details enabling outstanding conference-wide technical content.

Even more important is this annual gathering of a vibrant community that wants to tell the world about these important technologies with societal impact. NAMS is working hard to bring together industry and academia to mentor a new generation of membranologists. Our awards programs recognize career-long success and enable young scientists to be part of the community. Congratulations to our new NAMS Fellows, Anthony (Tony) Allegrezza and Dibakar (DB) Bhattacharya, for decades of impressive contributions to the membrane community. Be sure to attend our Young Scientist Award Technical Session on Wednesday morning that represents the best works across diverse membrane fields. Additionally, critical to the meeting success are workshops and mentorship events. Though the annual meeting is the pinnacle of society activity, throughout the year we work hard at getting the word out with our Membrane Quarterly newsletter and a new personalized mentorship program with sustained interactions. Behind the scenes we have enacted an Industrial Advisory Committee as well as a formal worldwide body to coordinate events. We look forward to new educational initiatives to make NAMS the ‘go to place’ for membrane science and engineering with public education, technical resources, and expert networking.

We would like to thank the NAMS 2019 co-chairs, David Latulippe, Meagan Mauter and Andrew Zydney for all their hard work in putting this event together. We look forward to seeing you at the meeting and, above all, hope you enjoy this dynamic and engaging community.

Jeff McCutcheon, NAMS President and Bruce Hinds, NAMS Vice-President

Message from the 2019 NAMS Conference Chairs

It is our pleasure to welcome you to the 28th Annual Meeting of the North American Membrane Society, and the first ever NAMS meeting in the city of Pittsburgh. It has been our honor to serve as co-chairs for this year’s NAMS meeting. We received nearly 500 abstract submissions, an all-time high for a NAMS meeting – we are truly excited about the outstanding technical program that we were able to assemble with the help of our session chairs.

In addition to the normal array of special programs at NAMS, this year marks the inauguration of a new NAMS Undergraduate Student Travel Award program, supported by a grant from the National Science Foundation. We were able to provide almost full support for a dozen undergraduates from around the country to attend this year’s NAMS meeting – we encourage you to welcome this group of young students to NAMS and to the membrane community.

While you are here, we hope you will have an opportunity to explore the city of Pittsburgh. The Wyndham hotel is located just down the street from Point State Park, which marks the convergence of the Allegheny, Monongahela, and Ohio Rivers. May should be a beautiful time to wander the Park and the paths along the rivers. The NAMS Welcome Reception will occur at the Carnegie Science Center, just across the Monongahela River and adjacent to Heinz Field, home of the Pittsburgh Steelers. Market Square is just up the street from the Wyndham, as is the Fort Pitt Museum.

We truly look forward to seeing you in Pittsburgh – this looks like it will be the largest NAMS meeting ever with more than 500 attendees! Thank you for your support of the North American Membrane Society and NAMS 2019.

David Latulippe, Meagan Mauter, and Andrew Zydney
NAMS 2019 Conference Co-Chairs
<table>
<thead>
<tr>
<th>Parallel Sessions</th>
<th>BALLROOM 3</th>
<th>BALLROOM 4</th>
<th>KINGS GARDEN 1</th>
<th>KINGS GARDEN 3</th>
<th>KINGS GARDEN 4</th>
<th>KINGS GARDEN 5</th>
</tr>
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<tbody>
<tr>
<td>7:45</td>
<td>Sessions Summary</td>
<td>Plenary Session 1 - Dr. Peter S. Fiske, Innovation Pathways in the Water Ecosystem: The PAX Water Story (Ballroom 1)</td>
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<td>9:30</td>
<td>2a - Continuous on-demand dehydration of solvents in flow chemistry manufacturing processes</td>
<td>4a - Enantioselective Polymeric Membrane for Chiral Separation of Enantiomers</td>
<td>5a - Two-Dimensional Membranes for Gas Separation</td>
<td>3a - Sacrificial Protective Layer for Fouling Control in Reverse Osmosis Desalination</td>
<td>1a - Hydrodynamic-colloidal interactions of an oil droplet and a membrane surface</td>
<td>6a - Polymers with Side Chain Porosity for Ultrapermeable and Plasticization Resistant Materials for Gas Separations</td>
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<td></td>
<td>Hannah Murren (Compact Membrane Systems)</td>
<td>Marine Michel (Imperial College London)</td>
<td>Dan Zhao (National University of Singapore)</td>
<td>Moon Son (Penn State University)</td>
<td>Guy Z Ramon (Technion - Israel Institute of Technology)</td>
<td>Sharon Lin (MIT)</td>
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<td>10:00</td>
<td>2b - How membrane technology has been successfully applied to ethanol processing</td>
<td>4b - Tailored Synthesis of Inorganic-supported Polymer, Graphene, and Nanocomposite Membranes for Liquid-phase Separations</td>
<td>5b - Restricting Lattice Flexibility in Polycrystalline Metal-Organic Framework Membrane for Efficient Carbon Capture</td>
<td>3b - Water Transport through Ultrathin Polyamide Nanofilms Used for Reverse Osmosis</td>
<td>1b - Do Graphene Oxide Nanostructured Coatings Mitigate Bacterial Adhesion to Membrane Interfaces?</td>
<td>6b - Bench scale testing of next generation hollow fiber membrane modules at subambient conditions at the National Carbon Capture Center</td>
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<td>Stephan Blum (Whitefox Technologies)</td>
<td>Michael Z Hu (Oak Ridge National Laboratory)</td>
<td>Kumar Vairon Agrawal (Ecole polytechnique fédérale de Lausanne)</td>
<td>Zhiwei Jiang (Imperial College London)</td>
<td>Santiago Romero-Vargas Carstillon (University of Edinburgh)</td>
<td>David Hasse (Air Liquide)</td>
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<td>Ali Zamani (University of Ottawa)</td>
<td>Katie Di-Lucakey (University of Wyoming)</td>
<td>Jay Junqing Liu (The Dow Chemical Company)</td>
<td>Sunyi Jiang (JUC Irvine)</td>
<td>Alon Kirschner (The University of Texas at Austin)</td>
<td>Theodore T Tsotsis (University of Southern California)</td>
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<td>11:00</td>
<td>2d - Unique 3D printed spacers for process enhancement in membrane distillation</td>
<td>4d - Enhancing water permeance in reduced graphene oxide membranes by chemical etching</td>
<td>5d - Hitze zeolite membrane separation system (HDS) for gas separation</td>
<td>3d - Flow Reversal for Increased Recovery of 2nd Pass Seawater RO</td>
<td>1d - Fouling-Resistant, Multi-functional Membranes with Ultra-Thin Hydrogel Selective Layers using Interfacially Initiated Free Radical Polymerization (IIFRP)</td>
<td>6d - Synthesis of Polymers of Intrinsic Microporosity (PIM-1) with Poly(ethylene glycol) for Membrane Application</td>
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<td>Navya Thomas (Kuwait University)</td>
<td>Xiaoyi Chen (The State University of New York at Buffalo)</td>
<td>Hitachi Zosen Corporation</td>
<td>Jack Gilron (Ben-Gurion University)</td>
<td>Ayse Asatekin (Tufts University)</td>
<td>Volkan Filiz (Helmholtz-Zentrum Geesthacht)</td>
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<tr>
<td>11:30</td>
<td>2e - 2D boron nitride encapsulated nanofiber membranes for membrane distillation</td>
<td>4e - Nanocomposite RO Membranes with High Aspect Ratio Functional Nanoparticles for Controlled Interfacial Transport</td>
<td>5e - Insights on the Carbon Molecular Sieve Structure from Stability and Rejuvenation Tendencies</td>
<td>3e - Zwitterionic poly(arylene ether sulfone) (PAES) copolymer for biofouling/chlorine resistant desalination membranes</td>
<td>1e - Unravel the Gordian Knot of membrane desalination: Understanding and mitigating silica scaling in reverse osmosis</td>
<td>6e - High-permeance polymer-functionalized graphene membranes that surpass the postcombustion carbon capture target</td>
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<td>Yunchul Woo (Korea Institute of Civil Engineering and Building Technology)</td>
<td>Stephen M Martin (Virginia Tech)</td>
<td>Samuel Hays (Georgia Institute of Technology)</td>
<td>Yi Yang (Arizona State University)</td>
<td>Tiezheng Tong (Colorado State University)</td>
<td>Kumar Vairon Agrawal (Ecole polytechnique fédérale de Lausanne)</td>
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<tr>
<td>12:00</td>
<td>2f - Impact of membrane properties on scaling-induced wetting in membrane distillation</td>
<td>4f - If one were to develop a new NF/RO membrane, specifically for uncharged organic solute rejection, how permeable could it be to water while meeting organic solute rejection goals?</td>
<td>5f - Fabrication of zeolitic imidazolate framework ZIF-8 membranes by ligand-induced perselectivisation in vapor phase</td>
<td>3f - Chlorine resistance of functionalized HNTs-based TFN membranes</td>
<td>1f - RO Mineral Scale Mitigation via Self-Adaptive Feed-Flow Reversal</td>
<td>6f - Fabrication of Thin Film Composite Membranes using Microporous Polymer Blends and Polybenzimidazole Nanoporous Supports for CO2/N2 Separation</td>
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<td>Allyson L McGaughey (University of Southern California)</td>
<td>Eric Heek (UCLA)</td>
<td>Xiaoli Ma (University of Wisconsin-Milwaukee)</td>
<td>Boguslaw Kruczek (University of Ottawa)</td>
<td>Yeuinha Kim (UCLA)</td>
<td>Lingxiang Zhu (U.S. Department of Energy National Energy and Technology Laboratory)</td>
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<td>2:00</td>
<td>8a - CFD simulation of crimped hollow fiber membranes for liquid separation processes Glenn Lipcombe (University of Engineering and Technology, Peshawar)</td>
<td>9a - Structural and Transport Properties of Membranes in High-Salinity Desalination using Cascading Osmotically Mediated Reverse Osmosis Xi Chen (Columbia University)</td>
<td>11a - Ion Transport Through Perforated Nanoporous Graphene Mandakranta Ghosh (University of Twente)</td>
<td>12a - Expanding the chemical palette for reliable chemical separations using molecular simulations and machine learning David Sholl (Georgia Institute of Technology)</td>
<td>10a - Tannic acid-iron network based green technique for enhanced membrane performance in water reuse Hao Guo (The University of Hong Kong)</td>
<td>7a - Field trial of spiral-wound facilitated transport membrane module for CO2 capture from flue gas Yang Han (Ohio State University)</td>
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<td>9b - Utilization of reverse solute diffusion to enhance membrane performance during Osmotically-Driven processes - improved boron retention and silica scaling mitigation Y’Ning Wang (Nanyang Technological University)</td>
<td>10b - Membrane Distillation (MD) and Reverse Osmosis (RO) processes for water recovery from pre-treated high strength brewery wastewater Nawrin Anwar (Concordia University)</td>
<td>12b - Diffusion, Reaction, and Network Structure Modeling of Interfacial Polymerization of Polyamide Membranes Jeffrey D Willurt (DuPont Water Solutions)</td>
<td>7b - Gen-2 Proteus™ membrane and module development for CO2 capture from gasification streams Witoop Salim (Membrane Technology &amp; Research Inc.)</td>
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<td>3:00</td>
<td>8c - Direct numerical simulation of unsteady mixing in direct contact membrane distillation systems with membrane spacers Jincheng Lou (Colorado School of Mines)</td>
<td>9c - Osmotic Membrane Desalination Performance Governed by Molecular Reflection at the Liquid-Vapor Interfaces Jongho Lee (University of British Columbia)</td>
<td>11c - Co-transport of neutral solutes in Nanof 117 using In-situ ATR FTIR spectroscopy for multicomponent solution speciation Brenna Dobyns (Auburn University)</td>
<td>10c - Field Demonstration of Real-Time Colloidal Particle Monitoring to Improve MF and UF Membrane Performance Jana Safarik (Orange County Water District)</td>
<td>7c - One-pot surface modification of nano-cellulose fibrils and effect of manipulated fibril surfaces in Hybrid Facilitated Transport Membranes for CO2 capture Saravanjan Janakiram (Norwegian University of Science and Technology)</td>
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<td>9d - Characterization of External and Internal Fouling of Forward Osmosis (FO) Process through Ultrasonic Time Domain Reflectometry (UTDR) Method Li Lai (Nanyang Technological University)</td>
<td>10d - Selective removal of phosphorus from wastewater using electromembrane process Sunita Chaudhury (Ben-Gurion University of the Negev)</td>
<td>12d - Diffusivity in anion exchange membranes under low hydration: A molecular dynamics study Simcha Steidnik (Technion - Israel Institute of Technology)</td>
<td>7d - DRR-type zeolite membrane: The first opportunity in CO2-EDR industry Junya Okazaki (JGC Corporation)</td>
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<td>4:00</td>
<td>8e - Analysis of Micromixers to Minimize Scaling Effects on Reverse Osmosis Membranes Jeremy Walker (U.S. Army)</td>
<td>9e - Incorporating membrane deformation into the boundary layer equation to model water and reverse salt flux in osmotic processes Jaime A Idaraga-Mora (Clemson University)</td>
<td>11e - Polymerization of counterions in self-assembled, 1 nm pores of hydrotoc liquid crystal anion exchange membrane to tune nanopore and ion transport properties Michael J. McGrath (University of Colorado at Boulder)</td>
<td>10e - Water Recovery from Produced Water via Robust Membrane Distillation Rong Wang (Nanyang Technological University)</td>
<td>7e - Coating of hollow fiber membrane for carbon molecular sieve membrane preparation Yuhe Cao (Georgia Institute of Technology)</td>
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<td></td>
<td>9f - Do Hydodynamic Instabilities Cause Roughness in Thin Polyamide Films of Reverse Osmosis Membranes? Akshay Deshmukh (Yale University)</td>
<td>10f - Membrane Performance and Antifouling in the Diffusion Over Multiple Scales in Ionic and Non-Ionic Polymeric Membranes Louis Madsen (Virginia Tech)</td>
<td>12f - Modeling of polymer membrane formation via phase inversion by mesoscopic phase-field methods: investigating the development of structure on multiple scales Michael R Cervellere (University of Arkansas/EMD Millipore)</td>
<td>7f - Ultrapervmeable benzotriptycene-based PIMs that redefine the upper bounds for CO2 separations Alessio Fuoco (CNRS)</td>
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POSTER SESSION – 7:00 pm - 10:00 pm (Ballrooms 1 & 2)
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<tr>
<th>Time</th>
<th>Parallel Sessions</th>
<th>BALLROOM 3</th>
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<tr>
<td>9:30</td>
<td>14a - Oil drop behavior on model nanofiltration membrane surfaces under conditions of hydrodynamic shear</td>
<td>Charifa Hejase (Michigan State University)</td>
<td>15a - Membrane solvent recovery in edible oil industry</td>
<td>Petrus Cuperus (SolSep BV)</td>
<td>16a - Responsive CNT Composite Membranes for Protection Against Chemical Warfare Agents</td>
<td>Melinda L Jue (Lawrence Livermore National Laboratory)</td>
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<td>14b - A case study review of the application of reverse osmosis membranes for water treatment and reagent recovery at mining and mineral processing operations</td>
<td>Chris Biederman (Hatch)</td>
<td>15b - Molecular Design of Polymeric Membranes for Organic Solvent Recovery</td>
<td>Tai-Shung Chung (National University of Singapore)</td>
<td>16b - Highly Efficient Dimethyl Ether Production from CO2 Hydrogenation in a Dehydration Membrane Reactor</td>
<td>Huazheng Li (Rensselaer Polytechnic Institute)</td>
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<td>10:00</td>
<td>14c - Self-Cleaning Nanocomposite Membranes with Phosphorene-Based Pore Fillers for Water Treatment</td>
<td>Joyner Eke (University of Kentucky)</td>
<td>15c - Epoxy-based solvent resistant nanofiltration membranes prepared through phase inversion</td>
<td>Maarten Bastin (KU Leuven)</td>
<td>16c - Poly-methacrylic acid Functionalized Membranes with Incorporated Reactive Pd/Fe Nanoparticles: Lab Scale to Groundwater Remediation Applications</td>
<td>Hongyi (Derek) Wan (University of Kentucky)</td>
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<td>11:00</td>
<td>14d - Optimization of nanofiltration process for treating industrial wastewater of time-varying composition, Ryan LaRue (McMaster University)</td>
<td>15d - Nanoporous Graphene Membranes for Organic Solvent Nanofiltration</td>
<td>David Cheng (MIT)</td>
<td>16d - Investigation of a smart electrically responsive ultrafiltration membrane</td>
<td>Chia Miang Khor (UCLA)</td>
<td>17d - Enhancing CO2/N2 Selectivity and Elimination of Langmuir Sorption within High Tg, Glassy Polynorbornene Membranes</td>
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<td>12:00</td>
<td>14f - Selective separation of mono- and di-valent cations in electrodialysis during brackish water desalination: bench and pilot-scale studies</td>
<td>Xuesong Xu (New Mexico State University)</td>
<td>15f - Enabling Organic Solvent Nanofiltration and Reverse Osmosis using Ceramic Supported TFC Membranes</td>
<td>Jeffrey R McCutcheon (University of Connecticut)</td>
<td>16f - Plasmonic membrane catalytic activation of peroxide for quantized oxidation via residence time control</td>
<td>Bruce Hicks (University of Washington)</td>
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<td><strong>#21 Applications: Brine Treatment for Minimal and Zero Liquid Discharge</strong></td>
<td>21a - Reduction of Brackish Water Desalination Brine Volume using Membrane Evaporation Coupled with Activated Sludge Aeration Waste Heat&lt;br&gt;Drew W Johnson (The University of Texas at San Antonio)</td>
<td>22a - Novel Spirocyclic Polymers for Membrane-based Organic Solvent Separations&lt;br&gt;Ronita Mathias (Georgia Institute of Technology)</td>
<td>20a - Air Products Hybrid Membrane Adsorption&lt;br&gt;Cory E Sanderson (Air Products and Chemicals)</td>
<td>19a - Minimizing the cost of membrane distillation&lt;br&gt;Timothy V Bartholomew (Carnegie Mellon University)</td>
<td>18a - High temperature gas separation properties of sub-micron polybenzimidazole membranes&lt;br&gt;Melanie M Merrick (The University of Texas at Austin)</td>
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<td><strong>#22 Materials: Innovations in Membrane Synthesis and Casting</strong></td>
<td>21b - Smart High Recovery RO Boosts Recovery Rate to More Than 90% for Reuse Purposes&lt;br&gt;Jack Gilron (Ben-Gurion University of the Negev)</td>
<td>22b - 3D Printed fouling resistant composite membranes&lt;br&gt;Davide Mattia (University of Bath)</td>
<td>20b - Hybrid Distillation and Facilitated Transport Membrane Processes for C3 Splitter Debottlenecking&lt;br&gt;Christine Parrish (Compact Membrane Systems)</td>
<td>19b - Process Optimization Using Perturbation Expansion Solutions for Membrane Gas Separation Modules&lt;br&gt;Glenn Lipscomb (University of Toledo)</td>
<td>18b - Thermally Rearranged Semi-interpenetrating Polymer Network (TR-SIPN) Membranes for Olefin/Paraffin Separations&lt;br&gt;Young Moo Lee (Hanyang University)</td>
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<td><strong>#19 Processes: Process Scale-up and Techno-economic Assessment</strong></td>
<td>21c - Membrane Distillation for Enhanced Water Recovery by Inland Brackish Water Desalination Plants&lt;br&gt;Zhewei Zhang (University of Pittsburgh)</td>
<td>22c - Next-Generation Membranes Using Thin-Film Lift Off&lt;br&gt;Mackenzie Anderson (UCLA)</td>
<td>20c - Water Recovery via Forward Osmosis - Freeze Concentration&lt;br&gt;Vladimiro Papangelakis (University of Toronto)</td>
<td>19c - Multi-physics Simulation of Hollow Fiber Vacuum Membrane Distillation Using OpenFoam&lt;br&gt;Albert Kim (University of Hawaii)</td>
<td>18c - Conformation-controlled molecular sieving effect for membrane-based propylene/propane separation&lt;br&gt;Yang Liu (Georgia Institute of Technology)</td>
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<td><strong>#20 Processes: New Concepts in Hybrid Processes and Process Integration</strong></td>
<td>21d - Selective Separation of Industrial Relevant Metal Ions from High TDS Water using Wafer-Enhanced Electrodeionization (WE-EDI)&lt;br&gt;Humeeya B Ulusoy Erol (University of Arkansas)</td>
<td>22d - Interfacial Junctions Control Electrolyte Transport Through Charge-Patterned Membranes&lt;br&gt;Bill Phillip (University of Notre Dame)</td>
<td>20d - Leverage membrane technology in process intensification and new application design - from early stage design to technical scale implementation&lt;br&gt;Peter Kreis (Evronik Technology &amp; Infrastructure GmbH)</td>
<td>19d - Scale-up of Facilitated Transport Membrane Module for CO2 Capture from Flue Gas&lt;br&gt;Kai Chen (Ohio State University)</td>
<td>18d - Mixed matrix materials containing soluble discrete metal-organic polyhedra in rubbery polyethers for CO2/gas separation&lt;br&gt;Haiqing Lin (The State University of New York at Buffalo)</td>
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<td><strong>#18 Materials: Selective Polymeric and Mixed-Matrix Materials - Gas Separations</strong></td>
<td>21e - Pilot Evaluation of Closed Circuit Reverse Osmosis (CCRO) for Treatment of RO Concentrate for Potable Reuse&lt;br&gt;Han Gu (Orange County Water District)</td>
<td>22e - Fabrication of Inside-Out Isoporous Hollow Fiber Membranes via Spinning and Coating Methods&lt;br&gt;Kirti Sanhala (Heinrich-Zentrum Geesthacht, Geesthacht)</td>
<td>20e - Carbon Capture utilizing Hybrid Membrane/LiQufaction&lt;br&gt;David Hasse (Air Liquide)</td>
<td>19e - Development of industrial scale polyvinylidene fluoride transfer membrane&lt;br&gt;Marta E Bojarska (GVS Filter Technology)</td>
<td>18e - Accessing novel microporous polymers to enhance yield, stereoregular control, and membrane performance in the recovery of light hydrocarbons from natural gas&lt;br&gt;John Lawrence (Aramco)</td>
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<td><strong>#17 Applications: Brine</strong></td>
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<td>7:45</td>
<td>Plenary Session 3 - Dr. Rachel Segalman, Polymerice Ionic Liquids: A New Platform for Materials and Energy</td>
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<td>9:00</td>
<td>#25 Processes: Innovations in Microfiltration and Ultrafiltration</td>
<td>#26 Materials: Bio-inspired and Biomimetic Materials</td>
<td>#24 Applications: Cell and Protein Purification, Harvesting, and Processing</td>
<td>#23 Awards Session (Student Fellowship &amp; Young Membrane Scientist Awards)</td>
<td>#27 Materials: Advances in Membrane and Materials Characterization</td>
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<td>9:30</td>
<td>25a - A systematic approach to remove bottlenecks in high concentration UF/DF for subcutaneous application of biological drug substances Hasin M Feroz (Bristol-Myers Squib)</td>
<td>26a - Artificial Water Channels - toward biomimetic membranes for desalination Mihail Barboiu (Institut European des Membranes)</td>
<td>24a - Experimental and Theoretical Investigations of the Loss of Protein Sieving Due to Fouling of ATF Microfilters Alex Apostolidis (Amgen)</td>
<td>23a - Creation of well-defined &quot;mid-sized&quot; micropores in carbon molecular sieve membranes for organic solvent separations Yao Ma (Georgia Institute of Technology)</td>
<td>27a - Surface Nano-structuring with Hydrophilic Polymer Brush Layers for Membrane Performance Tailoring and Optimization Yian Chen (UCLA)</td>
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<td>10:00</td>
<td>25b - Continuous Diaphragm for cGMP Biomanufacturing Akshat Gupta (MilliporeSigma)</td>
<td>26b - Self-Assembly of Long-Lasting Lipid Bilayers and the Effect of Temperature of their Ion Rejection Yair Kaufman (Ben Gurion University of the Negev)</td>
<td>24b - pH and Excipient Partitioning in Ultrafiltration / Diafiltration Processes for Formulation of High Concentration Monoclonal Antibody (mAb) Products Parinaz Emami (Penn State University)</td>
<td>23b - PoreDesigner for computational optimization of channel proteins and porous organic cages for highly selective membrane-based separations Ratul Chowdhury (Penn State University)</td>
<td>27b - Roughness in Polyamide RO Membranes: Its Formation Mechanism, Control, and Implications Chuyang Y Tang (University of Hong Kong / University of New South Wales)</td>
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<td>10:30</td>
<td>25c - Understanding the role that patterning plays on membrane biofouling by visualization using light imaging and simulation Anna Malakian (Clemson University)</td>
<td>26c - Peptoid-based membrane-mimetic 2D nanomaterials with incorporated natural and synthetic channels Chunlong Chen (Pacific Northwest National Laboratory)</td>
<td>24c - Effect of membranes molecular weight cut-off on peptides migration and selectivity during electrodialysis with filtration membranes Sabita Kadel (Laval University)</td>
<td>23c - Crack-free, large-area, single-layer graphene membranes with a record performance in gas mixture separation Shiqi Huang (L’Ecole polytechnique fédérale de Lausanne)</td>
<td>27c - Mechanism of chlorine attack on polyamide membranes studied by EIS Viatcheslav Freger (Technion - IIT)</td>
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<td>11:00</td>
<td>25d - Treating Poultry Processing Wastewaters by Combined Electrocoagulation and Ultrafiltration Ranil Wickramasingha (University of Arkansas)</td>
<td>26d - Scalable High-Performance Membranes with High Density Channel Protein-Polymer Nanosheets Yu-Ming Tu (Penn State University)</td>
<td>24d - Scale down depth filtration case study using Pall Supracap™ 50 to predict large scale STAX™ capacity and product quality Patricia Rose (Merck Pharmaceuticals)</td>
<td>23d - Unprecedented CO₂/H₂ Selectivity and CO₂ Permeance Demonstrated in Facilitated Transport Membranes with Tunable Amine-CO₂ Chemistry Yang Han (Ohio State University)</td>
<td>27d - Physicochemical and electrochemical characterization of cation-exchange membranes modified with polyethyleneimine for elucidating enhanced monovalent permeselectivity of electrodialysis Wenbin Jiang (New Mexico State University)</td>
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<td>11:30</td>
<td>25e - Mass transfer assisted TIPS processes to precisely tailor the hollow fiber membrane surface and sublayer structures Hideto Matsuyama (Kobe University)</td>
<td>26e - Fabrication of aquaporin-based biomimetic membrane for seawater desalination Ye Li (Nanyang Technological University)</td>
<td>24e – Unraveling the Plugging Mechanisms during a Combined Tangential-flow and Depth Filtration Process Xianghong Qian (University of Arkansas)</td>
<td>23e - Engineering the Nanochannels in Reduced Graphene Oxide Membrane for Dye Desalination Liang Huang (The State University of New York at Buffalo)</td>
<td>27e - Unraveling the Film-Formation Kinetics during Interfacial Polymerization via Low Coherence Interferometry Xin Liu (Southern University of Science and Technology)</td>
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<td>12:00</td>
<td>25f - Organic solvent resistant membranes obtain by using non-toxic solvents Stefan Chisca (King Abdullah University of Science and Technology)</td>
<td>26f - Biomimetic channel membranes: can they realize their full potential upon scale-up? Viatcheslav Freger (Technion - IIT)</td>
<td>24f - Functionalized Microporous Membranes for Protein Capture and Analysis Joshua Berwanger (University of Notre Dame)</td>
<td>23f - Impact of module design on heat transfer and Nusselt correlation selection in membrane distillation Alexander V Dudchenko (Carnegie Mellon University)</td>
<td>27f - Operando Membrane Spectroscopy for Elucidating Transport Mechanisms in Membranes Casey O’Brien (University of Notre Dame)</td>
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<td><strong>2:00</strong></td>
<td>32a - A Holistic Approach to Explore Interfacially Confined Ionomers Designed for Energy Conversion Device Shuidipto K Dishari (University of Nebraska-Lincoln)</td>
<td>28a - Biocatalytic resistant membranes for wound healing Antoine Venault (Chung Yuan Christian University)</td>
<td>31a - Optimizing Microfluidic Nanoparticle Capture from Biofluids on Ultrathin Silicon Nanomembranes: A Computational and Experimental Analysis of Tangential Flow Analyte Capture (TFAC) Kilean Lucas (University of Rochester)</td>
<td>30a - Numerical and experimental studies on the deposition of sticky particles near a membrane surface Seon Yeop Jung (Seoul National University)</td>
<td>29a - A novel method to distinguish between crystal and defect transport in zeolite membranes Boguslaw Kruczek (University of Ottawa)</td>
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<td><strong>2:30</strong></td>
<td>33b - Anion Conducting Membranes Based on Poly(norbornene): High Conductivity, Chemical Stability and Fuel Cell Performance &gt;2.5 W/cm² Minmey Mandal (Georgia Institute of Technology)</td>
<td>28b - Impacts of Bio-inspired Zwitterionic Membranes for Health Care Applications Yung Chang (R&amp;D Center for Membrane Technology, CYCU)*</td>
<td>31b - Development and scale-up of laterally-fed membrane chromatography for the purification of therapeutic viruses Karina Kavka (McMaster University)</td>
<td>30b - Characterization of the Stripping Phenomenon during Membrane Fouling via Optical Coherence Tomography Wei Ji Li (Southern University of Science and Technology)</td>
<td>29b - Study on antifouling behaviors of GO modified nanocomposite membranes through QCMD and surface energetics analysis Mohtada Sadrzadeh (University of Alberta)</td>
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<td><strong>3:00</strong></td>
<td>32c - High Temperature Fuel Cells with Ion-Pair Membranes and Phosphonated Ionomers Michael R Hibbs (Sandia National Laboratories)</td>
<td>28c - Biomimetic membrane systems utilizing electro-dynamic interfaces Bruce Hinds (University of Washington)</td>
<td>31c - Characterization of EV Secretion at Single Cell Resolution Gerardo Mauleon Ramos (University of Chicago)</td>
<td>30c - A closer look at biofouling: time-lapse optical microscopy of biofilm formation in wastewater reuse Emily W Tow (Olin College)</td>
<td>29c - 3D characterization of polyelectrolyte reverse osmosis membranes Tyler E Culp (Penn State University)</td>
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<td><strong>3:30</strong></td>
<td>32d - High temperature, anhydrous proton conducting membranes and micropatterned bipolar membranes for electrochemical energy conversion and storage technologies Christopher G Argus (Louisiana State University)</td>
<td>28d - Responsiveness and function of DNA-gated membranes Thomas Schäfer (Polymat, University of the Basque Country)</td>
<td>31d - Charge, size distribution and hydrophobicity of viruses: Effect of the virus purification method Vlad Tarabara (Michigan State University)</td>
<td>30d - Improved graphene oxide membrane increases membrane distillation desalination of RO concentrate Lucy M Carmona (Texas A&amp;M University-Kingsville)</td>
<td>29d - Selective Ion Transport Properties of Membrane Materials Anita Hill (CSIRO)</td>
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<td><strong>4:00</strong></td>
<td>32e - Membrane through-plane alignment of ion-conducting channels Michael D Guiver (Tianjin University)</td>
<td>28e - Nature-inspired Coating-free Membranes for Desalination Jamilya Naunuzbayeva (King Abdullah University of Science and Technology)</td>
<td>31e - Risk Mitigation Strategies for the use of polymeric consumables for manufacturing of Anti-Sense Oligonucleotides Bill Scott (Biogen)</td>
<td>30e - Automated real-time membrane biofouling assessment using microbial enzyme activity Babar K Khan (King Abdullah University of Science and Technology)</td>
<td>29e - Membrane-based oil-gas separation for dissolved gas-in-oil extraction: gas transport properties of ceramic supported Teflon membranes Liang-Chih Ma (Arizona State University)</td>
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<td><strong>4:30</strong></td>
<td>32f - Novel sulfonated aromatic polymer membranes for breaking the proton selectivity-conductivity trade-off limitation in vanadium redox flow battery Sanggil Kim (University of Illinois, Chicago)</td>
<td>28f - Carbon nanotube porous as model biomimetic membrane nanofluidues Aleksandr Noy (Lawrence Livermore National Laboratory)</td>
<td>31f - Use of Nanosphere Self-Assembly to Pattern Nanoporous Membranes for the Study of Extracellular Vesicles Marcela Mireles (University of Rochester)</td>
<td>30f - Interactions between extracellular polymeric substances and zwitterionic hydrogels as a designing tool for antifouling surfaces Angela Li Vedhamanickam (Ben-Gurion University of the Negev)</td>
<td>29f - Porous support of TFC membranes: Does it truly have negligible resistance? Masoud Aghajani (University of Colorado Boulder)</td>
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Conference Organizers

Conference Chairs
David Latulippe, McMaster University, latulippe@mcmaster.ca
Meagan Mauter, Carnegie Mellon University, mauter@cmu.edu
Andrew Zydney, Pennsylvania State University, zydney@engr.psu.edu

Student Program Chairs
Evan Hatakeyama, Chevron, EHatakeyama@chevron.com
Jacob Weidman, U.S. Department of Energy National Technical Laboratory, Jacob.Weidman@netl.doe.gov
Aaron Wilson, Idaho National Laboratory, aaron.wilson@inl.gov
Boya Xiong, MIT, boyax@mit.edu

Fundraising Chair
Keith Murphy, Air Products and Chemicals, Inc., murphymk@airproducts.com

Poster Session Chairs
Prity Bengani-Lutz, Repligen, plutz@repligen.com
Ramesh Bhave, Oakridge National Laboratory, bhaverr@ornl.gov
Yuexiao Shen, UC Berkeley, syxbach@berkeley.edu
Nicholas Siefert, U.S. Department of Energy National Technical Laboratory, Nicholas.Siefert@netl.doe.gov

Workshop Chair
Isabel Escobar, University of Kentucky, Isabel.escobar@uky.edu

Conference Registration System
Peggy Anderson, University of Arkansas, nams@uark.edu

Conference Website, Media and Marketing
Ryan LaRue, McMaster University, laruerj@mcmaster.ca

Conference Support Staff
Janet Delsey, McMaster University, delsey@mcmaster.ca
Jennifer Zaltman, Jennifer Zaltman Marketing and Event Consulting, jennifer@jenniferzaltman.com

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Abhishek Roy, The Dow Chemical Company
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Zach Smith, MIT
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Chuyang Tang, University of New South Wales
Vlad Tarabara, Michigan State University
Emily Tow, Olin College
Lee Vane, Environmental Protection Agency
Radisav Vidic, University of Pittsburgh
David Warsinger, Purdue University
Jia Wei Chew, Nanyang Technological University
Steve White, Membrane Technology & Research Inc.
Ulrich Wiesner, Cornell University
Chris Wilmer, University of Pittsburgh
Aaron Wilson, Idaho National Laboratory
Sen Xu, Merck Pharmaceuticals
Pei Xu, New Mexico State University
Miao Yu, Rensselaer Polytechnic Institute

Weiyi Li, Southern University of Science and Technology
NAMS 2019 Fellows

NAMS Fellows are recognized members of NAMS who have demonstrated ongoing excellence in membrane engineering and practice. Election as Fellow is in recognition of both “service to NAMS” and “highly significant professional accomplishment in the membrane field.”

Anthony (Tony) Allegrezza
MilliporeSigma (retired)

Tony Allegrezza started a 40-year career in membrane R&D in 1973 at Albany Research working on composite hollow fiber RO membranes. This was probably the first adaptation of composite membrane technology to the hollow fiber format. The manufacturing process developed from this effort served as the basis for hollow fiber gas separation membrane and a sulfonated polysulfone RO products which were sold to other firms. In 1978 he moved to Koch Membrane Systems and worked on composite RO flat sheet membranes for the dairy industry. In 1983 he started his 25 year association with Millipore. There he developed a novel UF membrane – thin layer composite UF – for virus removal in biotherapeutic drug manufacturing. For this work he received the Jack Bush Award from Millipore, their highest R&D award.

Tony was a member of the Board of Directors of NAMS and Treasurer for nine years. He was Co-Chair of the 2005 and 2010 Annual Meetings. He served as a member of the Industrial Advisory Board of the Membrane Applied Science and Technology Center at the University of Colorado (Boulder) for seven years, serving as Chair for two years.

He has a B.S. in chemical engineering from Worcester Polytech and Ph.D. from University of Massachusetts at Amherst.

Dibakar (DB) Bhattacharyya
University of Kentucky

Prof. Dibakar Bhattacharyya (DB) is the University of Kentucky Alumni Chair Professor of Chemical Engineering, Director of Center of Membrane Sciences, and a Fellow of the American Institute of Chemical Engineers. DB has forged a successful career over 45 years as a chemical engineering professor and researcher fueled by his serious interest in creating clean water through advanced membranes and other technologies. His 220+ refereed publications (over 180 journal articles, 36 book chapters, and two books), and nine U.S. patents in the area of functionalized membranes and water detoxification have made him a renowned authority in the area of membrane and hybrid technology based, water, water reuse, and pollutant separation activities. He has received many highly prestigious awards (such as, AIChE Gerhold and Cecil awards, Sturgill award, etc.). DB is an outstanding teacher, and he received the highest education award “University of Kentucky Great Teacher Award” in three different decades (1984, 1996, and 2008). DB’s service to the membrane community is enormous. Starting from his involvement in the original founding days of NAMS (has never missed a NAMS Annual meeting), he has coordinated and co-chaired three highly successful NAMS Annual Meetings (1992, 2001, 2018) in Lexington. The 2018 NAMS meeting in Lexington brought a lot of industrial and international people. He is highly active in professional societies (such as the 2010-2011 Chair of the AIChE Separations Division and the June 2015-June 2016 President of the North American Membrane Society).
NAMS 2019 Award Recipients

Awards Session #23 - Wednesday, May 15 at 9:30 am, Kings Garden 4

Student Fellowship Award

The NAMS Student Fellowship Awards are presented annually to outstanding graduate students in the area of membrane science and technology.

Ratul Chowdhury
Pennsylvania State University
USA

Shiqi Huang
École polytechnique fédérale de Lausanne, Switzerland

Yao Ma
Georgia Institute of Technology
USA

Young Membrane Scientist Award

The NAMS Young Membrane Scientist Awards are awarded annually to those individuals who are within five years of completing their Ph.D. degree and have already proven to be outstanding membrane scientists in the area of membrane science and technology.

Alexander Dudchenko
Carnegie Mellon University
USA

Liang Huang
The State University of New York at Buffalo, USA

Yang Han
Ohio State University
USA

Undergraduate Student Travel Awards

The Undergraduate Student Travel Awards were generously provided by a grant from the National Science Foundation.

William Baker (University of Alabama), Andy Basalla (University of Colorado Boulder), Sandrina DePaz (University of Arkansas – Fayetteville), Zhihao Feng (The State University of New York State at Buffalo), Aristotle Grosz (Georgia Institute of Technology), Nicholas Hagopian (University of Minnesota), Michael Lemelin (Clemson University), Samantha McVety (University of Southern California), Halle Shannon (University of Kentucky), Siddharth Sharma (Penn State University), RJ Vogler (University of Kentucky), Sam Walker (The State University of New York State at Buffalo)
NAMS 2019 Student Activities

NAMS is committed to helping students succeed in their career paths. We offer a number of events tailored towards students, with an emphasis on professional development, mentorship, and networking. Students will not want to miss the following events!

Sunday, May 12

Student Workshop – 1:30 pm - 5:00 pm (Sterlings Room)
A fun workshop geared especially to both graduate and undergraduate students. This interactive session will feature speakers and activities designed to inspire students to develop their skills as young membrane professionals. Personal development and networking opportunities will be offered.

Welcome Reception – 6:00 pm - 9:00 pm (Carnegie Science Center, 1 Allegheny Ave, Pittsburgh, PA 15212)
Join us for an evening of food, drinks, and socializing! You will also have the opportunity to browse the exhibits at the Carnegie Science Center.

Monday, May 13

Lunch with Legends – 12:30 pm - 2:00 pm (Commonwealth Room)
This popular event provides students the opportunity to connect and network with “legends” in the field of membrane science and engineering in an intimate, small-group setting. Pre-registration required.

Poster Session – 7:00 pm - 10:00 pm (Ballrooms 1 & 2)
The poster session offers students the chance to interact with other researchers and professionals and discuss cutting-edge membrane research. Refreshments will be served and awards will be given to the best poster presenters!

Tuesday, May 14

Happy Hour – 6:30 pm - 7:30 pm (Ballroom Foyer)
Banquet & Awards Ceremony – 7:30 pm - 10:30 pm (Ballroom 1)
Join us for our annual banquet: a fun night of food, drinks, and celebrations. Awards will be presented to the best poster winners from the Tuesday poster session.

Wednesday, May 15

Awards Session #23 – 9:30 am - 12:30 pm (Kings Garden 4)
Recipients of the NAMS Student Fellowship and the Young Membrane Scientist Awards will give presentations at this special technical session. Come and learn about the work of these outstanding individuals!

Are you interested in applying for next year’s NAMS student awards? Visit http://membranes.org/nams_awards.htm for information!
Membrane Workshops

Saturday, May 11

Workshop 1: Measurement Methods for Membranes
8:00 am – 5:00 pm, Benedum Room

Presented by John Pellegrino (University of Colorado, Boulder), Ryan Lively (Georgia Institute of Technology) and Uwe Beuscher (W.L. Gore & Associates)

This workshop provides an overview of the entire field of membrane science, technology, and applications through measurements, and is therefore an excellent resource for novices with a technical background, as well as, seasoned veterans interested in broadening their scope (or having a refresher). The workshop will provide a survey of the various physical and chemical properties of membranes (and membrane process characteristics) that are measured, and the equipment (instruments) and techniques used, along with their underlying principles. A mixture of classical, novel, and resource-intensive techniques are included.

Workshop 2: Membranes for Water Treatment Applications
8:00 am – 5:00 pm, Duquesne Room

Presented by Isabel Escobar (University of Kentucky), DB Bhattacharya (University of Kentucky) and Ben Weaver (Solecta, Inc.)

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.

Sunday, May 12

Workshop 3: Membranes for Gas Separations
8:00 am – 5:00 pm, Birmingham/Smithfield Room

Presented by Glenn Lipscomb (University of Toledo), Benny Freeman (University of Texas, Austin) and Tim Merkel (Membrane Technology & Research, 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.

Workshop 4: Polymeric and Inorganic Membrane Materials and Membrane Formation
8:00 am – 5:00 pm, Benedum Room

Presented by Maria Coleman (University of Toledo) and Henk Verweij (Ohio State University) This workshop includes synthesis and properties of polymeric and inorganic membranes.

Workshop 5: Membranes for Bioprocessing
8:00 am – 5:00 pm, Duquesne Room

Presented by Herb Lutz (MilliporeSigma) and John Cyganowski (MilliporeSigma) This workshop includes the use of membranes in bioprocessing for clarification, harvest, sterilization, virus retention, and protein concentration and buffer exchange.
Dr. Peter S. Fiske is the Director of the Water-Energy Resilience Research Institute (WERRI) at Lawrence Berkeley National Laboratory. WERRI’s goal is to orient and align the water-related research programs at LBNL to address critical gaps in the reliability, efficiency and sustainability of water-energy systems in California and the nation.

Fiske was the Chief Executive Officer of PAX Water Technologies, Inc. from 2008 until January, 2017 when it was acquired by UGSI Inc. in an all-cash transaction. PAX Water pioneered the use of biomimicry to develop innovative and energy efficient technologies for the water industry.

He has been an advisor, mentor and friend to numerous early-stage technology entrepreneurs. He is also a frequent writer and lecturer on the subject of career strategy, entrepreneurship and leadership for scientists and engineers. He has been a keynote speaker or guest lecturer at some of the leading research universities in the United States including MIT, Harvard, Stanford, Northwestern, Princeton and the University of California at Berkeley (where he teaches at the Haas School of Business). He is a founding faculty member of the Department of Energy’s I-Corps Program. He is the author of *Put Your Science to WORK!*, numerous articles for the American Association for the Advancement of Science’s career website ScienceCareers.org, and presently writes an occasional column in the journal, *Nature*.

He received his Ph.D. from Stanford University in 1994 and an M.B.A. from the Haas School of Business at the University of California at Berkeley in 2002. In 1996, Fiske was one of 18 young professionals selected nationally for the White House Fellowship. He served his fellowship year as Special Assistant to the Secretary of Defense for Special Projects where he led a major personnel policy reform initiative for the Pentagon.

**Abstract**

Scientific advances in water treatment ultimately must end up in the commercial market for their benefits to be realized. But few research scientists have experience taking early-stage technologies through the circuitous path to successful commercialization. Many academic researchers consider technology commercialization to be a “magical” process performed by tech transfer offices and “entrepreneurs” and not involving them. In my presentation, I will describe the actual landscape of technology commercialization and provide the research community with a fresher perspective on how successful technology commercialization happens, and what they can do to increase the odds that their research will have commercial impact and be utilized to improve water availability for mankind.
Tim Merkel received his B.S. in Chemical Engineering from Polytechnic University (Brooklyn, NY) and his M.S. and Ph.D. in Chemical Engineering from North Carolina State University (Raleigh, NC), completing a dissertation on transport in nanocomposite membranes under the guidance of Professor Benny Freeman.

Dr. Merkel joined Membrane Technology and Research, Inc. (MTR) full-time as a Senior Research Scientist in 2003, became Director of MTR’s Research and Development Group in 2009, and Vice-President of Technology in 2013. In his current role, Dr. Merkel leads a team of researchers developing new membrane materials and processes for use in industrial gas separations. Some of his group’s recent work includes an industry-leading program on development of a membrane solution for carbon capture from power and industrial exhaust gases.

Dr. Merkel has published over 40 peer-reviewed articles on various aspects of membrane materials and process development, and he has given numerous presentations at academic and industrial meetings. He is inventor/co-inventor on 25 patents in the field of membrane gas separations. He has previously served on the NAMS Board of Directors, and has been an instructor in the membrane gas separation workshop at the Society’s annual meeting for several years.

Abstract

It has become increasingly evident that climate change caused by CO₂ emissions from combustion of fossil fuels is a major challenge facing humanity. Replacing fossil fuels as an energy source with no- or low-carbon alternatives, such as solar and wind, is underway but will take decades to complete. Moreover, important industrial processes such as steel and cement production generate CO₂ independent of energy use, and thus have no practical way to avoid emissions. For these reasons, an affordable method to capture CO₂ from exhaust gases is seen as an important bridging technology to a clean energy future.

Membrane gas separation is an attractive CO₂ capture option because of advantages such as energy-efficient passive operation, environmental friendliness (no hazardous chemical emissions, handling or storage issues), small footprint, and reduced water requirements. Despite these benefits, CO₂ capture from flue gases is challenging because these are very large streams with low CO₂ content at atmospheric pressure, and it is necessary to separate the CO₂ as a relatively pure stream at high pressure for a low cost. In this talk, I will describe how we have approached this challenge through innovations to the process design, the membrane material, and the membrane module.
Rachel A. Segalman received her B.S. from the University of Texas at Austin and Ph.D. from the University of California, Santa Barbara. She was a postdoctoral fellow at the Université Louis Pasteur before joining the faculty of UC Berkeley and Lawrence Berkeley National Laboratories from 2004-2014. She also served as the Materials Science Division Director at Lawrence Berkeley National Laboratories. In 2014, she moved to UC Santa Barbara to be the Kramer Professor of Chemical Engineering and Materials and became Department Chair of Chemical Engineering in 2015. In 2018 she also became the Schlinger Distinguished Chair of Chemical Engineering and the Associate Director of the UT/UCSB/LBL Center for Materials for Water and Energy Systems. Segalman’s group works on controlling the structure and thermodynamics of functional polymers including polymeric ionic liquids and semiconducting and bioinspired polymers. Among other awards, Segalman received the Journal of Polymer Science Innovation Award, the Dillon Medal from the American Physical Society, the Presidential Early Career Award in Science and Engineering, is an Alfred P. Sloan Fellow and a Camille Dreyfus Teacher Scholar. She is also a Fellow of the American Physical Society and serves on the Board of Directors of the Materials Research Society.

Abstract

While polymer electrolytes hold the promise of improving safety and mechanical durability of electrochemical devices, most suffer from relatively low ionic conductivities especially at ambient temperature. This combination of challenges becomes even more pronounced in the conduction of the multivalent metal ions likely to be necessary for next generation, high energy density energy storage devices where the ions are likely to have complex, multi-functional interactions with the polyelectrolyte matrix. Ionic liquids (IL’s) have been suggested for applications as diverse as solubilizing cellulose, antimicrobial treatments, and electrolytes in batteries due to their molten salt properties. Polymeric ionic liquids are not just solid counterparts to IL’s, but are excellent vectors for the inclusion of a variety of functionalities ranging from multi-valent ion conductivity for batteries to magnetism into a polymer membrane. Polymeric ionic liquids capable of conducting multivalent ions are based on transient metal ligand coordination interactions. In this talk, I will discuss the roles of polymer backbone chemistry, metal-ligand coordination, and ion concentration on ion conductivity and mechanical properties.
ORAL SESSIONS

Presenting authors are indicated by an asterisk*. See the most up-to-date version of the program with abstracts at nams2019.org or via the Attendify (NAMS 2019) app.

Plenary Session 1

7:45 am - 9:00 pm | Ballroom 1

Dr. Peter S. Fiske
Lawrence Berkeley National Laboratory

Innovation Pathways in the Water Ecosystem: The PAX Water Story

#1 Processes: Fundamentals of Predicting and Preventing Membrane Fouling

9:30 am - 12:30 pm | Kings Garden 4

Co-Chairs: Manish Kumar (Penn State University), Davide Mattia (University of Bath), Saifur Rahaman (Concordia University)

9:30 am MONDAY

1a - Hydrodynamic-colloidal interactions of an oil droplet and a membrane surface
Mariano Galvagno (Technion - Israel Institute of Technology), Guy Z Ramon (Technion - Israel Institute of Technology)*

10:00 am MONDAY

1b - Do Graphene Oxide Nanostructured Coatings Mitigate Bacterial Adhesion to Membrane Interfaces?
Santiago Romero-Vargas Castrillon (University of Edinburgh)*, Sara BinAhmed (University of Minnesota), Karl Wuolo-Journey (University of Minnesota)

10:30 am MONDAY

1c - Fouling mechanisms in constant flux crossflow ultrafiltration
Alon Kirschner (The University of Texas at Austin)*, Yu-Heng Cheng (The University of Texas at Austin), Donald Paul (The University of Texas at Austin), Robert Field (University of Oxford), Benny Freeman (The University of Texas at Austin)

11:00 am MONDAY

1d - Fouling-Resistant, Multi-Functional Membranes with Ultra-Thin Hydrogel Selective Layers using Interfacially Initiated Free Radical Polymerization (IIFRP)
Ayse Asatekin (Tufts University)*, Ilin Sadeghi (Tufts University), Eric Liu (Tufts University), Alice Oliveira Aguiar (Tufts University), Hyunmin Yi (Tufts University)

11:30 am MONDAY

1e - Unravel the Gordian Knot of membrane desalination: Understanding and mitigating silica scaling in reverse osmosis
Tiezheng Tong (Colorado State University)*, Song Zhao (Tianjin University), Amanda Quay (Carnegie Mellon University), Yunlong Qi (Tianjin University)

12:00 pm MONDAY

1f - RO Mineral Scale Mitigation via Self-Adaptive Feed-Flow Reversal
Yeunha Kim (UCLA)*, Anditya Rahardianto (UCLA), Tae Lee (UCLA), Yoram Cohen (UCLA)

#2 Processes: Membrane Distillation and Pervaporation: Innovations in Process Design and Scalability

9:30 am - 12:30 pm | Ballroom 3

Co-Chairs: Lee Vane (Environmental Protection Agency), David Warsinger (Purdue University)

9:30 am MONDAY

2a - Continuous on-demand dehydration of solvents in flow chemistry manufacturing processes
Hannah Murnen (Compact Membrane Systems)*, Sudip Majumdar (Compact Membrane Systems)

10:00 am MONDAY

2b - How membrane technology has been successfully applied to ethanol processing
Stephan Blum (Whitefox Technologies)*, Trond Heggenhougen (Whitefox Technologies), Meridith K. Bridge (Whitefox Technologies)
10:30 am  MONDAY
2c - Modeling the effect of different single-walled carbon nanotube orientations on permeation through mixed matrix membranes
Ali Zamani (University of Ottawa)*, Jules Thibault (University of Ottawa), Handan Tezel (University of Ottawa)

11:00 am  MONDAY
2d - Unique 3D printed spacers for process enhancement in membrane distillation
Navya Thomas (Khalifa University)*, Nurshaun Sreedhar (Khalifa University), Oraib Al-Ketan (Khalifa University), Reza Rowshan (New York University Abu Dhabi), Rashid Abu Al-Rub (Khalifa University), Hassan Arafat (Khalifa University)

11:30 am  MONDAY
2e - 2D boron nitride encapsulated nanofiber membranes for membrane distillation
Yunchul Woo (Korea Institute of Civil Engineering and Building Technology)*, Ho Kyong Shon (University of Technology Sydney), June-Seok Choi (Korea Institute of Civil Engineering and Building Technology)

12:00 pm  MONDAY
2f - Impact of membrane properties on scaling-induced wetting in membrane distillation
Allyson L McGaughey (University of Southern California)*, Prathamesh Karandikar (University of Southern California), Malancha Gupta (University of Southern California), Amy Childress (University of Southern California)

#3 Applications: Seawater Desalination
9:30 am - 12:30 pm  |  Kings Garden 3
Co-Chairs: Sunny Jiang (UC Irvine), Bill Phillip (University of Notre Dame)

10:00 am  MONDAY
3b - Water Transport through Ultrathin Polyamide Nanofilms Used for Reverse Osmosis
Zhiwei Jiang (Imperial College London)*, Santanu Karan (Imperial College London), Andrew Livingston (Imperial College London)

10:30 am  MONDAY
3c - Balancing Carbon, Nitrogen and Phosphorus Concentration in Seawater as a Strategy to Prevent Accelerated Membrane Biofouling
Siqian (Simon) Huang (University of Minnesota, Duluth), Nikolay Voutchkov (Water Globe Consultants, LLC), Sunny Jiang (UC Irvine)*

11:00 am  MONDAY
3d - Flow Reversal for Increased Recovery of 2nd Pass Seawater RO
Tomer Osman (Rotec Water Ltd.), Dan Peled (AST-Water Ltd.), Noam Perlmutter (Rotec Water Ltd.), Arina Shulman (Mekorot Water Company), Riki Harpness (Mekorot Water Company), Sivan Bleich (Mekorot Water Company), Eli Korin (Ben-Gurion University of the Negev), Jack Gilron (Ben-Gurion University of the Negev)*

11:30 am  MONDAY
3e - Zwitterionic poly(arylene ether sulfone) (PAES) copolymer for biofouling/chlorine resistant desalination membranes
Yi Yang (Arizona State University)*, Matthew Green (Arizona State University)

12:00 pm  MONDAY
3f - Chlorine resistance of functionalized HNTs-based TFN membranes
Farhad Asempour (University of Ottawa), Somaye Akbari (Amirkabir University of Technology), Du Bai (University of Ottawa), Ramzi Aoun (University of Ottawa), Sofia Reyes Lombardo (University of Ottawa), Amir Sajjad Atashgar (University of Ottawa), Boguslaw Kruczek (University of Ottawa)*
#4 Materials: Selective Polymeric and Mixed-Matrix Materials - Liquid Separations

9:30 am - 12:30 pm | Ballroom 4

Co-Chairs: Dan Miller (Lawrence Berkeley National Laboratory), Baoxia Mi (UC Berkeley)

9:30 am  MONDAY
4a - Enantioselective Polymeric Membrane for Chiral Separation of Enantiomers
Marine Michel (Imperial College London)*

10:00 am  MONDAY
4b - Tailored Synthesis of Inorganic-supported Polymer, Graphene, and Nanocomposite Membranes for Liquid-phase Separations
Michael Z Hu (Oak Ridge National Laboratory)*

10:30 am  MONDAY
4c - Two-Dimensional (2D) Covalent Organic Framework Mixed-Matrix Membranes
Phuoc Duong (University of Wyoming), Valerie Kuehl (University of Wyoming), Bruce Mastorovich (University of Wyoming), John Hoberg (University of Wyoming), Bruce Parkinson (University of Wyoming), Katie D Li-Oakey (University of Wyoming)*

11:00 am  MONDAY
4d - Enhancing water permeance in reduced graphene oxide membranes by chemical etching
Xiaoyi Chen (The State University of New York at Buffalo)*, Liang Huang (The State University of New York at Buffalo), Zhihao Feng (The State University of New York at Buffalo), Janavi Gohil (The State University of New York at Buffalo), Haiqing Lin (The State University of New York at Buffalo)

11:30 am  MONDAY
4e - Nanocomposite RO Membranes with High Aspect Ratio Functional Nanoparticles for Controlled Interfacial Transport
Stephen M Martin (Virginia Tech)*, Ethan Smith (Virginia Tech), E. Johan Foster (Virginia Tech), Keith Hendren (Virginia Tech), James Haag (Virginia Tech)

12:00 pm  MONDAY
4f - If one were to develop a new NF/RO membrane, specifically for uncharged organic solute rejection, how permeable could it be to water while meeting organic solute rejection goals?
Eric Hoek (UCLA)*

#5 Materials: Inorganic Materials

9:30 am - 12:30 pm | Kings Garden 1

Co-Chairs: Jay Kniep (Membrane Technology & Research), Jerry Lin (Arizona State University)

9:30 am  MONDAY
5a - Two-Dimensional Membranes for Gas Separation
Dan Zhao (National University of Singapore)*

10:00 am  MONDAY
5b - Restricting Lattice Flexibility in Polycrystalline Metal-Organic Framework Membrane for Efficient Carbon Capture
Deepu Babu (L’Ecole polytechnique fédérale de Lausanne), Kumar Varoon Agrawal (L’Ecole polytechnique fédérale de Lausanne)*

10:30 am  MONDAY
5c - New Asymmetric and Permselective Carbon Molecular Sieve Membranes
Jay (Junqiang) Liu (The Dow Chemical Company)*, Ted Calverley (The Dow Chemical Company), Dean Millar (The Dow Chemical Company), Mark Brayden (The Dow Chemical Company), Marcos Martinez (The Dow Chemical Company)

11:00 am  MONDAY
5d - Hitz zeolite membrane separation system (HDS) for gas separation
Masaya Itakura (Hitachi Zosen Corporation)*, Satoshi Imasaka (Hitachi Zosen Corporation), Kentaro Shinoya (Hitachi Zosen Corporation), Masashi Okada (Hitachi Zosen Corporation)
11:30 am MONDAY
5e - Insights on the Carbon Molecular Sieve Structure from Stability and Rejuvenation Tendencies
Samuel Hays (Georgia Institute of Technology)*, Oishi Sanyal (Georgia Institute of Technology), Nicholas Leon (Georgia Institute of Technology), Chen Zhang (University of Maryland), Pezhman Arab (Georgia Institute of Technology), William Koros (Georgia Institute of Technology)

12:00 pm MONDAY
5f - Fabrication of zeolitic imidazolate framework ZIF-8 membranes by ligand-induced permselectivation in vapor phase
Xiaoli Ma (University of Wisconsin-Milwaukee)*, Prashant Kumar (University of Minnesota), Nitish Mittal (University of Minnesota), Alexandra Khlyustova (University of Minnesota), Prodromos Daoutidis (University of Minnesota), Andre Mkhyon (University of Minnesota), Michael Tsapatsis (Johns Hopkins University)

#6 Applications: Assessing Performance, Robustness, and Scalability for Carbon Capture
9:30 am - 12:30 pm | Kings Garden 5
Co-Chairs: Dave Hopkinson (U.S. Department of Energy National Energy Technology Laboratory), Winston Ho (Ohio State University)

9:30 am MONDAY
6a - Polymers with Side Chain Porosity for Ultrapermeable and Plasticization Resistant Materials for Gas Separations
Sharon Lin (MIT)*, Francesco Benedetti (University of Bologna), Yuan He (MIT), Chao Liu (University of Chinese Academy of Sciences), Yanchuan Zhao (University of Chinese Academy of Sciences), Hong-Zhou Ye (MIT), Troy Van Voorhis (MIT), Maria Grazia De Angelis (University of Bologna), Timothy Swager (MIT), Zach Smith (MIT)

10:00 am MONDAY
6b - Bench scale testing of next generation hollow fiber membrane modules at subambient conditions at the National Carbon Capture Center
David Hasse (Air Liquide)*, Shilu Fu (Air Liquide), Sudhir Kulkarni (Air Liquide), Trapti Chaubey (Air Liquide), Alex Augustine (Air Liquide), Andrew Hamilton (Air Liquide), Monaca Mcnall (Air Liquide)

10:30 am MONDAY
6c - A Carbon Molecular Sieve Membrane-Based Reactive Separation Process for Pre-Combustion CO2 Capture
Mingyuan Cao (University of Southern California), Linghao Zhao (University of Southern California), Dongwan Xu (University of Southern California), Secgin Karagoz (UCLA), Patricia Pichardo (UCLA), Richard J. Ciora, Jr. (Media and Process Technology, Inc.), Paul Kt Liu (Media and Process Technology, Inc.), Vasilios I. Manousiouthakis (UCLA), Theodore T Tsotsis (University of Southern California)*

11:00 am MONDAY
6d - Synthesis of Polymers of Intrinsic Microporosity (PIM-1) with Poly(ethylene glycol) for Membrane Application
Volkan Filiz (Helmholtz-Zentrum Geesthacht)*, Gisela Bengtson (Helmholtz-Zentrum Geesthacht), Silvio Neumann (Helmholtz-Zentrum Geesthacht)

11:30 am MONDAY
6e - High-permeance polymer-functionalized graphene membranes that surpass the postcombustion carbon capture target
Guangwei He (L'Ecole polytechnique fédérale de Lausanne), Kumar Varoon Agrawal (L'Ecole polytechnique fédérale de Lausanne)*
12:00 pm MONDAY
6f - Fabrication of Thin Film Composite Membranes using Microporous Polymer Blends and Polybenzimidazole Nanoporous Supports for CO₂/N₂ Separation

#7 Applications: Assessing Performance, Robustness, and Scalability for Carbon Capture
2:00 pm - 5:00 pm | Kings Garden 5
Co-Chairs: Dave Hopkinson (U.S. Department of Energy National Energy Technology Laboratory), Winston Ho (Ohio State University)

2:00 pm MONDAY
7a - Field trial of spiral-wound facilitated transport membrane module for CO₂ capture from flue gas
Yang Han (Ohio State University)*, Witopo Salim (Ohio State University), Kai Chen (Ohio State University), Dongzhu Wu (Ohio State University), Winston Ho (Ohio State University)

2:30 pm MONDAY
7b - Gen-2 Proteus™ membrane and module development for CO₂ capture from gasification streams
Witopo Salim (Membrane Technology & Research Inc.)*, Karl Amo (Membrane Technology & Research Inc.), Trevor Carlisle (Oregon State University), Richard Baker (Membrane Technology & Research Inc.), Jenny He (Membrane Technology & Research Inc.), Jay Knipe (Membrane Technology & Research Inc.), Tim Merkel (Membrane Technology & Research Inc.), Vincent Nguyen (Membrane Technology & Research Inc.), Zhen Sun (Membrane Technology & Research Inc.), Jonathan Tan (Membrane Technology & Research Inc.), Bob Watson (Membrane Technology & Research Inc.), Erik Westling (Membrane Technology & Research Inc.)

3:00 pm MONDAY
7c - One-pot surface modification of nanocellulose fibrils and effect of manipulated fibril surfaces in Hybrid Facilitated Transport Membranes for CO₂ capture
Saravanan Janakiram (Norwegian University of Science and Technology)*, Xinyi Yu (Norwegian University of Science and Technology), Luca Ansaloni (SINTEF Industry), Zhongde Dai (Norwegian University of Science and Technology), Liyuan Deng (Norwegian University of Science and Technology)

3:30 pm MONDAY
7d - DDR-type zeolite membrane: The first opportunity in CO₂-EOR industry
Junya Okazaki (JGC Corporation)*, Hiroaki Hasegawa (JGC Corporation), Nobuyasu Chikamatsu (JGC Corporation), Kenji Yajima (NGK Insulators), Katsuya Shimizu (NGK Insulators), Makiko Niino (NGK Insulators)

4:00 pm MONDAY
7e - Coating of hollow fiber membrane for carbon molecular sieve membrane preparation
Yuhe Cao (Georgia Institute of Technology)*, Kuang Zhang (Georgia Institute of Technology), Dishi Sanyal (Georgia Institute of Technology), William Koros (Georgia Institute of Technology)

4:30 pm MONDAY
7f - Ultrapermeable benzotriptycene-based PIMs that redefine the upper bounds for CO₂ separations
Alessio Fuoco (National Research Council of Italy)*, Bibiana Comesaña-Gándara (University of Edinburgh), Jie Chen (University of Edinburgh), Grazia Bezzu (University of Edinburgh), Mariolino Carta (Swansea University), Ian Rose (University of Edinburgh), Maria-Chiara Ferrari (University of Edinburgh), Johannes Carolus (John) Jansen (National Research Council of Italy), Elisa Esposito (National Research Council of Italy), Marcello Monteleone (National Research Council of Italy) Neil McKeown (University of Edinburgh)
#8 Processes: Innovations in Module Modeling and Design

2:00 pm - 5:00 pm | Ballroom 3

Co-Chairs: David Ladner (Clemson University), Grigorios Panagakos (U.S. Department of Energy National Energy Technology Laboratory)

2:00 pm MONDAY
8a - CFD simulation of crimped hollow fiber membranes for liquid separation processes
Mohammad Younas (University of Engineering and Technology, Peshawar), Amir Muhammad (University of Engineering and Technology, Peshawar), Glenn Lipscomb (University of Toledo)*

2:30 pm MONDAY
8b - Computational Fluid Dynamics Modeling for the Investigation of Multi-Layer Spacer Effects
Zachary Binger (The University of Arizona), Andrea Achilli (The University of Arizona)*

3:00 pm MONDAY
8c - Direct numerical simulation of unsteady mixing in direct contact membrane distillation systems with membrane spacers
Jincheng Lou (Colorado School of Mines)*, Jacob Johnston (Colorado School of Mines), Nils Tilton (Colorado School of Mines)

3:30 pm MONDAY
8d - Concentration polarization modeling for high-pressure membranes with engineered surface features
Zuo Zhou (Clemson University)*, David Ladner (Clemson University), Sapna Sarupria (Clemson University), Steven Weinman (Clemson University), Scott Husson (Clemson University), Ilenia Battiato (Stanford University), Negin Kananizadeh (Clemson University)

4:00 pm MONDAY
8e - Analysis of Micromixers to Minimize Scaling Effects on Reverse Osmosis Membranes
Jeremy Walker (U.S. Army)*, Shawn McElmurry (Wayne State University), James Dusenbury (U.S. Army)

4:30 pm MONDAY
8f - Do Hydrodynamic Instabilities Cause Roughness in Thin Polyamide Films of Reverse Osmosis Membranes?
Akshay Deshmukh (Yale University)*, Puskar Mondal (Yale University), Subhajyoti Chaudhuri (Yale University), Menachem Elimelech (Yale University)

#9 Processes: Osmotically-Driven Membrane Processes for Water and Energy

2:00 pm - 5:00 pm | Ballroom 4

Co-Chairs: Tony Straub (University of Colorado Boulder/MIT), Aaron Wilson (Idaho National Lab), Emily Tow (Olin College), Chris Gorski (Penn State University), Kitty Nijmeijer (Eindhoven University of Technology)

2:00 pm MONDAY
9a - Structural and Transport Properties of Membranes in High-Salinity Desalination using Cascading Osmotically Mediated Reverse Osmosis
Xi Chen (Columbia University)*, Chanhee Boo (Columbia University), Ngai Yin Yip (Columbia University)

2:30 pm MONDAY
9b - Utilization of reverse solute diffusion to enhance membrane performance during osmotically driven processes - improved boron retention and silica scaling mitigation
Yining Wang (Nanyang Technological University)*, Weiyi Li (Southern University of Science and Technology), Chuyang Tang (University of New South Wales), Rong Wang (Nanyang Technological University)

3:00 pm MONDAY
9c - Osmotic Membrane Desalination Performance Governed by Molecular Reflection at the Liquid-Vapor Interface
Akshay Deshmukh (Yale University), Jongho Lee (University of British Columbia)*
3:30 pm  MONDAY
9d - Characterization of External and Internal Fouling of Forward Osmosis (FO) Process Through Ultrasonic Time Domain Reflectometry (UTDR) Method
Li Lai (Nanyang Technological University)*, Tzyy Haur Chong (Singapore Membrane Technology Centre)

4:00 pm  MONDAY
9e - Incorporating membrane deformation into the boundary layer equation to model water and reverse salt flux in osmotic processes
Jaime A Idarraga-Mora (Clemson University)*, Alton O’Neal (Clemson University), Morgan Pfeiler (Clemson University), David Ladner (Clemson University), Scott Husson (Clemson University)

4:30 pm  MONDAY
9f - A Thin-Film Forward-Osmosis Membrane Made from a Graphene Oxide-Silver Metal-Organic Framework Nanocomposite: Antifouling and Antibiofouling Assessment
Mostafa Dadashi Firouzjaei (University of Alabama), Ahmad Arabi Shamsabadi (Drexel University), Mohammad Sharifian Gh (University of Virginia), Milad Rabbani Esfahani (University of Alabama)*, Ahmad Rahimpour (Babol Noshirvani University of Technology), Masoud Soroush (Drexel University)

2:30 pm  MONDAY
10b - Membrane Distillation (MD) and Reverse Osmosis (RO) processes for water recovery from pre-treated high strength brewery wastewater
Nawrin Anwar (Concordia University)*, Mahbuboor Choudhury (Concordia University), Saifur Rahaman (Concordia University)

3:00 pm  MONDAY
10c - Field Demonstration of Real-Time Colloidal Particle Monitoring to Improve MF and UF Membrane Performance
Jana Safarik (Orange County Water District)*, Ganesh Rajagopalan (Kennedy/Jenks Consultants), Helia Safaee (Kennedy/Jenks Consultants), Megan Plumlee (Orange County Water District), Zita Yu (West Basin Municipal Water District)

3:30 pm  MONDAY
10d - Selective removal of phosphorus from wastewater using electromembrane process
Sanhita Chaudhury (Ben-Gurion University of the Negev)*, Oded Nir (Ben-Gurion University of the Negev)

4:00 pm  MONDAY
10e - Water Recovery from Produced Water via Robust Membrane Distillation
Rong Wang (Nanyang Technological University)*

4:30 pm  MONDAY
10f - Potable-quality water recovery from primary effluent through an integrated algal-osmosis membrane system
Lu Lin (New Mexico State University)*, Wenbin Jiang (New Mexico State University), Pei Xu (New Mexico State University)
#11 Materials: Ion-Exchange and Electrofunctional Materials

2:00 pm - 5:00 pm | Kings Garden 1

Co-Chairs: Geoff Geise (University of Virginia), Orlando Coronell (University of North Carolina at Chapel Hill)

2:00 pm MONDAY
11a - Ion Transport Through Perforated Nanoporous Graphene
Mandakranta Ghosh (University of Twente)*, Koen F. A. Jorissen (University of Twente), Jeffery A. Wood (University of Twente), Rob G. H. Lammertink (University of Twente)

2:30 pm MONDAY
11b - Developing a new approach to describe ion sorption and transport in Nafion membranes
Rahul Sujanani (The University of Texas at Austin)*, Jovan Kamcev (UC Berkeley), Eui-Soung Jang (The University of Texas at Austin), Benny Freeman (The University of Texas at Austin), Donald Paul (The University of Texas at Austin)

3:00 pm MONDAY
11c - Co-transport of neutral solutes in Nafion 117 using In-situ ATR FTIR spectroscopy for multicomponent solution speciation
Breanna Dobyns (Auburn University)*, Bryan S Beckingham (Auburn University)

3:30 pm MONDAY
11d - Functionalized Nanoporous Ceramic Membranes Towards Low-Cost Electrodialysis
Gregory M Newbloom (Membrion, Inc.)*, Ryan Kingsbury (Membrion, Inc.), Rachel Malone (Membrion, Inc.)

4:00 pm MONDAY
11e - Polymerization of counterions in self-assembled, 1 nm pores of lyotropic liquid crystal anion exchange membrane to tune nanopore and ion transport properties
Michael J. McGrath (University of Colorado at Boulder)*, Samantha Hardy, Andrew Basalla (University of Colorado Boulder), Hans Funke (University of Colorado Boulder), Bryce Manubay (University of Colorado Boulder), Zhangxing Shi (University of Colorado Boulder), Douglas Gin (University of Colorado Boulder), Richard Noble (University of Colorado Boulder)

4:30 pm MONDAY
11f - Quantifying tortuosity and diffusion over multiple scales in ionic and non-ionic polymer membranes
Louis Madsen (Virginia Tech)*

#12 Materials: Membrane Material and Transport Simulation: Molecular & Process Modeling of Membranes

2:00 pm - 5:00 pm | Kings Garden 3

Co-Chairs: Chris Wilmer (University of Pittsburgh), Abhishek Roy (The Dow Chemical Company)

2:00 pm MONDAY
12a - Expanding the chemical palette for reliable chemical separations using molecular simulations and machine learning
David Sholl (Georgia Institute of Technology)*, Farhad Ghargheizi (Georgia Institute of Technology), Dai Tang (Georgia Institute of Technology)

2:30 pm MONDAY
12b - Diffusion, Reaction, and Network Structure Modeling of Interfacial Polymerization of Polyamide Membranes
Jeffrey D Wilbur (DuPont Water Solutions)*, Toni Bechtel (DuPont Water Solutions), Matthew Jansma (DuPont Water Solutions), Steve Rosenberg (DuPont Water Solutions), Dan Arriola (DuPont Water Solutions)
3:00 pm  MONDAY
12c - Optimization of Mixed Matrix Membrane Materials for Post-Combustion Carbon Capture
Janice A. Steckel (U.S. Department of Energy National Energy Technology Laboratory)*, Samir Budhathoki (U.S. Department of Energy National Energy Technology Laboratory), Miguel Zamarripa-Perez (U.S. Department of Energy National Energy Technology Laboratory), Paul Boone (University of Pittsburgh), Christopher Wilmer (University of Pittsburgh)

3:30 pm  MONDAY
12d - Diffusivity in anion exchange membranes under low hydration: A molecular dynamics study
Dario Dekel (Technion - Israel Institute of Technology), Israel Zadok (Technion - Israel Institute of Technology), Srdan Pusara (Technion - Israel Institute of Technology), Simcha Srebnik (Technion - Israel Institute of Technology)*

4:00 pm  MONDAY
12e - Modeling of polymer membrane formation via phase inversion by mesoscopic phase-field methods: Investigating the development of structure on multiple scales
Michael R Cervellere (University of Arkansas/EMD Millipore)*, Xianghong Qian (University of Arkansas), David Ford (University of Arkansas), Paul Millett (University of Arkansas)

4:30 pm  MONDAY
12f - Multiscale Modeling of Gas Permeation Through Poly(Dimethyl Phenylene Oxide) (PPO) and Its Pre-Steady State Polymer Response
Marielle Soniat (Lawrence Berkeley National Laboratory)*, Meron Tesfaye (Lawrence Berkeley National Laboratory), Daniel Brooks (CalTech), Nicholas Humphrey (USC), Lien-Chun Weng (Lawrence Berkeley National Laboratory), Boris Merinov (CalTech), William Goddard (CalTech), Adam Weber (Lawrence Berkeley National Laboratory), Frances Houle (Lawrence Berkeley National Laboratory)
Plenary Session 2
7:45 am - 9:00 pm | Ballroom 1
Dr. Tim Merkel
Membrane Technology and Research, Inc.
Development of Membranes for CO₂ Capture

#13 Processes: Process Innovations in Electrofunctional and Electrocatalytic Membrane Processes
9:30 am - 12:30 pm | Kings Garden 4
Co-Chairs: Charles-François de Lannoy (McMaster University), David Jassby (UCLA)

9:30 am TUESDAY
13a - Scaling mitigation in membrane distillation through electrokinetic mixing
Unnati Rao (UCLA)*, Guy Z Ramon (Technion - Israel Institute of Technology), Eric Hoek (UCLA), David Jassby (UCLA)

10:00 am TUESDAY
13b - Donnan dialysis desalination with thermolytic salts
Hanqing Fan (Columbia University)*, Ngai Yin Yip (Columbia University)

10:30 am TUESDAY
13c - Electrically Conductive Membranes as Sensors: Stability, Conductivity, and Sensitivity
Nan Zhang (McMaster University), Amin Halali (McMaster University), Charles-François de Lannoy (McMaster University)*

11:00 am TUESDAY
13d - Electrocatalytic Membrane Reactor-based Integrated Processes for Landfill Leachate Treatment
Jianxin Li (Tianjin Polytechnic University)*, Hong Wang (Tianjin Polytechnic University), Junhao Ding (Tianjin Polytechnic University)

11:30 am TUESDAY
13e - Nitrogen and Phosphorus Recovery from Agricultural Wastewater Effluents - Role of Electrically Conductive Membranes
Avner Ronen (Temple University)*, Kartikeya Kekre (Temple University)

12:00 pm TUESDAY
13f - Simulations of Highly Selective Separations Based on Electromigration
Merlin Bruening (University of Notre Dame)*, Andriy Yaroshchuk (Polytechnic University of Catalonia), Mykola Bondarenko (National Academy of Sciences of Ukraine), Chao Tang (University of Notre Dame), Muhammad Ahmad (University of Notre Dame)

#14 Applications: Contaminant Removal from Water Sources
9:30 am - 12:30 pm | Ballroom 3
Co-Chairs: Andre da Costa (Michigan Technological University), Prakhar Prakash (Chevron - RPE)

9:30 am TUESDAY
14a - Oil drop behavior on model nanofiltration membrane surfaces under conditions of hydrodynamic shear
Emily Tummons (Michigan State University), Charifa Hejase (Michigan State University)*, Zhefei Yang (University of Massachusetts Amherst), Jia Wei Chew (Nanyang Technological University), Merlin Bruening (University of Notre Dame), Vlad Tarabara (Michigan State University)

10:00 am TUESDAY
14b - A case study review of the application of reverse osmosis membranes for water treatment and reagent recovery at mining and mineral processing operations
Chris Biederman (Hatch)*, Jeffrey Cobbledick (Hatch)
10:30 am  TUESDAY
14c - Self-Cleaning Nanocomposite Membranes with Phosphorene-Based Pore Fillers for Water Treatment
Joyner Eke (University of Kentucky)*, Isabel Escobar (University of Kentucky)

11:00 am  TUESDAY
14d - Optimization of nanofiltration process for treating industrial wastewater of time-varying composition
Salman Alizadeh Kordkandi (McMaster University); Ryan LaRue (McMaster University)*; Abhishek Premachandra (McMaster University); Jacob Sitko (McMaster University); David Latulippe (McMaster University)

11:30 am  TUESDAY
14e - Adsorptive and Reactive Membranes for Remediation of PFOA, Chloro-organics, and RCRA Metals from Water
DB Bhattacharyya (University of Kentucky)*, Hongyi (Derek) Wan (University of Kentucky), Anthony Saad (University of Kentucky), Md. Saiful Islam (University of Kentucky), Ashish Aher (University of Kentucky), Rollie Mills (University of Kentucky), Lindell Ormsbee (University of Kentucky), Evan Hatakeyama (Chevron)

12:00 pm  TUESDAY
14f - Selective separation of mono- and di-valent cations in electrodialysis during brackish water desalination: bench and pilot-scale studies
Xuesong Xu (New Mexico State University)*, Pei Xu (New Mexico State University), Guanyu Ma (New Mexico State University)

#15 Materials: Materials for Organic Solvent Separations
9:30 am - 12:30 pm  |  Ballroom 4
Co-Chairs: Steve White (Membrane Technology & Research Inc.), Ryan Lively (Georgia Institute of Technology)

9:30 am  TUESDAY
15a - Membrane solvent recovery in edible oil industry
Petrus Cuperus (SolSep BV)*, Ingrid Wienk (SolSep BV), Pieter Vandezande (VITO), Marco Pipolo (Bunge), Jan Kolijn (TUSTI), Will Fuchten (MTSA)

10:00 am  TUESDAY
15b - Molecular Design of Polymeric Membranes for Organic Solvent Recovery
Tai-Shung Chung (National University of Singapore)*

10:30 am  TUESDAY
15c - Epoxy-based solvent resistant nanofiltration membranes prepared through phase inversion
Maarten Bastin (KU Leuven)*, Jasper Raymenants (KU Leuven), Ivo Vankelecom (KU Leuven)

11:00 am  TUESDAY
15d - Nanoporous Graphene Membranes for Organic Solvent Nanofiltration
David Cheng (MIT)*, Rohit Karnik (MIT)

11:30 am  TUESDAY
15e - OSN Technology in Petrochemical Industry: Looking Back, Looking Forward
Dhaval Bhandari (ExxonMobil), JR Johnson* (ExxonMobil)

12:00 pm  TUESDAY
15f - Enabling Organic Solvent Nanofiltration and Reverse Osmosis using Ceramic Supported TFC Membranes
Jeffrey R McCutcheon (University of Connecticut)*, Lingling Xia (University of Connecticut), Marcus Weyd (Fraunhofer Institute for Ceramic Technologies and Systems IKTS), Mi Zhang (University of Connecticut)
#16 Materials: Catalytic and Responsive Materials
9:30 am - 12:30 pm | Kings Garden 3

Co-Chairs: Miao Yu (Rensselaer Polytechnic Institute), Ayse Asatekin (Tufts University)

9:30 am TUESDAY
16a - Responsive CNT Composite Membranes for Protection Against Chemical Warfare Agents
Melinda L Jue (Lawrence Livermore National Laboratory)*, Chiatai Chen (Cornell University), Yifan Li (MIT), Eric Meshot (Lawrence Livermore National Laboratory), Ngoc Bui (Lawrence Livermore National Laboratory), Rong Zhu (MIT), Myles Herbert (MIT), Sei Jin Park (Lawrence Livermore National Laboratory), Steven Buchsbaum (Lawrence Livermore National Laboratory), Kuang Jen Wu (Lawrence Livermore National Laboratory), Timothy Swager (MIT), Francesco Fornasiero (Lawrence Livermore National Laboratory)

10:00 am TUESDAY
16b - Highly Efficient Dimethyl Ether Production from CO$_2$ Hydrogenation in a Dehydration Membrane Reactor
Huazheng Li (Rensselaer Polytechnic Institute)*, Qiaobei Dong (Rensselaer Polytechnic Institute), Shoujie Ren (Missouri University of Science and Technology), Xinhua Liang (Missouri University of Science and Technology), Naomi Klinghoffer (Gas Technology Institute), Shiguang Li (Gas Technology Institute), Miao Yu (Rensselaer Polytechnic Institute)

10:30 am TUESDAY
16c - Poly-methacrylic acid Functionalized Membranes with Incorporated Reactive Pd/Fe Nanoparticles: Lab Scale to Groundwater Remediation Applications
Hongyi (Derek) Wan (University of Kentucky)*, Md. Saiful Islam (University of Kentucky), Nicolas Briot (University of Kentucky), Anthony Saad (University of Kentucky), Lindell Ormsbee (University of Kentucky), DB Bhattacharyya (University of Kentucky)

11:00 am TUESDAY
16d - Investigation of a smart electrically responsive ultrafiltration membrane
Chia Miang Khor (UCLA)*, David Jassby (UCLA)

11:30 am TUESDAY
16e - Catalytic Membranes for Groundwater Treatment
Alexander J Sutherland (McMaster University)*, Charles-François de Lannoy (McMaster University)

12:00 pm TUESDAY
16f - Plasmonic membrane catalytic activation of peroxide for quantized oxidation via residence time control
Hao Tang (University of Washington), Guozheng Shao (University of Washington), Bruce Hinds (University of Washington)*

#17 Materials: Selective Polymeric and Mixed-Matrix Materials - Gas Separations
9:30 am - 12:30 pm | Kings Garden 5

Co-Chairs: Ben Sundell (Aramco Services Company), Zach Smith (MIT)

9:30 am TUESDAY
17a - Mixed-matrix membranes formed from imide-functionalized UiO-66-NH$_2$ for improved interfacial compatibility
Qihui Qian (MIT)*, Zach Smith (MIT)

10:00 am TUESDAY
17b - Janus polymers bearing tri(n-alkoxy)silyl side groups: glassy membrane materials with properties of rubbers
10:30 am TUESDAY

17c - Solution processable metal organic frameworks for gas separations: from porous liquids to mixed matrix membranes

Anastasiya V Bavykina (King Abdullah University of Science and Technology)*, Alexander Knebel (Leibniz University Hannover Institute for Physical Chemistry and Electrochemistry), Shuvo Datta (King Abdullah University of Science and Technology), Magnus Rueping (King Abdullah University of Science and Technology), Mohamed Eddaoudi (King Abdullah University of Science and Technology), Juergen Caro (Leibniz University Hannover Institute for Physical Chemistry and Electrochemistry), Jorge Gascon (King Abdullah University of Science and Technology)

11:00 am TUESDAY

17d - Enhancing CO2/N2 Selectivity and Elimination of Langmuir Sorption within High Tg, Glassy Polynorbornene Membranes

Christopher Maroon (University of Tennessee), Jacob Townsend (University of Tennessee), Kevin Gmernicki (University of Tennessee), Daniel Harrigan (Aramco Services Company), Ben Sundell (Aramco Services Company), John Lawrence (Aramco), Shannon Mahurin (Oak Ridge National Laboratory), Konstantinos Vogiatzis (University of Tennessee), Brian Long (University of Tennessee)*

11:30 am TUESDAY

17e - Ultra-High Permeability Mixed-Matrix Membranes as a Next-Generation Carbon Capture Technology for Post-Combustion

Sameh K Elsaidi (U.S. Department of Energy National Energy Technology Laboratory)*, Surendar Venna (U.S. Department of Energy National Energy Technology Laboratory), Ali Sekizkardes (Battelle/ U.S. Department of Energy National Energy Technology Laboratory), Mona Mohamed (University of Pittsburgh), David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory)

12:00 pm TUESDAY

17f - Composite gas separation membranes from metal-induced ordered polymeric frameworks

Zhihua Qiao (Tianjin University), Song Zhao (Tianjin University), Menglong Sheng (Tianjin University), Jixiao Wang (Tianjin University), Zhi Wang (Tianjin University), Chongli Zhong (Tianjin University), Michael D Guiver (Tianjin University)*


2:00 pm - 5:00 pm | Kings Garden 5

Co-Chairs: Ben Sundell (Aramco Services Company), Zach Smith (MIT)

2:00 pm TUESDAY

18a - High temperature gas separation properties of sub-micron polybenzimidazole membranes

Melanie M Merrick (The University of Texas at Austin)*, Benny Freeman (The University of Texas at Austin)

2:30 pm TUESDAY

18b - Thermally Rearranged Semi-interpenetrating Polymer Network (TR-SIPN) Membranes for Olefin/Paraffin Separations

Young Moo Lee (Hanyang University)*, Won Hee Lee (Hanyang University), Jong Geun Seong (Hanyang University), Ho Hyun Wang (Hanyang University), Sun Ju Moon (Hanyang University)

3:00 pm TUESDAY

18c - Conformation-controlled molecular sieving effect for membrane-based propylene/propane separation

Yang Liu (Georgia Institute of Technology)*, William Koros (Georgia Institute of Technology), Mohamed Eddaoudi (KAUST), Gongping Liu (Georgia Institute of Technology), Youssef Belmabkhout (KAUST), Zhijie Chen (KAUST)

3:30 pm TUESDAY

18d - Mixed matrix materials containing soluble discrete metal-organic polyhedra in rubbery polyethers for CO2/gas separation

Haiqing Lin (The State University of New York at Buffalo)*, Junyi Liu (The State University of New York at Buffalo), Cressa Fulong (The State University of New York at Buffalo), Tim Cook (The State University of New York at Buffalo)
4:00 pm TUESDAY
18e - Accessing novel microporous polymers to enhance yield, stereochemical control, and membrane performance in the recovery of light hydrocarbons from natural gas
John Lawrence (Aramco Services Company)*

4:30 pm TUESDAY
18f - Insight into the transport in polymeric and mixed matrix membranes via analysis of unique mixed gas diffusion coefficients
Johannes Carolus (John) Jansen (National Research Council of Italy)*, Alessio Fuoco (National Research Council of Italy), Marcello Monteleone (National Research Council of Italy), Elisa Esposito (National Research Council of Italy)

#19 Processes: Process Scale-Up and Techno-Economic Assessment

2:00 pm - 5:00 pm | Kings Garden 4

Co-Chairs: JR Johnson (ExxonMobil), Bharat Bhut (Merck Pharmaceuticals), Ivy Huang (Membrane Technology and Research), Albert Kim (University of Hawaii)

2:00 pm TUESDAY
19a - Minimizing the cost of membrane distillation

2:30 pm TUESDAY
19b - Process Optimization Using Perturbation Expansion Solutions for Membrane Gas Separation Modules
Norfamila Che Mat (Universiti Malaysia Sarawak), Glenn Lipscomb (University of Toledo)*

3:00 pm TUESDAY
19c - Multi-physics Simulation of Hollow Fiber Vacuum Membrane Distillation Using OpenFoam
Albert Kim (University of Hawaii), Ho Ji (Korea Research Institute Of Ships And Ocean Engineering), Deok-Soo Moon (Korea Research Institute Of Ships And Ocean Engineering)

3:30 pm TUESDAY
19d - Scale-up of Facilitated Transport Membrane Module for CO2 Capture from Flue Gas
Kai Chen (Ohio State University)*, Witopo Salim (Ohio State University), Yang Han (Ohio State University), Dongzhu Wu (Ohio State University), Winston Ho (Ohio State University)

4:00 pm TUESDAY
19e - Development of industrial scale polyvinylidene fluoride transfer membrane
Marta E Bojarska (GVS Filter Technology)*, Deb English (GVS Filter Technology), Gil Tavares (GVS Filter Technology)

4:30 pm TUESDAY
19f - Low energy seawater desalination using multistage electrodialysis
Gijs Doornbusch (Eindhoven University of Technology)*, Michele Tedesco (Wetsus), Jan Post (Wetsus), Zandrie Borneman (Eindhoven University of Technology), Kitty Nijmeijer (Eindhoven University of Technology)

#20 Processes: New Concepts in Hybrid Processes and Process Integration

2:00 pm - 5:00 pm | Kings Garden 3

Co-Chairs: Jia Wei Chew (Nanyang Technological University), Ed Sanders (Air Liquide-Global Markets & Technologies)

2:00 pm TUESDAY
20a - Air Products Hybrid Membrane Adsorption
Cory E Sanderson (Air Products and Chemicals)*, Don Henry (Air Products and Chemicals)

2:30 pm TUESDAY
20b - Hybrid Distillation and Facilitated Transport Membrane Processes for C3 Splitter Debottlenecking
Kenneth Pennisi (Compact Membrane Systems), Christine Parrish (Compact Membrane Systems)*, Sudip Majumdar (Compact Membrane Systems)
3:00 pm  TUESDAY
20c - Water Recovery via Forward Osmosis - Freeze Concentration
Georgios Kolliopoulos (University of Toronto), Jeffrey Martin (University of Toronto), Chenbo Xu (University of Toronto), Vladimiro Papangelakis (University of Toronto)*

3:30 pm  TUESDAY
20d - Leverage membrane technology in process intensification and new application design - from early stage design to technical scale implementation
Peter Kreis (Evonik Technology & Infrastructure GmbH)*, Kah Peng Lee (Evonik Fibres GmbH), Lars Peters (Evonik Fibres GmbH), Erik Hoving (Evonik Cooperation), Steven Pedersen (Evonik Canada Inc.), Kumar Abhinava (Evonik Cooperation)

4:00 pm  TUESDAY
20e - Carbon Capture utilizing Hybrid Membrane/Liquifaction
David Hasse (Air Liquide)*

4:30 pm  TUESDAY
20f - Membrane distillation hybridized with a thermoelectric heat pump for energy-efficient water treatment and space cooling
Yong Zen Tan (Nanyang Technological University), Nick Guan Ping Chew (Nanyang Technological University), Wai Hoong Chow (Nanyang Technological University), Rong Wang (Nanyang Technological University), Jia Wei Chew (Nanyang Technological University)*

2:00 pm  TUESDAY
21a - Reduction of Brackish Water Desalination Brine Volume using Membrane Evaporation Coupled with Activated Sludge Aeration Waste Heat
Drew W Johnson (The University of Texas at San Antonio)*

2:30 pm  TUESDAY
21b - Smart High Recovery RO Boosts Recovery Rate to More Than 90% for Reuse Purposes
Ronit Erlitzki (AdEdge Water Technologies), Jack Gilron (Ben-Gurion University of the Negev)*

3:00 pm  TUESDAY
21c - Membrane Distillation for Enhanced Water Recovery by Inland Brackish Water Desalination Plants
Zhewei Zhang (University of Pittsburgh)*, Radisav Vidic (University of Pittsburgh)

3:30 pm  TUESDAY
21d - Selective Separation of Industrial Relevant Metal Ions from High TDS Water using Wafer-Enhanced Electrodeionization (WE-EDI)
Humeyra B Ulusoy Erol (University of Arkansas)*, Christa Hestekin (University of Arkansas), Jamie Hestekin (University of Arkansas)

4:00 pm  TUESDAY
21e - Pilot Evaluation of Closed Circuit Reverse Osmosis (CCRO) for Treatment of RO Concentrate for Potable Reuse
Han Gu (Orange County Water District)*, Megan Plumlee (Orange County Water District), Mike Boyd (Desaltech), Ran Nadav (Desaltech), Michael Hwang (Jacobs), Jim Lozier (Jacobs)

4:30 pm  TUESDAY
21f - Brine Treatment for Minimal and ZLD
Malynda Cappelle (The University of Texas at El Paso)*, W. Shane Walker (The University of Texas at El Paso)
#22 Materials: Innovations in Membrane Synthesis and Casting

2:00 pm - 5:00 pm | Ballroom 4

Co-Chairs: Rachel Dorin (Terapore Technologies), Ulrich Wiesner (Cornell University)

2:00 pm TUESDAY

22a - Novel Spirocyclic Polymers for Membrane-based Organic Solvent Separations
Ronita Mathias (Georgia Institute of Technology)*, Kirstie Thompson (Georgia Institute of Technology), Dhaval Bhandari (ExxonMobil), JR Johnson (ExxonMobil), Huaxing Zhou (ExxonMobil), M.G. Finn (Georgia Institute of Technology), Ryan Lively (Georgia Institute of Technology)

2:30 pm TUESDAY

22b - 3D Printed fouling resistant composite membranes
Davide Mattia (University of Bath)*

3:00 pm TUESDAY

22c - Next-Generation Membranes Using Thin-Film Lift Off
Mackenzie Anderson (UCLA)*, Brian McVerry (UCLA), Na He (UCLA), Eric Hoek (UCLA), Richard Kaner (UCLA)

3:30 pm TUESDAY

22d - Interfacial Junctions Control Electrolyte Transport Through Charge-Patterned Membranes
Feng Gao (University of Notre Dame), Bill Phillip (University of Notre Dame)*

4:00 pm TUESDAY

22e - Fabrication of Inside-Out Isoporous Hollow Fiber Membranes via Spinning and Coating Methods
Kirti Sankhala (Helmholtz-Zentrum Geesthacht, Geesthacht)*, Joachim Koll (Helmholtz-Zentrum Geesthacht, Geesthacht), Maryam Radjabian (Helmholtz-Zentrum Geesthacht, Geesthacht), Clarissa Abetz (Helmholtz-Zentrum Geesthacht, Geesthacht), Volker Abetz (Helmholtz-Zentrum Geesthacht, Geesthacht)

4:30 pm TUESDAY

22f - Empirical evidence suggests that polyamide film formation during interfacial polymerization in thin film composite (TFC) membranes is not self-limiting
Kasia Grzebyk (University of North Carolina at Chapel Hill)*, Orlando Coronell (University of North Carolina at Chapel Hill)
**Plenary Session 3**
7:45 am - 9:00 pm | Ballroom 1

Dr. Rachel Segalman  
University of California, Santa Barbara  
Polymeric Ionic Liquids: A New Platform for Materials and Energy

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**#23 Awards Session (Student Fellowship & Young Membrane Scientist Awards)**
9:30 am - 12:30 pm | Kings Garden 4

Chair: Caleb Funk (The Dow Chemical Company)

9:30 am WEDNESDAY
23a - Creation of well-defined "mid-sized" micropores in carbon molecular sieve membranes for organic solvent separations
Yao Ma (Georgia Institute of Technology)*, Dhaval Bhandari (ExxonMobil), JR Johnson (ExxonMobil), Ryan Lively (Georgia Institute of Technology)

10:00 am WEDNESDAY
23b - PoreDesigner for computational optimization of channel proteins and porous organic cages for highly selective membrane-based separations
Ratul Chowdhury (Penn State University)*

10:30 am WEDNESDAY
23c - Crack-free, large-area, single-layer graphene membranes with a record performance in gas mixture separation
Shiqi Huang (L’Ecole polytechnique fédérale de Lausanne)*, Kumar Varoon Agrawal (L’Ecole polytechnique fédérale de Lausanne), Jing Zhao (L’Ecole polytechnique fédérale de Lausanne)

11:00 am WEDNESDAY
23d - Unprecedented CO₂/H₂ Selectivity and CO₂ Permeance Demonstrated in Facilitated Transport Membranes with Tunable Amine-CO₂ Chemistry
Yang Han (Ohio State University)*, Winston Ho (Ohio State University)

11:30 am WEDNESDAY
23e - Engineering the Nanochannels in Reduced Graphene Oxide Membrane for Dye Desalination
Liang Huang (The State University of New York at Buffalo)*, Haqing Lin (The State University of New York at Buffalo)

12:00 pm WEDNESDAY
23f - Impact of module design on heat transfer and Nusselt correlation selection in membrane distillation

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**#24 Applications: Cell and Protein Purification, Harvesting, and Processing**
9:30 am - 12:30 pm | Kings Garden 3

Co-Chairs: Merlin Bruening (University of Notre Dame), Jessica Molek (GlaxoSmithKline), Prity Bengani-Lutz (Repligen Corporation), Sen Xu (Merck Pharmaceuticals)

9:30 am WEDNESDAY
24a - Experimental and Theoretical Investigations of the Loss of Protein Sieving Due to Fouling of ATF Microfilters
Alex Apostolidis (Amgen)*, Glen Bolton (Amgen)

10:00 am WEDNESDAY
24b - pH and Excipient Partitioning in Ultrafiltration/Diafiltration Processes for Formulation of High Concentration Monoclonal Antibody (mAb) Products
Parinaz Emami (Penn State University)*, Youngbin Baek (Penn State University), Nripen Singh (Bristol-Myers Squibb), Andrew Zydney (Penn State University)
10:30 am WEDNESDAY
24c - Effect of membranes molecular weight cut-off on peptides migration and selectivity during electrodialysis with filtration membranes
Sabita Kadel (Laval University)*, Jacinthe Thibodeau (Laval University), Carole Laine (Amer-Sil), Laurent Bazinet (Laval University)

11:00 am WEDNESDAY
24d - Scale down depth filtration case study using Pall Supracap™ 50 to predict large scale STAX™ capacity and product quality
Patricia Rose (Merck Pharmaceuticals)*, Jennifer Pollard (Merck Pharmaceuticals)

11:30 am WEDNESDAY
24e - Unraveling the Plugging Mechanisms during a Combined Tangential-flow and Depth Filtration Process
Xianghong Qian (University of Arkansas)*, Da Zhang (University of Arkansas), Daniel Strauss (Asahi Kasei), Parag Patel (Asahi Kasei), Ranil Wickramasinghe (University of Arkansas)

12:00 pm WEDNESDAY
24f - Functionalized Microporous Membranes for Protein Capture and Analysis
Joshua Berwanger (University of Notre Dame)*, Merlin Bruening (University of Notre Dame), Liu Yang (University of Notre Dame), Hui Yin Tan (University of Notre Dame), Weijing Liu (University of Notre Dame)

Yan Chen (Bristol-Myers Squibb), Erinc Sahin (Bristol-Myers Squibb), Andrew Zydny (Penn State University), Melissa Holstein (Bristol-Myers Squibb), Sanchayita Ghose (Bristol-Myers Squibb)

10:00 am WEDNESDAY
25b - Continuous Diafiltration for cGMP Biomanufacturing
Akshat Gupta (MilliporeSigma)*, Beth Goodrich (MilliporeSigma), Herb Lutz (MilliporeSigma)

10:30 am WEDNESDAY
25c - Understanding the role that patterning plays on membrane biofouling by visualization using light imaging and simulation
Anna Malakian (Clemson University)*, Bowen Ling (Stanford University), Ilenia Battiato (Stanford University), Scott Husson (Clemson University)

11:00 am WEDNESDAY
25d - Treating Poultry Processing Wastewaters by Combined Electrocoagulation and Ultrafiltration
Ranil Wickramasinghe (University of Arkansas)*, Kamyar Sardari (University of Arkansas)

11:30 am WEDNESDAY
25e - Mass transfer assisted TIPS process to precisely tailor the hollow fiber membrane surface and sublayer structures
Hideto Matsuyama (Kobe University)*, Chuanjie Fang (Kobe University), Saeid Rajabzadeh (Kobe University)

12:00 pm WEDNESDAY
25f - Organic solvent resistant membranes obtain by using non-toxic solvents
Stefan Chisca (King Abdullah University of Science and Technology)*, Gheorghe Falca (King Abdullah University of Science and Technology), Tommaso Marchesi (University of Bologna), Valentina Elena Musteata (King Abdullah University of Science and Technology), Suzana Nunes (King Abdullah University of Science and Technology)
#26 Materials: Bio-inspired and Biomimetic Materials

9:30 am - 12:30 pm | Ballroom 4

Co-Chairs: Chunlong Chen (Pacific Northwest National Laboratory), Yair Kaufman (Ben Gurion University of the Negev), DB Bhattacharyya (University of Kentucky)

9:30 am WEDNESDAY
26a - Artificial Water Channels - toward biomimetic membranes for desalination
Mihail Barboiu (Institut Europeen des Membranes)*

10:00 am WEDNESDAY
26b - Self-Assembly of Long-Lasting Lipid Bilayers and the Effect of Temperature of their Ion Rejection
Yair Kaufman (Ben Gurion University of the Negev)*, Shiju Abraham (Ben Gurion University of the Negev), Tabea Heckenthaler (Ben Gurion University of the Negev), Yacov Morgenstern (Ben Gurion University of the Negev)

10:30 am WEDNESDAY
26c - Peptoid-based membrane-mimetic 2D nanomaterials with incorporated natural and synthetic channels
Chunlong Chen (Pacific Northwest National Laboratory)*

11:00 am WEDNESDAY
26d - Scalable High-Performance Membranes with High Density Channel Protein-Polymer Nanosheets
Yu-Ming Tu (Penn State University)*, Woohul Song (Penn State University), Tingwei Ren (Penn State University), Yuexiao Shen (UC Berkeley), Ratul Chowdhury (Penn State University), Prasangi Rajapaksha (University of Kentucky), Arwa Mukhtar (Penn State University), Miaoci Zhang (Penn State University), Alina Thokkadam (Rutgers University), DB Bhattacharyya (University of Kentucky), Bill Phillip (University of Notre Dame), Robert Hickey (Penn State University), Yinai Wei (University of Kentucky), Manish Kumar (Penn State University)

11:30 am WEDNESDAY
26e - Fabrication of aquaporin-based biomimetic membrane for seawater desalination
Ye Li (Nanyang Technological University)*, Rong Wang (Nanyang Technological University)

12:00 pm WEDNESDAY
26f - Biomimetic channel membranes: can they realize their full potential upon scale-up?
Viatcheslav Freger (Technion - IIT)*

#27 Materials: Advances in Membrane and Materials Characterization

9:30 am - 12:30 pm | Kings Garden 5

Co-Chairs: Weiyi Li (School of Environment Science and Engineering), Maria-Chiara Ferrari (The University of Edinburgh), Chuyang Tang (University of New South Wales)

9:30 am WEDNESDAY
27a - Surface Nano-structuring with Hydrophilic Polymer Brush Layers for Membrane Performance Tailoring and Optimization
Yian Chen (UCLA)*, Soomin Kim (UCLA), Anditya Rahardianto (UCLA), Yoram Cohen (UCLA)

10:00 am WEDNESDAY
27b - Roughness in Polyamide RO Membranes: Its Formation Mechanism, Control, and Implications
Chuyang Tang (University of Hong Kong / University of New South Wales)*

10:30 am WEDNESDAY
27c - Mechanism of chlorine attack on polyamide membranes studied by EIS
Mikhail Stolov (Technion - IIT), Viatcheslav Freger (Technion - IIT)*
11:00 am WEDNESDAY
27d - Physicochemical and electrochemical characterization of cation-exchange membranes modified with polyethylenimine for elucidating enhanced monovalent permselectivity of electrodialysis
Wenbin Jiang (New Mexico State University)*, Lu Lin (New Mexico State University), Xuesong Xu (New Mexico State University), Pei Xu (New Mexico State University)

11:30 am WEDNESDAY
27e - Unraveling the Film-Formation Kinetics during Interfacial Polymerization via Low Coherence Interferometry
Xin Liu (Southern University of Science and Technology)*, Weiyi Li (Southern University of Science and Technology), Zhuo Li (Southern University of Science and Technology), Anthony Fane (Singapore Membrane Technology Centre), Baolin Deng (Southern University of Science and Technology)

12:00 pm WEDNESDAY
27f - Operando Membrane Spectroscopy for Elucidating Transport Mechanisms in Membranes
Casey O'Brien (University of Notre Dame)*

#28 Materials: Bio-inspired and Biomimetic Materials
2:00 pm - 5:00 pm | Ballroom 4

Co-Chairs: Chunlong Chen (Pacific Northwest National Laboratory), Yair Kaufman (Ben Gurion University of the Negev), DB Bhattacharyya (University of Kentucky)

2:00 pm WEDNESDAY
28a - Biofouling resistant membranes for wound healing
Antoine Venault (Chung Yuan Christian University)*, Hao-Tung Lin (Chung Yuan Christian University), Yung Chang (Chung Yuan Christian University)

2:30 pm WEDNESDAY
28b - Impacts of Bio-inspired Zwitterionic Membranes for Health Care Applications
Yung Chang (R&D Center for Membrane Technology, CYCU)*

3:00 pm WEDNESDAY
28c - Biomimetic membrane systems utilizing electro-dynamic interfaces
Bruce Hinds (University of Washington)*

3:30 pm WEDNESDAY
28d - Responsiveness and function of DNA-gated membranes
Beñat Olave (Polymat, University of the Basque Country), Iliane Rafaniello (Polymat, University of the Basque Country), Thomas Schäfer (Polymat, University of the Basque Country)*

4:00 pm WEDNESDAY
28e - Nature-inspired Coating-free Membranes for Desalination
Himanshu Mishra (King Abdullah University of Science and Technology), Ratul Das (King Abdullah University of Science and Technology), Sankara Arunachalam (King Abdullah University of Science and Technology), Zain Ahmad (King Abdullah University of Science and Technology), Edelberto Manalastas (King Abdullah University of Science and Technology), Jamila Nauruzbayeva (King Abdullah University of Science and Technology)*

4:30 pm WEDNESDAY
28f - Carbon nanotube porins as model biomimetic membrane nanopores
Aleksandr Noy (Lawrence Livermore National Laboratory)*
#29 Materials: Advances in Membrane and Materials Characterization

2:00 pm - 5:00 pm  |  Kings Garden 5

Co-Chairs: Wei-yi Li (School of Environment Science and Engineering), Maria-Chiara Ferrari (The University of Edinburgh), Chuyang Tang (University of New South Wales)

2:00 pm  WEDNESDAY
29a - A novel method to distinguish between crystal and defect transport in zeolite membranes
David Carter (University of Ottawa), Shaaima Al Akwaa (University of Ottawa), Boguslaw Kruczek (University of Ottawa)*, Handan Tezel (University of Ottawa)

2:30 pm  WEDNESDAY
29b - Study on antifouling behaviors of GO modified nanocomposite membranes through QCMD and surface energetics analysis
Amin Karkooti (University of Alberta), Neda Nazemifard (University of Alberta), Mohtada Sadrazadeh (University of Alberta)*

3:00 pm  WEDNESDAY
29c - 3D characterization of polyamide reverse osmosis membranes
Tyler E Culp (Penn State University)*, Manish Kumar (Penn State University), Enrique Gomez (Penn State University)

3:30 pm  WEDNESDAY
29d - Selective Ion Transport Properties of Membrane Materials
Anita Hill (Commonwealth Scientific and Industrial Research Organisation)*, Aaron Thornton (Commonwealth Scientific and Industrial Research Organisation), Cara Doherty (Commonwealth Scientific and Industrial Research Organisation)

4:00 pm  WEDNESDAY
29e - Membrane-based oil-gas separation for dissolved gas-in-oil extraction: gas transport properties of ceramic supported Teflon membranes
Liang-Chih Ma (Arizona State University)*, Chuan Chen (Global Energy Interconnection Research Institute Co., Ltd.), Jerry Lin (Arizona State University)

4:30 pm  WEDNESDAY
29f - Porous support of TFC membranes: Does it truly have negligible resistance?
Masoud Aghajani (University of Colorado Boulder)*, Alan R. Greenberg (University of Colorado Boulder), Yifu Ding (University of Colorado Boulder)

#30 Processes: Fundamentals of Predicting and Preventing Membrane Fouling

2:00 pm - 5:00 pm  |  Kings Garden 4

Co-Chairs: Manish Kumar (Penn State University), Davide Mattia (University of Bath), Saifur Rahaman (Concordia University)

2:00 pm  WEDNESDAY
30a - Numerical and experimental studies on the deposition of sticky particles near a membrane surface
Seon Yeop Jung (Seoul National University)*, Kyung Hyun Ahn (Seoul National University)

2:30 pm  WEDNESDAY
30b - Characterization of the Striping Phenomenon during Membrane Fouling via Optical Coherence Tomography
Weiyi Li (Southern University of Science and Technology)*, Xin Liu (Southern University of Science and Technology), Anthony Fane (Singapore Membrane Technology Centre)

3:00 pm  WEDNESDAY
30c - A closer look at biofouling: time-lapse optical microscopy of biofilm formation in wastewater reuse
Emily W Tow (Olin College)*, Behzad Rad (Lawrence Berkeley National Laboratory), Robert Kostecki (Lawrence Berkeley National Laboratory)
### ORAL SESSIONS

**3:30 pm WEDNESDAY**

**30d - Improved graphene oxide membrane increases membrane distillation desalination of RO concentrate**  
Samuel Olatunji (Texas A&M University-Kingsville), Lucy M Camacho (Texas A&M University-Kingsville)*

**4:00 pm WEDNESDAY**

**30e - Automated real-time membrane biofouling assessment using microbial enzyme activity**  
Babar K Khan (King Abdullah University of Science and Technology)*, Luca Fortunato (King Abdullah University of Science and Technology), TorOve Leiknes (King Abdullah University of Science and Technology)

**4:30 pm WEDNESDAY**

**30f - Interactions between extracellular polymeric substances and zwitterionic hydrogels as a designing tool for antifouling surfaces**  
Angelin Ida Vedhamianickam (Ben-Gurion University of the Negev)*, Nir Goldberg (Ben-Gurion University of the Negev), Ronit Bitton (Ben-Gurion University of the Negev), Moshe Herzberg (Ben-Gurion University of the Negev)

### #31 Applications: Purification of Non-Protein Biologics

**2:00 pm - 5:00 pm | Kings Garden 3**

**Co-Chairs:** James McGrath (University of Rochester), Onur Kas (MilliporeSigma)

**2:00 pm WEDNESDAY**

**31a - Optimizing Microfluidic Nanoparticle Capture from Biofluids on Ultrathin Silicon Nanomembranes: A Computational and Experimental Analysis of Tangential Flow Analyte Capture (TFAC)**  
Kilean Lucas (University of Rochester)*, Danial Ahmad (University of Rochester), Mehdii (Aslan) Dehghani (Rochester Institute of Technology), Thomas Gaborski (Rochester Institute of Technology), Richard Waugh (University of Rochester), James McGrath (University of Rochester)

**2:30 pm WEDNESDAY**

**31b - Development and scale-up of laterally-fed membrane chromatography for the purification of therapeutic viruses**  
Karina Kawka (McMaster University)*, Pedram Madadkar (McMaster University), Shabnam Shoaebargh (McMaster University), Natasha Kazhdan (McMaster University), Maria Fe C. Medina (McMaster University), Brian Lichty (McMaster University), David Latulippe (McMaster University)

**3:00 pm WEDNESDAY**

**31c - Characterization of EV Secretion at Single Cell Resolution**  
Gerardo Mauleon Ramos (University of Chicago)*, Kilean Lucas (University of Rochester), Vladimir Riazanski (University of Chicago), James McGrath (University of Rochester), Deborah Nelson (University of Chicago)

**3:30 pm WEDNESDAY**

**31d - Charge, size distribution and hydrophobicity of viruses: Effect of the virus purification method**  
Hang Shi (Michigan State University), Vlad Tarabara (Michigan State University)*

**4:00 pm WEDNESDAY**

**31e - Risk Mitigation Strategies for the use of polymeric consumables for manufacturing of Anti-Sense Oligonucleotides**  
Anuradha Vaidya (Biogen), Bill Scott* (Biogen), Dave Kolwyck (Biogen)

**4:30 pm WEDNESDAY**

**31f - Use of Nanosphere Self-Assembly to Pattern Nanoporous Membranes for the Study of Extracellular Vesicles**  
Marcela Mireles (University of Rochester)*, Cody Soule (Rochester Institute of Technology), Mehdi Dehghani (Rochester Institute of Technology), Thomas Gaborski (Rochester Institute of Technology)
#32 Applications: Fuel Cells and Batteries

2:00 pm - 5:00 pm | Ballroom 3

Co-Chairs: Michael Guiver (Tianjin University), Mike Hickner (Penn State University), Peter Pintauro (Vanderbilt University)

2:00 pm WEDNESDAY
32a - A Holistic Approach to Explore Interfacially Confined Ionomers Designed for Energy Conversion Device
Shudipto K Dishari (University of Nebraska-Lincoln)*

2:30 pm WEDNESDAY
32b - Anion Conducting Membranes Based on Poly(norbornene): High Conductivity, Chemical Stability and Fuel Cell Performance >2.5 W/cm²
Mrinmay Mandal (Georgia Institute of Technology)*, Garrett Huang (Georgia Institute of Technology), Wanting Chen (Georgia Institute of Technology), Paul A Kohl (Georgia Institute of Technology)

3:00 pm WEDNESDAY
32c - High Temperature Fuel Cells with Ion-Pair Membranes and Phosphonated Ionomers
Michael R Hibbs (Sandia National Laboratories)*, Cy Fujimoto (Sandia National Laboratories), Ehren Baca (Sandia National Laboratories), Albert Lee (Los Alamos National Laboratory), Yu Seung Kim (Los Alamos National Laboratory)

3:30 pm WEDNESDAY
32d - High temperature, anhydrous proton conducting membranes and micropatterned bipolar membranes for electrochemical energy conversion and storage technologies
Christopher G Arges (Louisiana State University)*

4:00 pm WEDNESDAY
32e - Membrane through-plane alignment of ion-conducting channels
Xin Liu (Tianjin University), Yi Li (Tianjin University), Jiandang Xue (Tianjin University), Weikang Zhu (Tianjin University), Junfeng Zhang (Tianjin University), Yan Yin (Tianjin University), Michael D Guiver (Tianjin University)*

4:30 pm WEDNESDAY
32f - Novel sulfonated aromatic polymer membranes for breaking the proton selectivity-conductivity trade-off limitation in vanadium redox flow battery
Tongshuai Wang (University of Illinois, Chicago), JunYoung Han (Rensselaer Polytechnic Institute), Kihyun Kim (Rensselaer Polytechnic Institute), Andreas Muenchinger (Max-Planck-Institute for Solid State Research), Klaus-Dieter Kreuer (Max-Planck-Institute for Solid State Research), Chulsung Bae (Rensselaer Polytechnic Institute), Sangil Kim (University of Illinois, Chicago)*
Poster Presentations

Poster Session Chairs
Prity Bengani-Lutz (Repligen Corp) plutz@repligen.com
Ramesh R Bhave (Oak Ridge National Lab) bhaverr@ornl.gov
Yuexiao Shen (Uni of California Berkeley) syxbach@gmail.com

Presenting authors are indicated by an asterisk*. See the most up-to-date version of the program with abstracts at nams2019.org or via the Attendify (NAMS 2019) app.

SESSION A - Innovation in Bio-Inspired and Bio-Applied Membranes

A1 High-Capacity Multimodal Anion-Exchange Membranes for Purification of Biologics, Joshua Osuofa (Clemson University)*; Scott Husson (Clemson University)

A2 High throughput screening of ultra-filtration membranes with mixed dextrans in 96 well plate, Masha Khazan (Pall Corporation)*; James Hathcock (Pall Corporation); Jian Qiu (Pall Corporation)

A3 Impacts of Bio-inspired Zwitterionic Membranes for Health Care Applications, Yung Chang (R&D Center for Membrane Technology, CYCU)*

A4 Enhanced Membranes for Biogas Upgrading, Ning Shangguan (Compact Membrane Systems)*; Sudip Majumdar (Compact Membrane Systems); Kenneth Pennisi (Compact Membrane Systems)

A5 Monitoring of Membrane Fouling by the Zeta Potential, Thomas Luxbacher (Anton Paar GmbH)*; Hermina Buksek (University of Maribor); Irena Petrinic (University of Maribor); Elisa Innocenti (GSK Vaccines S.r.l.); Krzysztof Trzaskus (Aquaporin A/S); Maria Salud Camilleri-Rumbai (Aquaporin A/S)

A6 Tangential flow microfluidics for the capture and release of nanoparticles and extracellular vesicles on conventional and ultrathin membranes, Mehdi Dehghani (Rochester Institute of Technology)*; Kilean Lucas (University of Rochester); James McGrath (University of Rochester); Thomas Gaborski (Rochester Institute of Technology)

A7 Low-cost ultrathin porous polymeric membranes with precise control over pore size and thickness gradient for investigation of leukocyte transmigration through barrier models, Shayan Gholizadeh (Rochester Institute of Technology)*; Alec Salminen (University of Rochester); Zahra Allahyari (Rochester Institute of Technology); Robert Carter (Rochester Institute of Technology); Henry Chung (Rochester Institute of Technology); Marcela Mireles (University of Rochester); Thomas Gaborski (Rochester Institute of Technology)

A8 Application of Novel Multimodal Anion-exchange Membrane Chromatography Columns in a Two-step mAb Purification Scheme—Aggregates and HCP Removal, Daniel Henn (Purilogics, LLC)*; Anna Forsyth (Purilogics, LLC); Graham Temples (Purilogics, LLC); Jinxian Zhou (Purilogics, LLC); Scott Husson (Clemson University)

A9 Effect of Nanomembrane Orientation and Flow Modality on Benchtop Urea Clearance, Sam Walker (The State University of New York at Buffalo)*; Kayli Hill (University of Rochester); Alec Salminen (University of Rochester); Dean G Johnson (University of Rochester)

A10 Feed Spacer Modification for Listeria Control in Dairy Processing, Mainara Costa Teixeira (The University of Alabama)*; Preston Richier (The University of Alabama); Jake Colburn (The University of Alabama); Shelby Brooks (The University of Alabama); Will Baker (The University of Alabama); Thomas Hendrich (The University of Alabama); Ryan Summers (The University of Alabama); Stephen Ritchie (The University of Alabama)
A11 Critical Flux of Ultrathin Silicon Membranes in Tangential Flow Filtration of Protein Solutions, Danial Ahmad (University of Rochester)*; Kilean Lucas (University of Rochester); Mehdi (Aslan) Delghani (Rochester Institute of Technology); Thomas Gaborski (Rochester Institute of Technology); James McGrath (University of Rochester)

A12 Grafting Zwitterionic Polymer and Poly (amino acid) on Polyamide Membranes: "Defending and Attacking" Strategies for Biofouling Control, Wen Ma (Concordia University)*; Liuqing Yang (Concordia University); Saifur Rahaman (Concordia University)

A13 Monitoring of biological fluids with extraction membranes, Pinar Cay-Durgun (Arizona State University); Tianmiao Lai (Arizona State University); Nai-Yuan Liu (Arizona State University); Mark Sprowls (Arizona State University); Stewart Mann (Arizona State University); Leslie Thomas (Mayo Clinic in Arizona); Erica Forzani (Arizona State University); Mary Laura Lind (Arizona State University)*

A14 Fine-Tuned Biohybrid Polymeric Particles Mimicking Biological Compartmentalization Prepared by Membrane Emulsification, Emma Piacentini (National Research Council of Italy, Institute on Membrane Technology, CNR-ITM); Lidietta Giorno (National Research Council of Italy - Institute on Membrane Technology)*

A15 Bio-inspired immobilization of casein-coated silver nanoparticles on cellulose acetate ultrafiltration membranes: from laboratory to scale-up, Xiaobo Dong (University of Kentucky); Halle Shannon (University of Kentucky)*; Tequila Harris (Georgia Institute of Technology); Isabel Escobar (University of Kentucky)

A16 Surface-Specific Thermoresponsive Coating of Membranes, Marcela Mireles (University of Rochester)*; Cody Soule (Rochester Institute of Technology); Luis Delgadillo (University of Rochester); Thomas Gaborski (Rochester Institute of Technology)

A17 Pervaporation Separation of n-Butanol from Aqueous Solutions Using PDMS/Lignin Mixed Matrix Membranes, Ali Zamani (University of Ottawa); Handan Tezel (University of Ottawa)*; Jules Thibault (University of Ottawa)

A18 Rapid and Selective Water Permeation Across Biomimetic Membranes Through Artificial Water Channel Aggregates, Woochul Song (Penn State University)*; Ratul Chowdhury (Penn State University); Himanshu Joshi (University of Illinois at Urbana-Champaign); Joseph S. Najem (The University of Tennessee); Yue-xiao Shen (UC Berkeley); Chao Lang (Penn State University); Stephen Sarles (University of Tennessee); Jun-li Hou (Fudan University); Aleksei Aksimentiev (University of Illinois at Urbana-Champaign); Manish Kumar (Penn State University)

A19 Can porous membranes be engineered to induce physiologically relevant cell-substrate interactions?, Zahra Allahyari (Rochester Institute of Technology)*; Stephanie Casillo (Rochester Institute of Technology); Shayan Gholizadeh (Rochester Institute of Technology); Henry Chung (Rochester Institute of Technology); Thomas Gaborski (Rochester Institute of Technology)

A20 High Productivity Harvest - Intensify Harvest and Displace Depth Filtration in Fed-Batch Cell Culture, Shashi Kudugunti (Repligen Corporation)*, Jyoti Amatya (Repligen Corporation), Jamie Peyser (Repligen Corporation)

A21 Membrane Filtration of Flexible Particles: Rejection of Single Stranded DNA, Hossein Nouri Alavijeh (Clarkson University)*; Ruth E. Baltus (Clarkson University)
SESSION B - Innovation in Membrane Materials, Synthesis, and Characterization: Gases

B1 Covalently modified graphene oxide incorporated in PIM-1 mixed matrix thin film composite membranes for gas separation, Elvin Aliyev (Helmholtz-Zentrum Geesthacht)*; Volkan Filiz (Helmholtz-Zentrum Geesthacht); Sergey Shishatskiy (Helmholtz-Zentrum Geesthacht)

B2 Tunable Interlayer Channels in Graphene Oxide Membranes for Molecular Separations, Shaofei Wang (King Abdullah University of Science and Technology)*; Zhongyi Jiang (Tianjin University); Michael D Guiver (Tianjin University); Suzana Nunes (King Abdullah University of Science and Technology)

B3 Nanoporous two-dimensional nanosheets and their self-assembled gas-sieving membranes, Kumar Varoon Agrawal (École polytechnique fédérale de Lausanne)*; Mostapha Dakhchoune (École polytechnique fédérale de Lausanne); Luis Francisco Villalobos (École polytechnique fédérale de Lausanne)

B4 Thermally Rearranged Semi-interpenetrating Polymer Networks (TR-SIPNs) for Olefin/Paraffin Separation Applications, Won Hee Lee (Hanyang University)*; Young Moo Lee (Hanyang University); Jong Geun Seong (Hanyang University); Ho Hyun Wang (Hanyang University); Sun Ju Moon (Hanyang University)

B5 Design of new polymeric materials for membrane gas-separation based on norbornenes bearing hydrocarbonic groups, Alyona Wozniak (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Evgeniya Bermesheva (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Danila Bakhtin (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Ilya Borisov (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Alexey Volkov (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Eugene Finkelstein (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Maxim Bermeshev (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences)*

B6 Cake layer characterization in Activated Sludge Membrane Bioreactor: Real-time analysis, Luca Fortunato (King Abdullah University of Science and Technology)*; TorOve Leiknes (King Abdullah University of Science and Technology)

B7 Facilitated Transport Membrane for CO₂ Capture from Flue Gas: Module Fabrication and Scale-Up, Kai Chen (Ohio State University)*; Witopo Salim (Ohio State University); Yang Han (Ohio State University); Dongzhu Wu (Ohio State University); Winston Ho (Ohio State University)

B8 Interfacial phenomenon-driven hierarchical structuring of hard templated asymmetric ultrathin carbon molecular sieves films, Megha Sharma (Lehigh University)*; Mark Snyder (Lehigh University)

B9 Layer-by-Layer Assembled Metal Organic Framework Nanosheets with Polymer, Christy Koerner (U.S. Department of Energy National Energy Technology Laboratory)*; Fangming Xiang (U.S. Department of Energy National Energy Technology Laboratory); Eric Popczun (U.S. Department of Energy National Energy Technology Laboratory); David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory)

B10 Highly oxygen-rich rubbery polymers for membrane CO₂/CH₄ separation, Krysta Clark (The State University of New York at Buffalo)*; Junyi Liu (Air Liquide. Inc); Gengyi Zhang (The State University of New York at Buffalo); Haiqing Lin (The State University of New York at Buffalo)

B11 Adsorptive and Destructive Mixed Matrix Membranes for Chemical Protection, Yufeng Song (New Jersey Institute of Technology)*; John Chau (New Jersey Institute of Technology); Kamalesh K Sirkar (New Jersey Institute of Technology); Gregory Peterson (U.S. Army Edgewood Chemical Biological Center); Uwe Beuscher (W.L. Gore & Associates Inc.)

B12 Maximizing Ether Oxygen Content in Polymers for Membrane CO₂ Removal from Natural Gas, Junyi Liu (American Air Liquide. Inc)*; Gengyi Zhang (The State University of New York at Buffalo); Krysta Clark (The State University of New York at Buffalo); Haiqing Lin (The State University of New York at Buffalo)
B13 Novel CO₂ gas separation membranes prepared by chemical modification of highly permeable polymers, Eugenia Mariana Sandru (SINTEF AS); Arpenik Kroyan (Norwegian University of Science and Technology); Nebosja Simic (Norwegian University of Science and Technology); Jing Deng (Norwegian University of Science and Technology); Liyuan Deng (Norwegian University of Science and Technology); Marius Sandru (SINTEF AS)*

B14 Intrinsically Microporous Pentamethylene-based Polymers for Enhanced Gas Separation Performance and Physical Aging Resistance, Tanner Corrado (University of Notre Dame)*; Ruilan Guo (University of Notre Dame)

B15 Structural Designs of Cross-linked Polymer Network and Ionic Liquids for lon Gel Gas Separation Membranes, Victor A Kusuma (U.S. Department of Energy National Energy Technology Laboratory)*; James S Baker (U.S. Department of Energy National Energy Technology Laboratory); Megan Macala (U.S. Department of Energy National Energy Technology Laboratory); Samir Budhathoki (U.S. Department of Energy National Energy Technology Laboratory); David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory)

B16 Scalable hydrogen-bonded polyimide/metal-organic framework hybrid membranes for ultra-fast separations of multiple gas pairs, Canghai Ma (Lawrence Berkeley National Laboratory)*; Jeffrey Urban (Lawrence Berkeley National Laboratory)

B17 Performance Testing of Polyphosphazene-Based Membranes for Post-combustion Carbon Capture with Humidified Gas, Zi Tong (U.S. Department of Energy National Energy Technology Laboratory)*; David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory); Victor A Kusuma (U.S. Department of Energy National Energy Technology Laboratory)

B18 Systematic Optimization of MOF-based Mixed-Matrix Membranes: Surface Functionalization, Particle Size, and Loading, Patrick Muldoon (Oak Ridge Institute for Science and Education)*

B19 Membrane heat exchanger for novel heat recovery in post-combustion carbon capture, Shuaifei Zhao (Dalian Maritime University)*; Shuiping Yan (Huazhong Agricultural University); Qiufang Cui (Huazhong Agricultural University)

B19 High temperature gas separation properties of sub-micron polybenzimidazole membranes, Melanie M Merrick (The University of Texas at Austin)*; Benny Freeman (The University of Texas at Austin)

B20 CANAL Ladder Polymers for Membrane Gas Separation, Holden W. H. Lai (Stanford University)*; Francesco Benedetti (University of Bologna); Zach Smith (MIT); Yan Xia (Stanford University)

B21 Fabrication of CO₂ selective miscible polyimide blend membranes for gas separation applications, Chamaal Karunaweera (The University of Texas at Dallas)*; John Ferraris (The University of Texas at Dallas); Kenneth Balkus, Jr. (The University of Texas at Dallas); Inga Musselman (The University of Texas at Dallas); Samitha Panangala (The University of Texas at Dallas); Shahed Haghiri (The University of Texas at Dallas)

B22 On development of constant-volume permeation system for monitoring upstream pressure decay, Haoyu Wu (University of Ottawa)*; Jules Thibault (University Ottawa); Boguslaw Kruczek (University of Ottawa)

B23 Two-dimensional-material mixed-matrix membranes for gas separation, Gongping Liu (Nanjing Technical University)*

B24 Synthesis of crosslinked polyether-based membranes for gas separations, Malgorzata Chwatko (The University of Texas at Austin)*; Christina Rodriguez (The University of Texas at Austin); Caitlin Bentley (The University of Texas at Austin); Nathaniel Lynd (The University of Texas at Austin); Benny Freeman (The University of Texas at Austin)

B25 Novel polyimides with bulky tert-butyl and fluorine-containing side groups: gas permeation parameters and free volume, Susanta Banerjee (Indian Institutes of Information Technology); Nikolay Belov (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Roman Nikiforov (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Mikhail Mazo (Institute of Chemical Physics, Russian Academy of Sciences); Ivan Strelnikov (Institute of Chemical Physics, Russian Academy of Sciences); Yury P Yampolskii (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences)*
B26 New mixed matrix composite membrane PEBAX based membrane incorporated with metal organic framework for CO₂ separation, Tarik Eljaddi (Laboratoire Réactions et Génie des Procédés)*; Julien Bouillon (Normandie University); Laurent Lebrun (Normandie University)

B27 Dual-Layer MOF Composite Membranes with Tunable Gas Transport Properties for Post-combustion CO₂ Separation, Sameh K Elsaidi (U.S. Department of Energy National Energy Technology Laboratory)*; David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory); Suresh Venna (U.S. Department of Energy National Energy Technology Laboratory); Mona Mohamed (University of Pittsburgh)

B28 Performance of Pd-Based Membranes and Effects of Various Gas Mixtures on H₂ Permeation, Kourosh Kian (Worcester Polytechnic Institute)*

SESSION C - Innovation in Membrane Materials, Synthesis, and Characterization: Liquids

C1 Layer-by-layer modification of aliphatic polyamide anion-exchange membranes to increase chloride/sulfate selectivity, Muhammad Ahmad (University of Notre Dame)*; Chao Tang (University of Notre Dame); Liu Yang (University of Notre Dame); Andriy Yaroshchuk (Polytechnic University of Catalonia); Merlin Bruening (University of Notre Dame)

C2 Development of electrically conductive hollow fiber membranes, Melissa J Larocque (McMaster University)*, David R Latulippe (McMaster University), Charles-François de Lannoy (McMaster University)

C3 Structure Formation in Isoporous Hollow Fiber Membranes: An In Situ SAXS study, Kirti Sankhala (Helmholtz-Zentrum Geesthacht)*; D. C. Florian Wieland (Helmholtz-Zentrum Geesthacht); Joachim Koll (Helmholtz-Zentrum Geesthacht); Maryam Radjabian (Helmholtz-Zentrum Geesthacht); Clarissa Abetz (Helmholtz-Zentrum Geesthacht); Volker Abetz (Helmholtz-Zentrum Geesthacht)

C4 Microscopic membrane fouling characterization, Nandini Debnath (University of Alberta); Aloke Kumar (Indian Institute of Science); Thoams Thundat (The State University of New York at Buffalo); Mohtada Sadrzadeh (University of Alberta)*

C5 New Insights into the Impact of Nano-scale Surface Heterogeneity on the Wettability of Polymeric Membranes, Md Farhad Ismail (University of Alberta); Behnam Khorshidi (University of Alberta); Mohtada Sadrzadeh (University of Alberta)*

C6 A comparison of water and solute transport in ion exchange and desalination polymers, Ryan Kingsbury (Membrion, Inc.); Jingbo Wang (UCLA); Mikayla D Armstrong (University of North Carolina at Chapel Hill)*; Orlando Coronell (University of North Carolina at Chapel Hill)

C7 Water permeation through nanoporous particles in thin film nanocomposite membranes, Pinar Cay-Durgun (Arizona State University)*; Mary Laura Lind (Arizona State University)

C8 Printing Membranes: Enabling the Use of Both Conventional and Novel Polymers in High Performance Membranes, Jeffrey R McCutcheon (University of Connecticut); Ayse Asatekin (Tufts University); Maqsud Chowdhury (University of Connecticut); Xin Qian (University of Connecticut); Tulasi Ravindran (University of Connecticut)*; Samuel Loudner (Tufts University)

C9 Functionalization of PVDF Membranes with Thiol Groups for Heavy-Metal Capture, Ronald Vogler (University of Kentucky)*; Md. Saiful Islam (University of Kentucky); Evan Hatakeyama (Chevron Energy Technology Company); DB Bhattacharyya (University of Kentucky)

C10 Pure and mixed fluid sorption and transport in Celazole® polybenzimidazole: the effect of plasticization, Kelly P Bye (University of Oklahoma); Michele Galizia (University of Oklahoma)*

C11 Enhanced Water Interaction and Antifouling Compatible Zwitterion-PVDF Membrane Designs, Mahboobeh Maghami (University of Saskatchewan); Amira Abdelrasoul (University of Saskatchewan)*
<table>
<thead>
<tr>
<th>Posters ID</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>C12</td>
<td>Novel strategy to develop a composite membrane for desalination by membrane distillation</td>
<td>Tarik Eljaddi (Laboratoire Réactions et Génie des Procédés - UMR 7274)*; Deisy Mejia Mendez (Laboratoire Réactions et Génie des Procédés - UMR 7274); Eric Favre (Laboratoire Réactions et Génie des Procédés - UMR 7274); Denis Roizard (Laboratoire Réactions et Génie des Procédés - UMR 7274)</td>
</tr>
<tr>
<td>C13</td>
<td>One-Step Tailoring Surface Roughness and Surface Energy to Prepared Superhydrophobic Polyvinylidene Fluoride (PVDF) Membranes for Enhanced Membrane Distillation Performances</td>
<td>Weihua Qing (The University of Hong Kong)*; Xiaonian Shi (New Jersey Institute of Technology); Chuyang Tang (University of New South Wales)</td>
</tr>
<tr>
<td>C14</td>
<td>High-Performance Thin Film Composite (TFC) Membranes: Design Consideration Underneath the Polyamide Thin Film</td>
<td>Wangxi Fang (Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences)*; Jian Jin (Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences); Rong Wang (Singapore Membrane Technology Centre, Nanyang Technological University)</td>
</tr>
<tr>
<td>C15</td>
<td>Wafer-Scale, Vertically-Aligned SWCNT Composite Membranes for Nanofiltration</td>
<td>Melinda L Jue (Lawrence Livermore National Laboratory)*; Chiatai Chen (Cornell University); Steven Buchsbaum (Lawrence Livermore National Laboratory); Eric Meshot (Lawrence Livermore National Laboratory); Sei Jin Park (Lawrence Livermore National Laboratory); Kuang Jen Wu (Lawrence Livermore National Laboratory); Francesco Fornasiero (Lawrence Livermore National Laboratory)</td>
</tr>
<tr>
<td>C16</td>
<td>Vapor Phase Infiltration of Metal Oxides into Microporous Polymers for Solvent Stable Nanofiltration Membranes</td>
<td>Fengyi Zhang (Georgia Institute of Technology)*; Emily McGuinness (Georgia Institute of Technology); Yao Ma (Georgia Institute of Technology); Mark Losego (Georgia Institute of Technology); Ryan Lively (Georgia Institute of Technology)</td>
</tr>
<tr>
<td>C17</td>
<td>Understanding the Interlayer-spacing and Mass Transport Nexus of Graphene Oxide Membrane for Organic Solvent Nanofiltration</td>
<td>Sunxiang Zheng (UC Berkeley)*; Baoxia Mi (UC Berkeley);</td>
</tr>
<tr>
<td>C18</td>
<td>Organic-inorganic hybrid separation membrane having high chemical tolerance</td>
<td>Koichi Takada (TORAY Industries, Inc.)*; Takahiro Tokuyama (TORAY Industries, Inc.); Hiroki Minehara (TORAY Industries, Inc.); Takafuli Ogawa (TORAY Industries, Inc.); Masahiro Kimura (TORAY Industries, Inc.)</td>
</tr>
<tr>
<td>C19</td>
<td>Magnetron Sputtering-based Synthesis of Pd film on UF membrane support for environmental catalysis</td>
<td>Michael J Detisch (University of Kentucky)*; DB Bhattacharyya (University of Kentucky); John Balk (University of Kentucky)</td>
</tr>
<tr>
<td>C20</td>
<td>Influences of polymeric additives in different solvent systems on membrane performance and fouling resistance</td>
<td>Catharina Kahrs (Leibniz University Hannover)*; Jan Schwellenbach (Sartorius Stedim Biotech GmbH)</td>
</tr>
<tr>
<td>C21</td>
<td>Porous membranes with synergetic solvent and thermal resistance from polyoxindole derivatives</td>
<td>Bruno Pulido Ponce de Leon (King Abdullah University of Science and Technology)*; Suzana Nunes (King Abdullah University of Science and Technology)</td>
</tr>
<tr>
<td>C22</td>
<td>Functionalized random zwitterionic copolymers as chlorine- and fouling-resistant nanofiltration membranes</td>
<td>Samuel J Lounder (Tufts University)*; Ayse Asatekin (Tufts University)</td>
</tr>
<tr>
<td>C23</td>
<td>Deterioration of nanofiltration polyamide membrane by strong acid and its mechanism</td>
<td>Byung-Moon Jun (University of South Carolina); Hyung Kae Lee (Ulsan National Institute of Science and Technology); Young-Nam Kwon (Ulsan National Institute of Science and Technology)*</td>
</tr>
<tr>
<td>C24</td>
<td>Opening new doors: Epoxides as novel chemistry for interfacial polymerization</td>
<td>Rhea Verbeke (Katholieke Universiteit Leuven)*; Marijn Seynaeve (Katholieke Universiteit Leuven); Wouter Arts (Katholieke Universiteit Leuven); Elke Dom (Katholieke Universiteit Leuven); Ivo Vankelecom (Katholieke Universiteit Leuven)</td>
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<tr>
<td>C25</td>
<td>Solution-diffusion with ion association: a non-mean-field model that successfully describes NF of multi-ion mixtures</td>
<td>Viatcheslav Freger (Technion - Israel Institute of Technology)*</td>
</tr>
<tr>
<td>C26</td>
<td>Relative permittivity properties of hydrated polymer membranes for desalination applications</td>
<td>Kevin Chang (University of Virginia)*; Hongxi Luo (University of Virginia); Geoffrey M Geise (University of Virginia)</td>
</tr>
</tbody>
</table>
C27 Multi-solute transport behavior of aqueous mixtures through polyether-based membranes, Jung Min Kim (Auburn University)*; Bryan S Beckingham (Auburn University)

C28 Comparative analysis of novel covalent organic framework nanofiltration membranes synthesis, composition, thickness and substrate dependence, Gabrielle Levato (University of Illinois at Urbana-Champaign)*; David Burke (Northwestern University); Zhiwei Jiang (Imperial College London); Daniel Mosiman (University of Illinois at Urbana-Champaign); William Dichtel (Northwestern University); Andrew Livingston (Imperial College London); Benito Marinas (University of Illinois at Urbana-Champaign)

C29 Copper-MOF Functionalized Nanofiltration Membranes for Enhanced Dye Removal: Effects of Dip-Coating and In-Situ Modification Techniques, Mostafa Dadashi Firouzjaei (University of Alabama); Zane Joseph Parkerson (University of Alabama); Milad Rabbani Esfahani (University of Alabama)*

C30 Advancing Conductivity-Permselectivity Tradeoff of Ion-Exchange Membranes with Sulfonated CNT Nanocomposites, Hanqing Fan (Columbia University)*; Yuxuan Huang (Columbia University); Ngai Yin Yip (Columbia University)

C31 Ceramic-supported thin film composite membrane for organic solvent reverse osmosis, Mi Zhang (University of Connecticut)*; Lingling Xia (University of Connecticut); Jeffrey R McCutcheon (University of Connecticut); Marcus Weyd (Fraunhofer-Institut für Keramische Technologien und Systeme)

C32 Dynamic FO tests of commercial low pressure RO TFC membrane, Du Bai (University of Ottawa); Farhad Asempour (University of Ottawa); Boguslaw Kruczek (University of Ottawa)*

C33 New generation recycled polystyrene membranes for industrial water purification using membrane distillation, Machawe M Motsa (University of South Africa)*; Bhekie Mamba (University of South Africa)

C34 Advanced supported ionic liquid (SIL) membranes for Pi electron cloud mediated separation of aromatics, Mahmood Jebur (University of Arkansas); Arijit Sengupta (University of Arkansas); Ranil Wickramasinghe (University of Arkansas)*

C35 Graphene Oxide Membranes for Selective Molecular Separation of Lignin Model Compounds, Ashish Aher (University of Kentucky)*; DB Bhattacharyya (University of Kentucky)

C36 High Flux and Anti-fouling Electrospun Nylon 6 Ultrafiltration Membrane Coated with GO/N-carboxyethylchitosan (NCECS) Functionalized Polyvinyl Alcohol Hydrogel, Liuqing Yang (Concordia University)*; Tiantian Chen (Concordia University); Zhibin Ye (Concordia University); Benoit Barbeau (Polytechnique Montreal); Saifur Rahaman (Concordia University)

C37 Development and Characterization of nZVI/TiO2 Supported Membranes for Photocatalytic Treatment of 1,4-Dioxane in Water, Larissa L. S. Silva (Federal University of Rio de Janeiro)*; Wael Abdelraheem (University of Cincinnati); Minghao Kon (University of Cincinnati); Mallikarjuna Nadagouda (Wright State University); Ana Maria Rocco (Federal University of Rio de Janeiro); Cristiano Borges (Federal University of Rio de Janeiro); Fabiana Fonseca (Federal University of Rio de Janeiro); Dionysios Dionysiou (University of Cincinnati)

C38 Oxone Mediated TEMPO-Oxidized Nanocellulose Form-I and Form-II: Materials, Membranes and Modeling, John P Moore (University of Arkansas)*

C39 Facile Fabrication of Amphiphobic Nanocomposite Membranes for Application in Membrane Distillation, Tiantian Chen (Concordia University); Liuqing Yang (Concordia University); Saifur Rahaman (Concordia University)*

C40 Graphene Oxide Nanoplatelets Embedded Polyamide Thin Films for Water Desalination, Mahsa Abbaszadeh (Mississippi State University)*; Santanu Kundu (Mississippi State University)

C41 Development of Isoporous 0.2 Micron Nanoslit Silicon Nitride Membranes for Sterile Filtration of Biological Therapeutics, Evan Wright (McMaster University), Joshua Miller (Simpore), Andrew Gosselin (Simpore), Jared Carter (Simpore), James McGrath (University of Rochester), David Latulippe (McMaster University), James Roussie (Simpore)*
**SESSION D - Innovation in Membranes for Energy Applications**

**D1** A membrane to separate light olefins and paraffins; an update on pilot trials, module design and C4 separations, Ken Loprete (Compact Membrane Systems)*; Bill Charlton (Compact Membrane Systems); Hannah Murnen (Compact Membrane Systems); Kenneth Pennisi (Compact Membrane Systems); Sudip Majumdar (Compact Membrane Systems)

**D2** Cross-linked Polyethyleneimine (XLPEI) with superior H2/CO2 separation properties, Sankhajit Pal (The State University of New York at Buffalo)*; Weiguang Jia (The State University of New York at Buffalo); Haiqing Lin (The State University of New York at Buffalo)

**D3** Self-Cleaning Nanocomposite Membranes with Phosphorene-Based Pore Fillers for Water Treatment, Joyner Eke (University of Kentucky)*; Isabel Escobar (University of Kentucky)

**D4** Scale-up of A Catalytic Membrane Reactor for the Production of 5-Hydroxymethylfurfural from Lignocellulosic Biomass, Tammy Patra (University of Arkansas); Robert Beitle (University of Arkansas); Richard J. Ciora, Jr. (Media and Process Technology, Inc.); Ranil Wickramasinghe (University of Arkansas); Xianghong Qian (University of Arkansas)*

**D5** Thin-Film Composite Hollow Fiber Membrane for Post-Combustion Carbon Capture, Shouliang Yi (U.S. Department of Energy National Energy Technology Laboratory)*; James S Baker (U.S. Department of Energy National Energy Technology Laboratory); Ali Sekizkardes (Battelle/L.S. Department of Energy National Energy Technology Laboratory); Surendar Venna (U.S. Department of Energy National Energy Technology Laboratory); Victor A Kusuma (U.S. Department of Energy National Energy Technology Laboratory); Lingxiang Zhu (U.S. Department of Energy National Energy Technology Laboratory); Hyuk Kwon (U.S. Department of Energy National Energy Technology Laboratory); David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory); Kevin Resnik (U.S. Department of Energy National Energy Technology Laboratory)

**D6** Salinity gradient heat engine: optimising reverse electrodialysis for thermal-to-electric, Anna Hulme (Cranfield University)*

**D7** Use of desalination brine for low-energy concentration of orange juice via forward osmosis, Haley D White (Tennessee Technological University)*; Leif Templeton (Tennessee Technological University); Shelby Jones (Tennessee Technological University); Laura H Arias Chavez (Tennessee Technological University)

**D8** High-performance SSZ-13 membranes for CO2 and N2 removals from natural gas, Rongfei Zhou (Nanjing Technical University)*; Xinping Li (Nanjing Technical University); Bin Wang (Nanjing Technical University)

**D9** Highly efficient CO2 capture by mixed matrix membranes containing three-dimensional covalent organic framework fillers, Youdong Cheng (National University of Singapore)*; Dan Zhao (National University of Singapore)

**D10** Industrially relevant membrane testing and novel mixed-matrix membranes for a brighter membrane future, Raymond Thür (Katholieke Universiteit Leuven)*

**D11** Torlon® Hollow Fiber Membranes for Organic Solvent Reverse Osmosis separation of Complex Aromatic Hydrocarbon Mixtures, Hye Youn Y Jang (Georgia Institute of Technology)*; Ryan Lively (Georgia Institute of Technology); JR Johnson (ExxonMobil); Dhaival Bhandari (ExxonMobil)

**D12** Performance Investigation of Polymer Derived Ceramic Composite Membrane in Microbial Fuel Cell (MFC), Vignesh Ahilan (University of Bremen)*; Camila Cabral de Barros (University of Bremen); Gourav Dhar Bhowmick (Indian Institute of Technology); Makarand M Ghangrekar (Indian Institute of Technology); Michaela Wilhelm (University of Bremen); Kurosch Rezwan (University of Bremen)
D13 PIM-1 based polymeric blend membranes for gas separation applications, Ashley Miles (Oak Ridge Associated Universities/U.S. Department of Energy National Energy Technology Laboratory); Ali Sekizkardes ( Battelle/U.S. Department of Energy National Energy Technology Laboratory); Janice Steckel (U.S. Department of Energy National Energy Technology Laboratory); David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory)

D14 The dynamic fate of Organic micro-pollutants in MBR and their accumulation in fish tissue, Gal Dagan (Ben-Gurion University of the Negev); Inbal Zaibel (Ben-Gurion University of the Negev); Dina Zilberg (Ben-Gurion University of the Negev); Moshe Herzberg (Ben-Gurion University of the Negev)

D15 Improving H₂ Utilization of Solid Oxide Fuel Cell Using CO₂-Selective Membrane, Kai Chen (Ohio State University); Witopo Salim (Ohio State University); Yang Han (Ohio State University); Mike Gasda (Bloom Energy Corporation); Winston Ho (Ohio State University)

D16 Adapting a Blood CO₂ Removal Device for CO₂ Removal from Flue Gas, Katherine Hornbostel (University of Pittsburgh)

D17 Experimental study of dehumidification potential of PDMS hollow fiber membrane for HVAC applications, Michelle K Croal (Oakland University); Jonathan Maisonneuve (Oakland University)

D18 The Perfluoropolymer Upper Bound, Albert Wu (MIT); James Drayton (MIT); Zach Smith (MIT)

D19 Synthesis and characterization of catalytic PtNa-PdAu membranes for hydrogen production, Ana M Tarditi (Instituto de Investigaciones en Catálisis y Petroquímica); Laura Cornaglia (Instituto de Investigaciones en Catálisis y Petroquímica); Yohana Martínez Galeano Instituto de Investigaciones en Catálisis y Petroquímica)

D20 Hybrid facilitated transport membranes containing 2D GO-based nanoplatelets and scaffolds for CO₂ separation, Saravanan Janakiram (Norwegian University of Science and Technology); Juan Luis Martín Espejo (Norwegian University of Science and Technology); Zhongde Dai (Norwegian University of Science and Technology); Luca Ansaloni (SINTEF Industry); Liyuan Deng (Norwegian University of Science and Technology)

D21 Current Efforts in Harvesting Algae At-Scale For Biofuels to Meet the Dual Energy Challenge, Mark A Deimund (ExxonMobil Research and Engineering)

D22 Atomically-Ordered Intermetallic Hydrogen Separation Membranes, Casey O’Brien (University of Notre Dame)

D23 Molten Hydroxide Dual-Phase Membranes for Intermediate-temperature Fuel Cells, Vedasri Vedharathinam (Lawrence Livermore National Laboratory); Anna Ivanovskaya (Lawrence Livermore National Laboratory); Maira Ceron Hernandez (Lawrence Livermore National Laboratory); Patrick Campbell (Lawrence Livermore National Laboratory)

D24 High-Yield Recovery of Dissolved Methane Using Omniphobic Membranes, Xuesong Li (University of British Columbia); Abhishek Dutta (University of British Columbia); Giron Dong (Fibracast); Sasha Rollings-Scattergood (Anaergia); Jongho Lee (University of British Columbia)

D25 Aging minimization of CMSMs from the incorporation of copper pillars derived from metal organic polyhedra-18, Whitney Cosey (University of Texas at Dallas); Inga Musselman (University of Texas at Dallas); John Ferraris (University of Texas at Dallas); Kenneth Balkus (University of Texas at Dallas)

D26 (Cross-linked Poly(ionic liquid)-Ionic Liquid-Zeolite) Mixed-Matrix Membranes for CO₂/CH₄ Gas Separations Based on Curable Ionic Liquid Prepolymers, Collin A Dunn (University of Colorado Boulder); Zhangxing Shi (University of Colorado Boulder); Rongfei Zhou (Nanjing Technical University); Douglas Gin (University of Colorado Boulder); Richard Noble (University of Colorado Boulder)

D27 Integral hollow fiber membrane with chemical cross-linking for pressure retarded osmosis operated in the orientation of active layer facing feed solution, Ye Li (Nanyang Technological University); Rong Wang (Nanyang Technological University)
D28 GHG separation membrane application in KOGAS LNG regasification facilities, Kyung Taek Woo (Korea Gas Corporation)*; Hyun Seok You (Korea Gas Corporation); Jong Tae Chung (Korea Gas Corporation); Jae Dong Kim (Korea Gas Corporation)

D29 High performance electrochemical structures for power generation and oxygen separation, Ralph A Bauer (Global Research and Development Inc.)*

D30 Techno-economic comparison of RO and MD for small-scale brackish water desalination, Haamid S Usman (Concordia University)*; Khaled Touati (Concordia University); Saifur Rahaman (Concordia University)

D31 Tailor-made amphiphilic copolymer membranes for efficient gas and water vapor transport, Faheem Hassan Akhtar (King Abdullah University of Science and Technology)*; Klaus-Viktor Peinemann (King Abdullah University of Science and Technology)

D32 High-Temperature and High-Pressure Permeability-Selectivity Upper Bounds for Gas Separation Membranes Prepared From High Performance Polymers, Edson V Perez (The University of Texas at Dallas)*; Kenneth Balkus, Jr. (The University of Texas at Dallas); John Ferraris (University of Texas at Dallas); Inga Musselman (The University of Texas at Dallas)

D33 Synthesis and Characterization of Anion Exchange Membranes based on Semi-Crystalline Poly(Ethylene-block-Styrene-block-Ethylene) Triblock Copolymer, Carrie Trant (Rensselaer Polytechnic Institute)*; Chulsung Bae (Rensselaer Polytechnic Institute); Sangwoo Lee (Rensselaer Polytechnic Institute)

D34 Effect of Polyvinylamine Content on the CO₂ Separation Performance of Facilitated Transport Membranes, James S Baker (U.S. Department of Energy National Energy Technology Laboratory)*; Victor A Kusuma (U.S. Department of Energy National Energy Technology Laboratory); David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory)

D35 Effect of organic ballast properties on the energy efficiency of a concentration gradient flow battery, Fei Liu (University of North Carolina at Chapel Hill)*; Ryan Kingsbury (Membrion, Inc.); Jeromy Rech (University of North Carolina at Chapel Hill); Wei You (University of North Carolina at Chapel Hill); Orlando Coronell (University of North Carolina at Chapel Hill)

SESSION E - Innovation in Membranes for Water Treatment

E1 Feasibility of long-term treatment of malting wastewater in a submerged anaerobic membrane bioreactor (SAAnMBR) at psychrophilic temperature conditions, Esmat Maleki (Lakehead University)*; Baoqiang Liao (Lakehead University)

E2 Biofouling in ultrafiltration process for drinking water treatment and its control by chlorinated-water and pure water backwashing, Shao Senlin (The University of Hong Kong)*

E3 Membrane Distillation of High Salinity Water by Induction Heated Thermally Conducting Membranes, Avner Ronen (Temple University)*; Arezou Anvari (Temple University)

E4 Bromide Removal from Drinking Water Source Impacted by Energy Wastewater Discharge Using Electrically Conductive Membranes, Avner Ronen (Temple University)*; Mei Sun (University of North Carolina at Charlotte); Kartikeya Kekre (Temple University)

E5 A surface modification of forward osmosis (FO) membranes to enhance dye retention and fouling resistance for the treatment of textile wastewater, Sara Azari (Sterlitech)*; Mohammd Karimi (Amirkabir University of Technology)

E6 Evaluation of surface, bulk and electrochemical properties of Ti3C2Tx membranes used for selective ion removal from brine, Yousuf Z Bootwala (Georgia Institute of Technology)*; Wahiduz Zaman (Vanderbilt University); Kelsey Hatzell (Vanderbilt University); Marta Hatzell (Georgia Institute of Technology)
E7 Microwave-enhanced Membrane Filtration for Water Treatment, Wanyi Fu (New Jersey Institute of Technology)*; Wen Zhang (New Jersey Institute of Technology)

E8 Application of Nanofiltration (NF) Membranes for Perfluoroalkyl and Polyfluoroalkyl substances (PFAS) Removal, Daniel G Kulase (Michigan Technological University)*; Andre da Costa (Michigan Technological University); Ananya Ananya (Michigan Technological University); Sam Jacobs (Michigan Technological University)

E9 Development of membrane synthesis and novel draw materials for forward osmosis process, Yusak Hartanto (Katholieke Universiteit Leuven)*

E10 3D Printed Self-Assembled Zwitterionic Copolymer Membranes, Xin Qian (University of Connecticut)*; Samuel J Louder (Tufts University); Ayse Asatekin (Tufts University); Jeffrey R McCutcheon (University of Connecticut)

E11 Antifouling and Antiwetting Janus Membrane for Treating Hypersaline Oily Wastewater by Membrane Distillation, Chenxi Li (University of British Columbia); Xuesong Li (University of British Columbia); Xuewei Du (Colorado State University); Tiezheng Tong (Colorado State University); Tzahi Cath (Colorado School of Mines); Jongho Lee (University of British Columbia)*

E12 Treating Hydraulic Fracturing Produced Waters by Membrane Distillation, Ranil Wickramasinghe (University of Arkansas)*

E13 Synthesis of Polystyrene-b-poly(solketal methacrylate) (PS-b-PSMA) Polystyrene-b-poly(glyceryl methacrylate) (PS-b-PGMA) Block Copolymers for Isoporous Membranes, Sarah Saleem (Helmholtz-Zentrum Geesthacht); Sofia Rangou (Helmholtz-Zentrum Geesthacht); Clarissa Abetz (Helmholtz-Zentrum Geesthacht); Brigitte Lademann (Helmholtz-Zentrum Geesthacht); Volkan Filiz (Helmholtz-Zentrum Geesthacht)*; Volker Abetz (Helmholtz-Zentrum Geesthacht)

E14 Uranium isolation and concentration using reactive membranes for nuclear forensics applications, Abenazer W Darge (Clemson University); Timothy Devol (Clemson University); Scott Husson (Clemson University)*

E15 Development of Nano-enabled Membrane Technology for Water Reuse in Agriculture, Xingmao Ma (Texas A&M University); Yinghao Wen (Texas A&M University)*; Jieming Yuan (Texas A&M University)

E16 Detection of Electrically Conductive Membrane Fouling by Impedance Spectroscopy, Nan Zhang (McMaster University)*; Charles-François de Lannoy (McMaster University)

E17 Stability of Polyamide Nanofiltration Membranes with Peracetic Acid/Hydrogen Peroxide Disinfection, Mohsen Ghafari (State University of New York at Buffalo)*; Boya Xiong (MIT); Ning Dai (State University of New York at Buffalo)

E18 Fouling-Resistant Two-Dimensional (2D) Covalent Organic Framework Membranes for Industrial Water Reuse, Phuc Duong (University of Wyoming); Valerie Kuehl (University of Wyoming); Mohammad Afroz (University of Wyoming); John Hoberg (University of Wyoming); Bruce Parkinson (University of Wyoming); Katie D Li-Oakey (University of Wyoming)*

E19 Reduced-holy graphene oxide(r-HGO) membranes with enhanced water permeance for water purification, Xiaoyi Chen (The State University of New York at Buffalo)*; Liang Huang (The State University of New York at Buffalo); Zhihao Feng (The State University of New York at Buffalo); Janavi Gohil (The State University of New York at Buffalo); Haiqing Lin (The State University of New York at Buffalo)

E20 A Comparison of PolarClean, Gamma-Valerolactone and their Mixture as Bio-derived Solvents for Polysulfone Membrane Fabrication, Xiaobo Dong (University of Kentucky)*; Halle Shannon (University of Kentucky); Isabel Escobar (University of Kentucky)

E21 Filterability of crude oil emulsions stabilized by COREXIT 9500 dispersant, Seyma Kucuk (Michigan State University); Charifa Hejase (Michigan State University)*; Iryna Kolesnyk (National University of Kyiv-Mohyla Academy); Jia Wei Chew (Nanyang Technological University); Vlad Tarabara (Michigan State University)
E22 Functional membrane and water purification technology via laser-induced graphene on dense substrates and porous polymer membranes, Chidambaram Thamaraiselvan (Ben-Gurion University)* and Christopher J. Arnusch (Ben-Gurion University)

E23 New generation of patterned membranes for water treatment, Asad Asad (University of Alberta); Dan Sameoto (University of Alberta); Mohtada Sadrzadeh (University of Alberta)*

E24 Enhancing boron rejection on electrically conducting reverse osmosis membranes through local electrochemical pH modification, Bongyeon Jung (UCLA)*; David Jassby (UCLA)

E25 Cellulose Triacetate Membrane Parameter Estimation Under Osmotic and Osmotic-Assisted Process Conditions, Jacob L Weidman (U.S. Department of Energy National Energy Technology Laboratory/Oak Ridge Institute for Science and Education)*; Sara Osipi (Federal University of Rio de Janeiro); Alexander V Dudchenko (Carnegie Mellon University); Meagan S Mauter (Carnegie Mellon University); Nicholas Siefert (U.S. Department of Energy National Energy Technology Laboratory)

E26 Porous hydrophobic-hydrophilic composite flat and hollow fiber membranes for direct contact membrane distillation, Aishwarya Puranik (New Jersey Institute of Technology); Lydia Rodrigues (New Jersey Institute of Technology); John Chau (New Jersey Institute of Technology); Lin Li (New Jersey Institute of Technology); Kamalesh K Sirkar (New Jersey Institute of Technology)*; Ashok Sharma (Applied Membrane Technology Inc); Stephen Conover (Applied Membrane Technology Inc); Adam Juelfs (Applied Membrane Technology Inc); Connor Colling (Applied Membrane Technology Inc); Saket Sharma (Applied Membrane Technology Inc)

E27 Polyamide-imide: a new platform for fabrication of oil/water separation membranes, Nusrat Helali (University of Alberta); Masoud Rastgar (University of Alberta); Mohtada Sadrzadeh (University of Alberta)*

E28 Monolayer Graphene transfer onto polyvinyl alcohol (PVA) microfiltration membrane for water desalination, Mansour Saberi (Clemson University)*

E29 Membrane Distillation-Crystallization (MDC) for Maximum Water Recovery in Inland Desalination, Evangelos Balis (University of Nevada, Reno); Sage Hiibel (University of Nevada, Reno)*

E30 Insights regarding thermomechanical bonding between porous membranes and thermoplastic polymers, Masoud Aghajani (MAST Center, University of Colorado Boulder)*; Adrienne Blevins (University of Colorado Boulder); Jason P. Killgore (National Institute of Standards and Technology); Ryan Sylvia (MilliporeSigma); Christina Carbrello (MilliporeSigma); Alan R. Greenberg (MAST Center, University of Colorado Boulder); Rong Long (MAST Center, University of Colorado Boulder); Yifu Ding (MAST Center, University of Colorado Boulder)

E31 Ion exchange polymer coatings enhance solute rejection of polyamide thin-film composite membranes, Mikayla D Armstrong (University of North Carolina at Chapel Hill)*; Ryan Kingsbury (Membrion, Inc.); Kasia Grzebyk (University of North Carolina at Chapel Hill); Orlando Coronell (University of North Carolina at Chapel Hill)

E32 Mechanical behaviour of the porous support of TFC membranes and its influence on the overall resistance, Masoud Aghajani (University of Colorado Boulder)*; Alan R. Greenberg (University of Colorado Boulder); Yifu Ding (University of Colorado Boulder)

E33 Development of Membrane Distillation through Tuning Membrane Surface Properties and Module Design, Siamak Nejati (University of Nebraska-Lincoln)*; Mahdi Mohammadi (University of Nebraska-Lincoln); Mona Bavarian (University of Nebraska-Lincoln)

E34 Integration of Forward Osmosis in the Treatment of Sewage by Chlorella vulgaris: Comparison between External and Immersed Systems, Xue Jin (Oregon State University)*; Mathieu Larronde-Larretche (University of Glasgow)
E35  Nanoengineered condensation surfaces for air gap membrane distillation, Yashwant S. Yogi (Purdue University); Sina Nejati (Purdue University); Akshay K. Rao (Purdue University); Rishav Roy (Purdue University); Abhimanyu Das, Longnan Li (University of Illinois, Urbana-Champaign); Soumyadip Sett (University of Illinois, Urbana-Champaign); John Lienhard (MIT); Nenad Miljkovic (University of Illinois, Urbana-Champaign); Justin A. Weibel (Purdue University); Jaichander Swaminathan (Massachusetts Institute of Technology); David Warsinger (Purdue University)*

E36  Fouling of Anion Exchange Membranes in Ferric Chloride Solutions: mechanism and the role of ion exchange capacity, water content, and pore structure, Michael J. McGrath (University of Colorado Boulder)*; Nicholas Patterson (UC San Diego); Bryce Manubay (University of Colorado Boulder); Hans Funke (University of Colorado); Samantha Hardy (University of Colorado Boulder); Andrew Basalla (University of Colorado Boulder); Xiujun Yue (UC San Diego); Ping Liu (UC San Diego); Douglas Gin (University of Colorado Boulder); Richard Noble (University of Colorado Boulder)

SESSION F - Innovation in Modeling of Membrane Fundamentals and Processes

F1  Molecular Dynamics Processing Tool for Transmembrane Simulations, Jia Lin Cheoh (Purdue University)*; Abhimanyu Das (Purdue University); David Warsinger (Purdue University)

F2  Low energy-consumption pre-treatment system for integrated forward osmosis - reverse osmosis desalination process, Yunchul Woo (Korea Institute of Civil Engineering and Building Technology)*; June-Seok Choi (Korea Institute of Civil Engineering and Building Technology); Kwang-Duk Park (Korea Institute of Civil Engineering and Building Technology)

F3  Arrested mobility effects on the spinodal decomposition of ternary polymer solutions for immersion precipitation, Jan Garcia (UC Santa Barbara)*; Douglas Tree (Brigham Young University); Kris Delaney (UC Santa Barbara); Glenn Fredrickson (UC Santa Barbara)

F4  Hydro- and perfluoro-carbon sorption, diffusion and permeation modeling in poly(dimethylsiloxane) using a PC-SAFT Equation of State, Liang Liu (The University of Melbourne)*

F5  The Potential of Low-Temperature Forward Osmosis for Water Recovery, Jeffrey Martin (University of Toronto); Georgios Kolliopoulos (University of Toronto); Vladimirios Papangelakis (University of Toronto)*

F6  Fouling mechanisms in constant flux crossflow ultrafiltration, Alon Kirschner (The University of Texas at Austin)*; Yu-Heng Cheng (The University of Texas at Austin); Donald Paul (The University of Texas at Austin); Robert Field (University of Oxford); Benny Freeman (The University of Texas at Austin)

F7  Hitz zeolite membrane separation system (HDS) for liquid separation, Akira Hamasaki (Hitachi Zosen Corporation)*

F8  Effect of short-term contact with C1-C4 alcohols on the water permeance and salt rejection of MPD-TMC thin-film composite reverse osmosis membranes, Jaime A Idarraga-Mora (Clemson University)*; Michael Lemelin (Clemson University); Steven Weinman (Clemson University); Scott Husson (Clemson University)

F9  Whey recovery using forward osmosis with hollow fiber configuration - Evaluating the factors limiting the flux performance, YiNing Wang (Nanyang Technological University)*; Rong Wang (Nanyang Technological University)

F10  Bimetallic Nanoparticles Incorporated Poly(methacrylic acid) Functionalized Membranes for Water Remediation: Synthesis, Advanced Characterization and Reactive Properties, Hongyi (Derek) Wan (University of Kentucky)*; Md. Saiful Islam (University of Kentucky); Nicolas Briot (University of Kentucky); Anthony Saad (University of Kentucky); Lindell Ormsbee (University of Kentucky); DB Bhattacharrya (University of Kentucky)

F11  Membrane compaction in forward osmosis process, Daniel Yee Fan Ng (Nanyang Technological University); Yunfeng Chen (Nanyang Technological University); Rong Wang (Nanyang Technological University)*; Zhili Dong (Nanyang Technological University)
F12 Novel Isothermal Acid Sweep Membrane Distillation for Selective and Energy Efficient Removal and Recovery of Ammonia, Stephanie N McCartney (Columbia University)*; Natalie Williams (Columbia University); Chanhee Boo (Columbia University); Ngai Yin Yip (Columbia University)

F13 In-situ micro-rheology of a foulant layer, Jose Agustin Epstein (Technion - Israel Institute of Technology); Guy Z Ramon (Technion - Israel Institute of Technology)*

F14 Mixed-gas permeation in thermally rearranged poly(benzoxazole-co-imide) polymer membranes, Adele Brunetti (Institute on Membrane Technology of Italian National Research Council); Elena Tocci (Institute on Membrane Technology of Italian National Research Council); Jong Geun Seong (Hanyang University); Young Moo Lee (Hanyang University)*; Enrico Drioli (Institute on Membrane Technology of Italian National Research Council); Giuseppe Barbieri (Institute on Membrane Technology of Italian National Research Council)

F15 Plug flow reactor IEMB - performance and modelling, Shalom Fox (Ben-Gurion University of the Negev); Kristina Stadnik (Ben-Gurion Univ.); Amit Thakur (Ben-Gurion University of the Negev); Zeev Ronen (Ben-Gurion Univ.); Yoram Oren (Ben-Gurion University of the Negev); Jack Gilron (Ben-Gurion University of the Negev)*

F16 Isolation of Extracellular Vesicles from a Biofluid Using Ultrathin Microslit and Nanopore Silicon Membranes, Jared Carter (SiMPore Inc.)*; Cassandra Walinski (SiMPore Inc.); Akash Patel (SiMPore Inc.); Joshua Miller (SiMPore Inc.); Jon-Paul DesOrmeaux (SiMPore Inc.); James A Roussie (SiMPore Inc.)

F17 High-Pressure Reverse Osmosis for Energy-Efficient Desalination of High Salinity Brines, Douglas M Davenport (Yale University)*; Akshay Deshmukh (Yale University); Jay Werber (Yale University); Yuhao Du (Yale University); Menachem Elimelech (Yale University)

F18 Computationally Efficient Methods of Simulating Membrane Spacers, Jacob Johnston (Colorado School of Mines)*; Jincheng Lou (Colorado School of Mines); Nils Tilton (Colorado School of Mines)

F19 Dissipative Particle Dynamics Simulations of PES membrane via NIPS, Eric Ledieu (University of Arkansas)*; Yuanhui Tang (University of Arkansas); Rosario Cervellere (University of Arkansas); Paul Millett (University of Arkansas); David Ford (University of Arkansas); Xianghong Qian (University of Arkansas)

F20 Leveraging Surplus Energy from Nuclear Power Generation for Seawater Desalination: A Process Modelling Investigation, J. Hunter Himes (Tennessee Tech University); Mary Adkisson (Tennessee Tech University); Laura H Arias Chavez (Tennessee Tech University)*

F21 Maxwell-Stefan characterization of surface diffusion flow through defect containing silicalite membranes., David Carter (University of Ottawa); Shaaima Al Akwaa (University of Ottawa); Boguslaw Kruczek (University of Ottawa); Handan Tezel (University of Ottawa)*

F22 Self-Regulating FO-RO Hybrid Systems, Noah Ferguson (University of Connecticut)*; Nicole Beauregard (University of Connecticut); Jeffrey R McCutcheon (University of Connecticut)

F23 Estimating salt diffusion coefficients in polyamide active layers of reverse osmosis membranes using microscale continuum modeling, Riley Vickers (University of North Carolina at Chapel Hill)*; Jingbo Wang (UCLA); Timothy Weigand (University of North Carolina at Chapel Hill); Casey Miller (University of North Carolina at Chapel Hill); Orlando Coronell (University of North Carolina at Chapel Hill)

F24 Energy-efficient Biogas Upgrading Membrane Process, Chung-Seop Lee (Airrane Co. Ltd); Jinhyuk Lim (Airrane Co. Ltd); Sejong Kim (Airrane Co. Ltd)*; Seong Yong Ha (Airrane Co. Ltd); Won Seok Chang (Korea District Heating Corporation); Moon Sei Oh (Korea District Heating Corporation)

F25 Multi-stage Membrane Process for CO2 Separation from LNG flue gas, Chung-Seop Lee (Airrane Co. Ltd)*; Sejong Kim (Airrane Co. Ltd); Chung-Seop Lee (Airrane Co. Ltd); Won Seok Chang (Korea District Heating Corporation); Moon Sei Oh (Korea District Heating Corporation)
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