

## *Program*

# **Advanced Membrane Technology VI: Water, Energy, and New Frontiers**

February 8 – 13, 2015

Sicily, Italy

### Conference Chairs

**Prof. D. Bhattacharyya (DB)**

Department of Chemical and Materials Engineering  
University of Kentucky, USA

**Prof. Benny Freeman**

Department of Chemical Engineering  
University of Texas at Austin, USA



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## **Previous conferences in this series**

### ***Advanced Membrane Technology***

**October 14-19, 2001**

**Barga, Italy**

*Conference Chairs:*

Dr. Norman N. Li, NL Chemical Technology, Inc., USA  
Prof. Enrico Drioli, University of Calabria, Italy  
Prof. William J. Koros, University of Texas, Austin, USA

### ***Advanced Membrane Technology II***

**May 23-28, 2004**

**Irsee, Germany**

*Conference Chair:*

Dr. Norman N. Li, NL Chemical Technology, Inc., USA

### ***Advanced Membrane Technology III***

**June 11-15, 2006**

**Cetraro (Calabria), Italy**

*Conference Chairs:*

Dr. Norman N. Li, NL Chemical Technology, Inc., USA  
Prof. Enrico Drioli, University of Calabria, Italy

### ***Advanced Membrane Technology IV***

**June 7-12, 2009**

**Trondheim, Norway**

*Conference Chair:*

Prof. May-Britt Hagg Norwegian University of Science & Technology, Norway

### ***Advanced Membrane Technology V***

**Oct. 14-19, 2012**

**Singapore**

*Conference Chairs:*

Dr. Tony Fane, Singapore Membrane Technology Centre  
Dr. Rong Wang, Singapore Membrane Technology Centre

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support from the  
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**KY<sup>NSF</sup> EPSCoR**

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## **Shakespeare and Co. Café Restaurant, Patisserie, Chocolates and Catering**

Shakespeare and Co. Cafe-Restaurant, Patisserie, Chocolates and Catering offer an all-day breakfast, lunch and dinner menu, complemented by pastries, cakes, chocolate and ice-cream. Full-service catering offered for corporate and private events and parties. Franchises are open in Qatar, Oman, Lebanon and coming soon to Jordan and other Gulf countries.

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## **Sunday, February 8, 2015**

16:30 – 18:00	Conference check-in
18:00 – 18:30	Introductions Conference Chairs (D. Bhattacharyya and Benny Freeman) ECI Liaison (Norman Li)
18:30 – 19:30	<b>Plenary Speaker</b> <b>New developments in understanding ion transport in an electric field</b> Mathias Wessling, University of Aachen, Germany
20:00 – 21:30	Dinner

### **Notes**

- *All technical sessions will be in Archimedes Hall. Poster sessions will be in Archimedes and the foyer.*
- *All meals will be in the Nesos Restaurant.*
- *Audiotaping, videotaping and photography of presentations are prohibited.*
- *Speakers – Please have your presentation loaded onto the conference computer prior to the session start (preferably the day before).*
- *Speakers – Please leave at least 3-5 minutes for questions and discussion.*
- *Please do not smoke at any conference functions.*
- *Turn your mobile telephones to vibrate or off during technical sessions.*
- *Please write your name on your program so that it can be returned to you if lost or misplaced.*
- *After the conference, ECI will send an updated participant list to all participants. Please check your listing now and if it needs updating, you may correct it at any time by logging into your ECI account.*

## **Monday, February 9, 2015**

07:30 – 08:30

Breakfast

### **Session 1: Membranes for CO<sub>2</sub> Capture and Energy-Related Separations**

Chairs: Ingo Pinnau, Advanced Membranes and Porous Materials Center, KAUST, Saudi Arabia  
Giulio C. Sarti, University of Bologna, Italy

08:30 – 08:55

#### **CO<sub>2</sub> capture in H<sub>2</sub> production by polymeric membranes**

Ikuo Taniguchi, Kyushu University, Japan

08:55 – 09:20

#### **Novel membrane absorption-based processes for CO<sub>2</sub> capture**

Kamalesh K. Sirkar, New Jersey Institute of Technology, USA

09:20 – 09:45

#### **New membranes for CO<sub>2</sub> separation/capture and water purification**

Winston Ho, The Ohio State University, USA

09:45 – 10:10

#### **CO<sub>2</sub>-induced plasticization effect in graphene oxide membranes**

Ho Bum Park, Hanyang University, South Korea

10:10 – 10:40

Coffee Break

10:40 – 11:05

#### **Sod-ZMOF/polyimide mixed-matrix membranes for CO<sub>2</sub>/CH<sub>4</sub> separation**

Ayse Kilic, Istanbul Technical University, Turkey

11:05 – 11:30

#### **Carbon dioxide capture membranes for artificial photosynthesis**

Daniel Miller, Lawrence Berkeley National Laboratory, USA

11:30 – 12:05

#### **Challenges for the integration of membrane separations in energy production processes in Brazil**

A. Claudio Habert, Universidade Federal do Rio de Janeiro, Brazil

12:05 – 12:30

#### **The University of Kentucky NIEHS Superfund Research Center: Reducing health impacts of toxic chemicals through nutrition and membrane/capture-based remediation**

Bradley Newsome, University of Kentucky, USA

12:30 – 14:00

Lunch

### **Session 2: Membrane Desalination and High Recovery**

Chairs: Norman Li, NL Chemical Co, USA  
Isabel Escobar, The University of Toledo, USA

14:00 – 14:25

#### **Membranes for power plant water reuse: High TDS and toxic metal issues**

Dibakar Bhattacharyya, University of Kentucky, USA

14:25 – 14:50

#### **Membrane desalination: Current status and advancements toward reducing energy consumption, mitigating fouling and mineral scaling and increasing recovery**

Yoram Cohen, University of California, USA

14:50 – 15:15

#### **Pilot-scale fertiliser driven forward osmosis desalination: Performance, limitations and life cycle assessment**

Ho Kyong Shon, University of Technology, Australia

15:15 – 15:45

Coffee Break

**Monday, February 9, 2015 (continued)**

- 15:45 – 16:10      **Nanotechnological application in water desalination: NAWADES**  
Alberto Figoli, ITM-CNR, Italy
- 16:10 – 16:35      **High recovery desalination – Overview of strategies**  
Jack Gilron, Ben Gurion University, Israel
- 16:35 – 17:00      **Novel 2D carbon composites for next generation desalination membranes**  
Khaled Mahmoud, Qatar Environment & Energy Research Institute, Qatar
- 17:00 – 19:00      *ad hoc* sessions / Free time
- 19:00 – 20:30      Dinner
- 20:30 – 21:30      Social Hour / Poster Session  
Chairs: Benny Freeman, University of Texas at Austin, USA  
Lidietta Giorno, ITM-CNR, Italy

## Tuesday, February 10, 2015

07:30 – 08:30 Breakfast

### **Session 3: Biomimetic, CNT, and Graphene-Based Membrane Advances and Applications**

Chairs: Rosemarie Wesson, National Science Foundation, USA  
A.G.(Tony) Fane, Nanyang Technological University, Singapore  
Uwe Beuscher, W.L. Gore & Associates, Inc., USA

08:30 – 08:55 **From natural to bioassisted and biomimetic artificial water channel systems**  
Mihail Barboiu, Institut Europeen des Membranes, France

08:55 – 09:20 **A scalable method for producing graphene membranes with nanofiltration properties**  
Mainak Majumder, Monash University, Australia

09:20 – 09:45 **Synthesis of membranes for artificial photosynthesis**  
Nathaniel A. Lynd, Lawrence Berkeley National Laboratory / UT-Austin, USA

09:45 – 10:10 **Carbon nanofluidics of fast water transport under graphitic nanoconfinements**  
Hyung Gyu Park, ETH Zurich, Switzerland

10:10 – 10:40 Coffee Break

10:40 – 11:05 **DNA-based gating membranes and nanodevices**  
Thomas Schäfer, Polymat, University of the Basque Country, Spain

11:05 – 11:30 **Voltage activated carbon nanotube membranes as biomimetic platforms**  
Bruce Hinds, University of Washington, USA

11:30 – 11:55 **Mixed matrix membranes containing functionalized carbon nanotubes for water treatment**  
Enrica Fontananova, ITM-CNR, Italy

11:55 – 12:20 **Nanocarbon-based membranes for high performance environmental applications**  
Timothy Tan, Nanyang Technological University, Singapore

12:30 – 14:00 Lunch

### **Session 4: FO, PRO, Membrane Distillation, and Reverse Electrodialysis Advances in Membranes and Systems**

Chairs: Suzana Nunes, King Abdullah University of Science and Technology (KAUST), Saudi Arabia  
Heather L. Jamieson, Arizona State University, USA  
Kamalesh K. Sirkar, New Jersey Institute of Technology, USA

14:00 – 14:25 **High performance forward osmosis and pressure retarded osmosis membranes - Structures, performance, and future perspectives**  
Chuyang Tang, The University of Hong Kong, Hong Kong

14:25 – 14:50 **Developing desired hollow fiber membrane for Forward Osmosis (FO), Pressure Retarded Osmosis (PRO) and low pressure Nanofiltration (NF)**  
Lei Shi, Nanyang Technological University, Singapore

14:50 – 15:15 **Designer water by membranes**  
Torleiv Bilstad (speaker), Remya Nair, University of Stavanger, Norway

**Tuesday, February 10, 2015 (continued)**

- 15:15 – 15:40      **Synthesis and characterization of high performance thin film composite flat sheet membranes for pressure retarded osmosis**  
Ye Li, Nanyang Technological Univeristy, Singapore
- 15:40 – 17:05      Coffee Break
- 17:05 – 17:30      **Reverse electrodialysis: Sustainable energy from blue water**  
Jamie Hestekin, University of Arkansas, USA
- 17:30 – 17:55      **Reverse electrodialysis in energy sustainability applications**  
Glenn Lipscomb, University of Toledo, USA
- 17:55 – 18:20      **Salinity gradient power from brines through reverse electrodialysis: From laboratory experiments to the first operating prototype in the world**  
Andrea Cipollina, Università di Palermo, Italy
- 18:20 – 18:55      **Alkaline sulfide solution regeneration utilizing EDU membrane systems**  
Corby G. Anderson, Colorado School of Mines, USA
- 19:00 – 20:30      Dinner
- 20:30 – 21:30      Social Hour / Poster Session  
Chairs: Brad Newsome, University of Kentucky, USA  
Thomas Schäfer, Polymat, University of the Basque Country, Spain

## Wednesday, February 11, 2015

07:30 – 08:30 Breakfast

### **Session 5: Reduced Fouling Membrane Advances for UF to NF to RO**

Chairs: Cristiana Boi, Università di Bologna, Italy

João G. Crespo, FCT - Universidade Nova de Lisboa, Portugal

08:30 – 09:10

#### **Plenary Speaker**

#### **A fifth fundamental rule for protein-repulsive surfaces or membranes**

Georges Belfort, Rensselaer Polytechnic Institute, USA

09:10 – 09:35

#### **Biofouling resistant membranes made of green silver nanoparticles**

Isabel Escobar, The University of Toledo, USA

09:35 – 10:00

#### **Non-invasive monitoring of membrane processes using fluorescence spectroscopy**

João G. Crespo, FCT - Universidade Nova de Lisboa, Portugal

10:00 – 10:25

#### **Self-assembled zwitterionic copolymers as selective layers for high flux, fouling-resistant, size-selective membranes**

Ayse Asatekin, Tufts University, USA

10:25 – 10:55

Coffee Break

10:55 – 11:20

#### **Advanced coating materials for fouling resistant water purification membranes**

Young-Hye Na, IBM Almaden Research Center, USA

11:20 – 11:45

#### **Surface modification of RO membranes with hydrogels for fouling reduction**

Jochen Meier-Haack, Leibniz-Institut für Polymerforschung Dresden e.V., Germany

11:45 – 12:10

#### **Threshold flux: A more useful concept than critical flux**

Robert Field, Oxford University, UK

12:30 – 13:30

Lunch

13:45

#### **Buses depart for optional excursion to Siracusa**

#### ***Excursion Itinerary***

15:00

*Arrival at the archeological park of the Neapolis where we can see the monolithic Greek Theatre (its cavea is one of the largest ever built by the ancient Greeks and still in use today for classical representations), the sacrificial Altar of Hieron II, the Ear of Dionysius (an artificial limestone quarry named by the painter Caravaggio) and the Roman Amphitheatre.*

16:30

*Continue on to the island of Ortigia to see the temple of Apollo, the oldest Doric style temple built in Sicily, The tour ends at the fresh water spring of Aretusa where the papyrus still grows abundantly.*

18.00

*Optional coffee stop in the scenic Piazza Duomo of Ortigia*

*Leisure time, dinner on your own*

21:00

*Transfer back to the hotel – leave time to walk back to bus parking area*

**Thursday, February 12, 2015**

- 07:30 – 08:30 Breakfast
- Session 6: Responsive/Tunable to Engineered Membranes**  
Chairs: Ayse Asatekin, Tufts University, USA  
Mihail Barboiu, Institut Europeen des Membranes, France
- 08:30 – 08:55 **Responsive membranes for tailored separations**  
Ranil Wickramasinghe, University of Arkansas, USA
- 08:55 – 09:20 **Engineered membrane roughness: The potential of patterns**  
John Pellegrino, University of Colorado, USA
- 09:20 – 09:45 **Supported thin-film hydrophilic nanocomposites for reverse osmosis membranes**  
Heather L. Jamieson, Arizona State University, USA
- 09:45 – 10:10 **Synthesis of new semi-crystalline block co-polymer membranes for artificial photosynthesis**  
Christina G. Rodriguez, Lawrence Berkeley National Lab, USA
- 10:10 – 10:40 Coffee Break
- 10:40 – 11:05 **Biofunctionalized responsive membranes**  
Lidietta Giorno, ITM-CNR, Italy
- 11:05 – 11:30 **Super-hydro-tunable membranes for advanced separations and processing of biofuels**  
Michael Hu, Oak Ridge National Laboratory, USA
- 12:00 – 13:30 Lunch
- Session 7: New Membrane Approaches to Challenging Applications and Industrial Perspectives**  
Chairs: Jamie Hestekin, University of Arkansas, USA  
Chuanfang Yang, Institute of Process Engineering, CAS, China
- 13:30 – 13:55 **Taking advantage of N-Heterocyclic polymers for membrane application**  
Suzana Nunes, King Abdullah University of Science and Technology (KAUST), Saudi Arabia
- 13:55 – 14:20 **Emerging markets: Small scale renewable energy powered membrane filtration for removal of dissolved contaminants from water**  
Andrea Schaefer, KIT, Germany
- 14:20 – 14:45 **Better membrane chromatography requires more monodisperse pores**  
Chuanfang Yang, Institute of Process Engineering, CAS, China
- 14:45 – 15:10 **Application of microporous fluoropolymeric membranes for challenging separations**  
Uwe Beuscher, W.L. Gore & Associates, Inc., USA
- 15:10 – 15:40 Coffee Break
- 15:40 – 16:05 **New approach for scientific research on RO membrane**  
Masahiro Kimura, Toray Industries, Inc., Japan
- 16:05 – 16:30 **Advanced nanofiltration and functionalized membranes for difficult to treat process separations**  
Ilan Wilf, Ultura Water Inc., USA



**Thursday, February 12, 2015 (continued)**

16:30 – 16:55      **Preparation and purification of autologous plasmin with affinity membranes**  
Cristiana Boi, Università di Bologna, Italy

16:55 – 17:20      **A new Membrane-Aerated Biofilm Reactor (MABR) for wastewater treatment**  
Geert Henk Koops, GE Water & Process Technologies, Canada

17:20 – 17:35      Stretch Break

**Session 8: Membrane Simulations/Characterizations to Batteries and Fuel Cells**

Chairs: Andrea Cipollina, Università di Palermo, Italy  
John Pellegrino, University of Colorado, USA

17:35 – 18:00      **Investigating antifouling mechanisms of zwitterionic materials from molecular dynamics simulations**  
Xianghong Qian, University of Arkansas, USA

18:00 – 18:25      **Polymeric membranes for water treatments: An atomistic simulation**  
Elena Tocci, Research Institute on Membrane Technology (ITM-CNR), Italy

18:25 – 18:50      **Where are we in predicting gas solubility and permeability in glassy polymeric membranes?**  
Giulio C. Sarti, University of Bologna, Italy

18:50 – 19:15      **An introduction to single ion conducting polymer electrolytes for Li-ion batteries**  
Bryan D. McCloskey, UC, Berkeley and LBNL, USA

20:00              Conference Banquet

**Friday, February 13, 2015**

- 07:30 – 08:30 Breakfast
- Plenary Session**  
Chairs: D. Bhattacharyya, University of Kentucky, USA  
Benny Freeman, The University of Texas at Austin, USA
- 08:30 – 09:15 **Bioinspired membrane engineering for water applications**  
A.G.(Tony) Fane, Nanyang Technological University, Singapore
- 09:15 – 10:00 **Advanced membranes for molecular separations in organic solvents**  
Andrew Livingston, Imperial College, United Kingdom
- 10:00 – 10:45 **Advances and research needs in graphene-based membrane science and engineering**  
Rosemarie Wesson, National Science Foundation, USA
- 10:45 – 11:15 Coffee Break
- 11:15 – 12:00 **Ion sorption and transport in crosslinked polyelectrolyte membranes**  
Donald R. Paul/Benny Freeman, University of Texas at Austin, USA
- 12:00 – 12:45 **New membrane operations for redesign of process engineering**  
Enrico Drioli, ITM–CNR, c/o University of Calabria, Rende, Italy
- 13:00 Lunch and Departure

# **Advanced Membrane Technology VI: Water, Energy, and New Frontiers**

*An ECI Conference Series*

**February 8-13, 2015  
Sicily, Italy**

## **Poster Presentations List**

1. **Rubbery organic frameworks-ROFs-Tuning the gas-diffusion through dynamic membranes**  
Mihail Barboiu, Institut Europeen des Membranes, France
2. **Metal-Organic Framework – based porous matrix membranes for improving mass transfer in forward osmosis membranes**  
Jian-Yuan Lee, Nanyang Technological University, Singapore
3. **Performance study of pervaporation in a microfluidic system for the removal of acetone from water**  
Yali Zhang, University of Twente, Netherlands
4. **Smart water from produced water using nanofiltration and ion exchange**  
Torleiv Bilstad, University of Stavanger, Norway
5. **An alternative CO<sub>2</sub> capture by electrodialysis**  
Ikuo Taniguchi, Kyushu University, Japan
6. **Development of Peek-WC/MWCNTS mixed matrix membranes**  
Enrica Fontananova, ITM-CNR, Italy
7. **Spongy and responsive PVDF-based membranes for water related applications**  
Douglas M. Davenport, University of Kentucky, USA
8. **Synthesis and evaluation of nanoparticle membrane-supported systems for degradation of toxic organic contaminants**  
Sebastián Hernández Sierra, University of Kentucky, USA
9. **Preparation and characterization of functional polyamide RO membrane via spin assisted layer by layer assembly of polyelectrolytes**  
Isam Aljundi, King Fahd University of Petroleum and Minerals, Saudi Arabia
10. **Microbial method of converting CO<sub>2</sub> into methane at low energy consumption using membranes for introducing hydrogen into a microbial reactor**  
Gossaye Tirunehe, Southern Denmark University, Denmark
11. **Enhancement of syngas biomethanation by high cell loading in a reverse membrane bioreactor (RMBR)**  
Konstantinos Chandolias, Borås University, Sweden
12. **Carbon nanotube blended nanofibers for forward osmosis membranes**  
Evrin Celik, SDU, Turkey

13. **An integrated membrane process for oily wastewater treatment, water reuse and valuable by-products recovery**  
Renata Tomczak-Wandzel, Aquateam COWI AS, Norway
14. **Evaluation of ferrate ( $K_2FeO_4$ ) as a coagulant/coagulant aid to reduce ultrafiltration membrane fouling in drinking water treatment**  
Wenzheng Yu, Imperial College London, United Kingdom
15. **Polymer-in-ceramic lithium-ion-conducting membranes**  
Diana Golodnitsky, Tel Aviv University, Israel
16. **Acoustics and vibration analysis of carbon fiber reinforced membrane**  
Taejin Shin, Inha University, South Korea
17. **Development of solid polymer electrolyte composite hollow fiber membrane for olefin/paraffin gas separation**  
Joo-hwan Lim, Airrane, South Korea
18. **Model for predicting ion sorption and transport in ion-exchange membranes**  
Jovan Kamcev, The University of Texas at Austin, USA
- 19.
20. **Micropollutant removal by carbon nanotube membranes**  
Hyung Gyu Park, ETH Zurich, Switzerland
21. **Discovery of novel anti-fouling membranes via combinatorial chemistry and a unique high throughput system**  
Joseph Imbrogno, Rensselaer Polytechnic Institute, USA
22. **Synthesis of ion exchange membranes and their application to MCDI**  
Ji Seon Kim, Hannam University, South Korea
23. **Separation characteristics using multi-layer hollow fiber nanofiltration membranes for ultra-low pressure**  
Su Yeon Kang, Hannam University, South Korea
24. **Facilitated transport separation of  $CO_2$  using aminated polysulfone membranes**  
Ka Young Kim, Hannam University, South Korea
25. **Development of hollow fiber membrane with high power density for pressure retarded osmosis (PRO)**  
Yunfeng Chen, Nanyang Technological University, Singapore
26. **Nanofiltration membrane characterization for the separation of oligosaccharides mixtures: an experimental study**  
Valentina Morelli, DICAM, University of Bologna, Italy
27. **Modeling partitioning and transport phenomena in nanofiltration of oligosaccharides solutions: a critical assessment**  
Valentina Morelli, DICAM, University of Bologna, Italy
28. **Synthesis of new semi-crystalline block co-polymer membranes for artificial photosynthesis**  
Christina G. Rodriguez, Lawrence Berkeley National Lab, USA

29. **Molecular separation by nanometer-thick membranes**  
Shigenori Fujikawa, Kyushu University, Japan
30. **Preparation and purification of autologous plasmin with affinity membranes**  
Cristiana Boi, Università di Bologna, Italy
31. **Preparation of bi-polar membranes and their application to hypochlorite production**  
Se Hwan Kwon, Hannam University, South Korea
32. **Surface-aminated cnt mesh for efficient CO<sub>2</sub> capture**  
Mengmeng Deng, ETH Zurich, Switzerland
33. **Modeling antisolvent membrane crystallization**  
Federico Milella, ETH Zürich, Switzerland
34. **Multi-module membrane configurations for gas separation**  
Paolo Gabrielli, ETH Zürich, Switzerland
35. **Low-fouling hydrogel-coated UF membranes for wastewater treatment with MBR**  
Eli Asa, Water Institute Midreshet Ben Gurion, Israel
36. **Block copolymer membranes based on polymerized ionic liquids for artificial photosynthesis**  
Gabriel E. Sanoja, University of California, Berkeley, USA
37. **The University of Kentucky NIEHS Superfund Research Center: Reducing health impacts of toxic chemicals through nutrition and membrane/capture-based remediation**  
Bradley Newsome, University of Kentucky, USA
38. **Effect of intrinsic surface roughness on colloidal fouling of reverse osmosis membrane**  
Zhiwei Jiang, Imperial College London, United Kingdom
39. **Molecular simulations of carbon nanotube membranes for reverse osmosis application**  
Elena Tocci, Institute on Membrane Technology (ITM-CNR), Italy
40. **Hydrophilic graft polymerization of ultrafiltration membranes with unique micro-spherical topography**  
Clil Regev, Ben-Gurion University of the Negev, Be'er Sheva, Israel