

# Advanced Membrane Technology III: Membrane Engineering for Process Intensification

June 11-15, 2006



Grand Hotel San Michele  
Località Bosco 8/9 - 87022 Cetraro CS (Italy)  
Telephone +39 0982 91012 - Fax +39 0982 91430  
[sanmichele@sanmichele.it](mailto:sanmichele@sanmichele.it) [www.sanmichele.it](http://www.sanmichele.it)

Conference Chair

**Prof. Enrico DRIOLI**

Institute on Membrane Technology, ITM-CNR, Italy  
The University of Calabria, Italy  
([e.drioli@itm.cnr.it](mailto:e.drioli@itm.cnr.it); [e.drioli@unical.it](mailto:e.drioli@unical.it))

**Program and Book of Abstracts**

# ECI

**ENGINEERING CONFERENCES INTERNATIONAL, INC.**

Six MetroTech Center - Brooklyn, NY 11201

T: 1-718-260-3743 - F: 1-718-260-3754

[info@eci.poly.edu](mailto:info@eci.poly.edu) - [www.engconfintl.org](http://www.engconfintl.org)

Engineering Conferences International (ECI) is a global engineering conferences program, originally established in 1962, that provides opportunities for the exploration of problems and issues of concern to engineers and scientists from many disciplines. ECI is a not-for-profit partnership between the Engineering Conferences Foundation (ECF) and Polytechnic University.

#### ECF BOARD MEMBERS

Barry C. Buckland

Mark Green

Allen I. Laskin

Raymond McCabe

Eli Pearce

David Robinson

P. Somasundaran

Chair of ECF Conferences Committee: Jules Routbort

ECF Technical Liaisons for this conference: Herman Bieber/Norman N. Li

Polytechnic University President: Jerry Hultin

Polytechnic Liaison to ECF: T.C. Westcott

ECI Director: Barbara K. Hickernell

ECI Assistant Director: Kevin Korpics

©Engineering Conferences Foundation

**The conference chair and organizers would like to thank the following for their generous support of this conference**

**US National Science Foundation  
Arlington, Virginia, USA**

**Institute on Membrane Technology  
National Research Council  
Rende CS, Italy**

**Department of Chemical Engineering and Materials  
The University of Calabria  
Rende CS, Italy**

## **Scientific Committee**

**Enrico Drioli**, The University of Calabria and ITM-CNR (Italy)  
**Pierre Aimar**, Université Paul Sabatier (France)  
**Giuseppe Barbieri**, ITM-CNR (Italy)  
**Rune Bredesen**, SINTEF (Norway)  
**May-Britt Hägg**, NTNU (Norway)  
**Tony Fane**, Nanyang Technological University (Singapore)  
**Benny Freeman**, The University of Texas at Austin (USA)  
**Rafiqul Gani**, Technical University of Denmark (Denmark)  
**Lidietta Giorno**, ITM-CNR (Italy)  
**Dieter Hofmann**, GKSS (Germany)  
**Gunnar Jonsson**, Technical University of Denmark (Denmark)  
**William J. Koros**, Georgia Institute on Green Technology (USA)  
**Kew-Ho Lee**, KRICT (South Korea)  
**Runyu Ma**, Beijing University of Chemical Technology (China)  
**Donald R. Paul**, The University of Texas at Austin (USA)  
**Gerard Pourcelly**, Université Montpellier II (France)  
**Gilbert Rios**, IEM (France)  
**Jesus Santamaria**, The University of Zaragoza (Spain)  
**Andrzej Stankiewicz**, DSM Research and Technical University of Delft (The Netherlands)  
**Doros Theodoru**, The University of Patras (Greece)  
**Gun Tragardh**, Lund University (Sweden)  
**Matthias Wessling**, The University of Twente (The Netherlands)

## **Local organizing committee**

**Enrico Drioli**, The University of Calabria, ITM-CNR (Italy)  
**Giuseppe Barbieri**, ITM-CNR (Italy)  
**Mariella Liberti**, ITM-CNR (Italy)  
**Alessandra Criscuoli**, ITM-CNR (Italy)  
**Francesco Scura**, The University of Calabria, ITM-CNR (Italy)  
**Adele Brunetti**, The University of Calabria, ITM-CNR (Italy)

## Technical Program

	Morning	Afternoon
<b>Sunday</b> June 11 <sup>th</sup>		16:30 – 18:30 <b>Registration</b>  18:30 – 19:30 <b>Welcome Cocktail</b>
<b>Monday</b> June 12 <sup>th</sup>	8:30 – 9:00 <b>Welcome and opening remarks</b>  9:00 – 10:00 <b>Plenary Lecture</b>  10:30 – 13:00 <i>Session I</i> <b>Membrane Engineering for Process Intensification</b>	15:30 – 17:30 <i>Session II</i> <b>Membrane contactors – (membrane distillation, membrane emulsification, liquid supported membranes, etc.)</b>  17:30 – 19:30 <b>Poster Paper Session A and Afternoon coffee</b>
<b>Tuesday</b> June 13 <sup>th</sup>	8:30 – 10:30 <i>Session III</i> <b>Integrated and hybrid membrane operations</b>  11:00 – 13:00 <i>Session IV</i> <b>Membranes engineering for regenerative medicine</b>	15:00 – 19:30 <b>Sightseeing and visit to The University of Calabria and ITM-CNR</b>  20:00 – 23:00 <b>Dinner at old Rende</b>
<b>Wednesday</b> June 14 <sup>th</sup>	8:30 – 12:30 <i>Session V</i> <b>Membrane engineering in desalination and water treatment</b>	15:30 – 18:00 <i>Session VI</i> <b>Catalytic membranes and membrane reactors</b>  18:00 – 19:30 <b>Poster Paper Session B and Afternoon coffee</b>
<b>Thursday</b> June 15 <sup>th</sup>	8:30 – 13:00 <i>Session VII</i> <b>Membrane engineering and microelectronic membrane devices</b>	

## **Sunday, 11<sup>th</sup> June 2006**

16:30 – 18:30 Registration

18:30 – 19:30 Welcome Cocktail

20:00 - 22:30 Dinner at Grand Hotel San Michele

### NOTES

- Please observe “No Smoking” at ECI technical sessions, meals and social hours.
- Speakers should allow time at the end of their presentation for questions and discussion.
- Please silence cell phones at all technical sessions.
- Oral presentations: only PowerPoint video-projector is available. The presentations should be uploaded the day before for the morning sessions or during the morning breaks for the afternoon sessions. A personal computer will be available at the conference site for uploading and checking the presentations.
- Poster sessions: Please be prepared to be by your poster for the scheduled time for each of the poster sessions so that you can answer questions. Available poster panel size is 74 cm high and 173 cm wide. Preferable poster orientation is horizontal, but vertical posters and posters of different dimensions can also be mounted.

## **Monday, 12<sup>th</sup> June 2006**

- 07:00 – 08:30 Breakfast
- 08:30 – 09:00 **Welcome and opening remarks**  
Enrico DRIOLI, Conference Chair  
Norman N. LI, ECI Technical Liaison
- 09:00 – 10:00 **Plenary Lecture** 22  
Session Chairs:  
Enrico DRIOLI, Conference Chair, ITM-CNR and The University of Calabria, Italy  
*Modern Chemical Engineering in the frame of globalization sustainability and technical innovation. (Molecules into money) The example of Membrane Engineering for Process Intensification*  
J.C. Charpentier, CNRS/ENSIC/INPL, Ecole Supérieure de Chimie Physique Electronique de Lyon, France
- 10:00 – 10:30 Coffee break
- 10:30 – 13:00 **Session I: Membrane Engineering for Process Intensification**  
Session Co-Chairs:  
Enrico DRIOLI, Conference Chair, ITM-CNR and The University of Calabria, Italy  
Rafiqul GANI, Technical University of Denmark
- 10:30 – 11:00 *Advanced membranes for more energy efficient separations* 26  
W.J. Koros, Georgia Institute of Technology, School of Chemical & Biomolecular Engineering, Atlanta, Georgia, USA
- 11:00 – 11:30 *Novel reverse osmosis membranes with improved properties* 27  
B.D. Freeman, H.B. Park, E. Van Wagner, A. Sagle, The University of Texas at Austin, J.E. McGrath, Virginia Tech, USA
- 11:30 – 12:00 *Keys for a good control of membrane integration in industrial processes* 28  
G.M. Rios, M. P. Belleville, E. Darnon, University Montpellier 2, France
- 12:00 – 12:30 *Natural gas processing with membranes* 29  
R. Baker, Membrane Technology and Research, Inc., USA
- 12:30 – 13:00 *Perovskite hollow fibre membranes for the production of oxygen enriched air and synthesis gas (CO, H<sub>2</sub>) – engineering aspects* 30  
J. Caro, H. Wang, University of Hannover, S. Werth, Uhde GmbH, P. Koelsch, Leibniz Institute for Catalysis, T.Schiestel, Fraunhofer Institute of Interfacial Engineering and Biotechnology, C. Hamel, A. Seidel-Morgenstern, Max Planck Institute for dynamics of complex technical systems, Germany
- 13:00 – 14:00 Lunch

- 15:30 – 17:30 **Session II: Membrane contactors – (membrane distillation, membrane emulsification, liquid supported membranes, etc.)**  
 Session Co-Chairs:  
Kamalesh K. SIRKAR, New Jersey Institute of Technology, USA  
Tony FANE, Nanyang Technological University, Singapore
- 15:30 – 16:00 *Multiscale studies of membrane distillation of saline water- experimental results and modeling* 34  
K.K. Sirkar, L. Song, J.L. Gilron, B. Li, New Jersey Institute of Technology, USA
- 16:00 – 16:30 *The integration of membrane contactors in the definition of sustainable treatment of wastewaters and effluents* 35  
A. Urtiaga, F. San Roman, M.J. Rivero, I. Ortiz, The University of Cantabria, Spain
- 16:30 – 17:00 *A membrane contactor for ammonia stripping, pilot scale experiences, modeling and comparisons with alternative stripping methods* 36  
B. Norddahl, V.G. Horn, M. Larsson, The University of Southern Denmark, J.H. du Preez, Bioscan A/S, K. Christensen, The University of Southern Denmark
- 17:00 – 17:30 *Studies on transport selectivity and stability in a supported liquid membrane by using the  $Cu^{2+}$  as model ion* 37  
R. Molinari, T. Poerio, P. Argurio, The University of Calabria, Italy
- 17:30 – 19:30 **Poster Paper Session A** and Afternoon Coffee
- 20:00 - 22:30 Dinner at Grand Hotel San Michele wine cellar



## **Tuesday, 13<sup>th</sup> June 2006**

- 07:00 – 08:30 Breakfast
- 08:30 – 10:30 **Session III: Integrated and hybrid membrane operations**  
Session Co-Chairs:  
Norman N. LI, ECI Technical Liaison  
Giuseppe BARBIERI, ITM-CNR, Italy
- 08:30 – 09:00 *Unconventional hybrid membrane process:  $1 + 2 > 3$  ?* 40  
T. Fane, Nanyang Technological University, Singapore
- 09:00 – 09:30 *Computer aided model-based design and analysis of hybrid membrane-reaction-separation processes* 41  
R. Gani, G. Jonsson, V. Soni, P.T. Mitkowski, Technical University of Denmark
- 09:30 – 10:00 *Process integration in wastewater treatment: enhanced separation characteristics in nanofiltration* 42  
B. Van der Bruggen, K.U. Leuven, Belgium
- 10:00 – 10:30 *New indexes for evaluating the performance of membrane operations in the logic of process intensification* 43  
A. Criscuoli, E. Drioli, ITM-CNR, Italy
- 10:30 – 11:00 Coffee break
- 11:00 – 13:00 **Session IV: Membranes engineering for regenerative medicine**  
Session Co-Chairs:  
Dieter HOFMANN, GKSS-Research Center, Germany  
Loredana DE BARTOLO, ITM-CNR, Italy
- 11:00 – 11:30 *Atomistic molecular modelling of biomaterials* 46  
D. Hofmann, M. Entrialgo, J. Pimthon, A. Lendlein, Institute of Polymer Research, GKSS, Germany
- 11:30 – 12:00 *Development of bioreactors for tissue engineering and regenerative medicine* 47  
A. Bader, Leipzig University, Germany
- 12:00 – 12:30 *Novel biodegradable hollow fibre membrane scaffolds for the production of clinical scale tissue engineered constructs* 48  
M. Ellis, University of Bath, S. Morgan, University of Southampton, S. Perera, University of Bath, R. Oreffo, University of Southampton, J. Chaudhuri, University of Bath, UK
- 12:30 – 13:00 *Human lymphocyte membrane bioreactor as model for immunomodulatory molecule studies* 49  
L. De Bartolo, A. Piscioneri, S. Morelli, G. Cotroneo, G. Campana, F. Tasselli, ITM-CNR, M.C. Caroleo, E. Curcio The University of Calabria, G. Barbieri, E. Drioli, ITM-CNR, Italy
- 13:00 – 14:30 Lunch

15:00 – 19:30 Sightseeing and visit to The University of Calabria and ITM-CNR

20:00 – 23:00 Dinner at old Rende

## **Wednesday, 14<sup>th</sup> June 2006**

07:00 – 08:30 Breakfast

08:30 – 13:00 **Session V: Membrane engineering in desalination and water treatment**

Session Co-Chairs:

Raphael SEMIAT, Rabin Desalination Laboratory, Technion Chemical Engineering Department, Israel

Masaru KURIHARA, Toray Industries Inc., Japan

08:30 – 09:00 *Membrane solutions for the removal of charged micropollutants from drinking water supplies* 52

S. Velizarov, C.T. Matos, A. Oehmen, R. Viegas, S. Serra, M. A. Reis, J.G. Crespo, Universidade Nova de Lisboa, Portugal

09:00 – 09:30 *Membrane crystallizer for increased desalination recovery* 53

R. Semiat, D.Lisitzin, D. Hasson, Rabin Desalination Laboratory, Israel

09:30 – 10:00 *Nanotechnology and functionalized membranes for water treatment applications and reactions* 54

D. Bhattacharyya, J. Xu, L. Bachas, Y. Tee, University of Kentucky, USA, S. Sikdar, U.S. EPA, USA

10:00 – 10:30 *High boron removal seawater RO membrane* 55

M. Kurihara, M. Henmi, H. Tomiyoka, Toray Industries Inc., Japan

10:30 – 11:00 Coffee break

11:00 – 11:30 *Progress and new applications of forward osmosis and enhanced and traditional direct contact membrane distillation* 56

T.Y. Cath, A.E. Childress, University of Nevada, Reno, USA

11:30 – 12:00 *Engineering of membrane crystallizers* 57

E. Curcio, G. Di Profio, E. Drioli, ITM-CNR and The University of Calabria, Italy

12:00 – 12:30 *Treatment of acrylic fiber process wastewater with IMS for recycling, a pilot test study* 58

J. Zhai, Hydranautics Beijing Office, China

13:00 – 14:00 Lunch

15:30 – 18:00	<b><u>Session VI: Catalytic membranes and membrane reactors</u></b>	
	Session Co-Chairs: Lidietta GIORNO, ITM-CNR, Italy Richard W. BAKER, MTR, USA	
15:30 – 16:00	<i>Mass transport through dense, polymeric, catalytic membrane layer with dispersed catalyst</i> <u>E. Nagy</u> , Veszprem University, Hungary	60
16:00 – 16:30	<i>Adiabatic reactor simulations of the reverse flow catalytic membrane reactor concept with perovskite membranes</i> <u>M. van Sint Annaland</u> , J. Smit, W. Zhang, J.A.M. Kuipers, University of Twente, The Netherlands	61
16:30 – 17:00	<i>Gas phase traffic control in nano-channels of ceramic catalytic membranes</i> <u>V.V. Teplyakov</u> , M.V. Tsodikov, M.I. Magsumov, O.A. Shkrebko, A.S. Fedotov, Topchiev Institute of Petrochemical Synthesis, Russia, F. Kapteijn, Delft University of Technology, The Netherlands	62
17:00 – 17:30	<i>Membrane reactor for the production of biodiesel</i> <u>A.Y. Tremblay</u> , M.A. Dubè, P. Cao, University of Ottawa, Canada	63
17:30 – 18:00	<i>Numerical simulation of a catalytic membrane reactor fuelling a PEM fuel cell loaded by a standard urban cycle</i> P. Schiavetti, L. Capobianco, Z. Del Prete, The University of Rome, <u>V. Violante</u> , Enea-Frascati, Italy	64
18:00 – 19:30	<b><u>Poster Paper Session B</u></b> and Afternoon Coffee	
20:00 - 22:30	Conference Dinner	

## **Thursday, 15<sup>th</sup> June 2006**

- 07:00 – 08:30 Breakfast
- 08:30 – 13:00 **Session VII: Membrane engineering and microelectronic membrane devices**  
Session Co-Chairs:  
Donald R. PAUL, The University of Texas at Austin, USA  
Matthias WESSLING, The University of Twente, The Netherlands
- 08:30 – 09:00 *Membranes for application in regenerative medicine* 66  
A. Lendlein, Institute of Polymer Research, GKSS, Germany
- 09:00 – 09:30 *Novel Membranes With Photoresponsive Permeabilities* 67  
T. Kanamori, K. Sumaru, S. Sugiura, T. Takagi, T. Shinbo, Research Center of advanced bionics, National Institute of Advanced Industrial Science and Technology, Japan
- 09:30 – 10:00 *Applications of zeolite layers in gas microsensors* 68  
R. Mallada, M.A. Urbiztondo, S. Irusta, M.P. Pina, J. Santamaria, The University of Zaragoza, Spain
- 10:00 – 10:30 *Molecular simulation of realistic membrane models of alkylated PEEK membranes* 69  
P. Pullumbi, Air Liquide- Centre de Recherche Claude-Delorme, France, E. Tocci, ITM-CNR, France-Italy
- 10:30 – 11:00 Coffee break
- 11:00 – 11:30 *Mixed matrix membrane adsorbers* 70  
M. Wessling, The University of Twente, The Netherlands
- 11:30 – 12:00 *The potential of facilitated membranes for CO<sub>2</sub>-capture* 71  
M.B. Hägg, T.-J. Kim, Norwegian University of Science and Technology, Norway
- 12:00 – 12:30 *Effect of film thickness on gas permeation characteristics of glassy polymer membranes* 72  
D.R. Paul, University of Texas at Austin, USA
- 12:30 – 13:00 *A short-cut method in membrane gas separation* 73  
G. Barbieri, F. Scura, E. Drioli, ITM-CNR, Italy
- 13:00 – 14:00 Lunch and departure

## Poster papers

Co-Chairs:

Alessandra CRISCUOLI, ITM-CNR, ITALY

Dibakar BHATTACHARYYA, University of Kentucky, USA

Jan GALUZSKA, CANMET Energy Technology Center-Ottawa, CANADA

### Session A

- 1 *Effect of sonication for in-situ stainless steel leaf filtration* 76  
A.Z.B. Sulaiman, R.M. Yunus, Azilah Bt Ajit @ Abd Aziz, Malaysia
- 2 *Facilitated olefin transport membranes - progress and problems* 77  
T. Merkel, R. Blanc, B. Firat, A. Suwarlim, USA
- 3 *The negative rejection of  $H^+$  and its effects on membrane performance in the NF of carbonate solution* 78  
A. Zhu, W. Zhu, X. Wang, F. Long, J. Ma, J. Li, China
- 4 *Water softening through nanofiltration: the role of the electrolyte on desal DK performances* 79  
L. Bruni, C. Mazzoni and S. Bandini, Italy
- 5 *Validity of the simplified versions of DSPM-DE model for the prediction of nanofiltration membranes performances with electrolyte solutions* 80  
L. Bruni, C. Mazzoni, D. Vezzani and S. Bandini, Italy
- 6 *Ammonia decomposition in a catalytic membrane reactor: comparison of various membrane materials* 81  
D. Koutsonikolas, S. Topis, S. Kaldis, G. Skodras, G.P. Sakellariopoulos, Greece
- 7 *Gas separation properties of zeolite filled polyimide membranes* 82  
D. Koutsonikolas, C.I. Chaidou, G.J. Tertsinidou, S.P. Kaldis, G.P. Sakellariopoulos, Greece
- 8 *Active membrane systems for multicomponent gas/vapour separation* 83  
V.V. Teplyakov, A.Y. Okunev, M.G. Shalygin, N.I. Laguntsov, Russia
- 9 *Effect of new photocatalytic coagulant on membrane fouling* 84  
I.C. Kim, K.H. Lee, I.H. Choi, South Korea
- 10 *Characterization and testing of Pd-doped PVDF hollow fibers for dissolved oxygen removal* 85  
G. Barbieri, A. Brunetti, F. Lentini, R. G. Agostino, M.J. Kim, V. Formoso, E. Drioli, K.H. Lee, Italy-South Korea
- 11 *Preparation of polymeric and hybrid proton conducting membranes for application in fuel cells* 86  
E. Fontananova, A. Regina, E. Drioli, F. Trotta, Italy

- 12 *Phosphorous derivatives of poly ether ether ketones* 87  
F. Trotta, P. Finocchiaro, S. Ceresa Mio, E. Drioli, Italy
- 13 *Modelling of glucose and oxygen mass transfer and reaction in mouse hepatocyte spheroids* 88  
 G. Barbieri, E. Curcio, S. Salerno, L. De Bartolo, E. Drioli, A. Bader, Italy-Germany
- 14 *Process intensification in ethylene production by means of membrane operations* 89  
P. Bernardo, G. Barbieri, E. Drioli, Italy
- 15 *Effectiveness comparison among operating parameters on a palladium membrane reactor for methane steam reforming by means of mathematical modeling* 90  
S. Hara, G. Barbieri, E. Drioli, Japan-Italy

## Session B

- 16 *PV separation of water/ethanol with zeolite membrane* 91  
K. Mizoguchi, S. Matsui, M. Arano, M. Iwahori, K. Hirahara, Y. Aoki, T. Nakane, S. Ikeda, T. Sawasaki, K. Sato, Japan
- 17 *The Influences of the pressure, temperature and pH values on the water softening by the NF90 membrane* 92  
J. Ma, A. Zhu and J. Liu, China
- 18 *Development of polymer inclusion membranes (PIMS) for treatment of radioactive wastewater* 93  
T. Kanamori, S. P. Kusumocahyo, M. Inoue, T. Iwatsubo, K. Sumaru, T. Shinbo, H. Matsuyama, M. Teramoto, Japan
- 19 *Development of novel cell separation system using poly(N-isopropylacrylamide)-graft-polypropylene non-woven membrane with antibody* 94  
T. Kanamori, A. Okamura, F. Yoshida, T. Shinbo, Japan
- 20 *10 Nm semiconductor membrane for cleaning of light atom gases* 95  
A. Bobyl, S. Konnikov, G. Tereschenko, Russia
- 21 *Integrated membrane systems for seawater desalination* 96  
F. Macedonio, G. Di Profio, E. Curcio, E. Drioli, Italy
- 22 *Optimization and control of integrated membrane systems for brackish and seawater desalination: modeling and simulation of membrane distillation contactors* 97  
S. Al-Obaidani, G. Di Profio, E. Curcio, E. Drioli, Italy
- 23 *Preparation of stable O/W emulsion containing water insoluble drugs by membrane emulsification* 98  
L. Giorno, E. Piacentini, S. Piluso, E. Drioli, Italy

24	<i>Novel CO<sub>2</sub>-selective membranes for hydrogen purification for fuel cells</i>	99
	<u>J. Zou</u> , J. Huang, W.S. Winston Ho, USA	
25	<i>Carbon dioxide removal from power plants flue gas using gas separation membranes</i>	100
	<u>F. Scura</u> , G. Barbieri, E. Drioli, Italy	
26	<i>Recovery of potassium clavulanate from simulated fermentation broth by a 2-stage process of ion exchange chromatography and desalting electro dialysis</i>	101
	<u>H.H. Kim</u> , T. Han, S.H. Kang, Y.K. Chang, South Korea	
27	<i>The behaviours of ultrafiltration membrane in cyclodextrins separation</i>	102
	<u>M.S.B.A. Munaim</u> , R.M. Illias, A.F. Ismail, O. Hassan, A.W. Zularisam, Malaysia	
28	<i>Modeling of mass transfer in metallurgical counter current process</i>	103
	<u>B. Sahebkar</u> , P.R. Scheller, E. Steinmetz, O. Volkova, A. Wilhelmi, Germany	
29	<i>Hydrogen production from syngas: preliminary design and economic evaluation of a membrane integrated system</i>	104
	<u>G. Clarizia</u> , G. Chiappetta, E. Drioli, A. Mancini, Italy-Ireland	
30	<i>Synthesis and radiation and chemical modification of high-silica zeolites and study of their catalytic activity in the methanol conversion</i>	105
	<u>G. Torosyan</u> , H. Sargsyan, S. Babayan, D. Hovhannisyan, Armenia	
31	<i>Fabrication of polyvinyl alcohol and polyether sulfone hemodialysis membranes and comparison of their performance and morphological characteristics</i>	106
	<u>J. Barzin</u> , S.S. Madaeni, S. Poormoghadas, Iran	
33	<i>Gibberellic acid pertraction using emulsion liquid membranes</i>	107
	<u>G. Aroca</u> , L. Pyle, J.A. Berríos, Chile-UK	
34	<i>Concentration and purification of pectin polysaccharides by dia-ultrafiltration system</i>	108
	<u>Z. Muhiddinov</u> , M. Akhmedov, K. Avloev, D. Khalikov Tajikistan	
35	<i>Selective membranes prepared by ion track etching</i>	109
	<u>V. Kulshrestha</u> , K. Awasthi, N.K. Acharya, M. Singh, Y.K. Vijay, D.K. Awasthi, S.A. Khan, India	
36	<i>Intensification of dead-end ultrafiltration of waters with high calcium hardness under the "pulsation" filtration conditions</i>	110
	<u>A. Kavitskaya</u> , M. Skilskaya, A. Kononova, Ukraine	



## Program Overview morning sessions

	Sunday June 11th	Monday June 12th	Tuesday June 13th	Wednesday June 14th	Thursday June 15th		
8:30-9:00		Welcome <b>Enrico DRIOLI</b> <i>Conference chair</i> <b>Norman N. Li</b> <i>ECI technical Liaison</i>	<i>Session III – Chairs: N.N. Li and G. Barbieri</i> Integrated and hybrid membranes operations	<b>S. VELIZAROV</b> Membrane solutions for the removal of charged micropollutants from drinking water supplies	<b>A. LENDLEIN</b> Membranes for application in regenerative medicine		
9:00-9:30	Plenary Lecture Chair: E. Drioli <b>J.C. CHARPENTIER</b> Modern Chemical Engineering in the frame of globalization sustainability and technical innovation (molecules into money). The example of Membrane Engineering for Process Intensification	<b>T. FANE</b> Unconventional hybrid membrane processes: 1 + 2 > 3 ?		<b>R. SEMIAT</b> Membrane crystallizer for increased desalination recovery		<b>T. KANAMORI</b> Novel Membranes with Photoresponsive Permeabilities	
9:30-10:00		<b>B. VAN DER BRUGGEN</b> Process integration in wastewater treatment: enhanced separation characteristics in nanofiltration		<b>D. BHATTACHARYYA</b> Nanotechnology and functionalized membranes for water treatment applications and reactions			<b>S. IRUSTA</b> Applications of zeolite layers in gas microsensors
10:00-10:30	Coffee break			<b>M. KURIHARA</b> High boron removal seawater RO membrane			
10:30-11:00	Session I – Chairs: E. Drioli and R. Gani Membrane engineering for Process Intensification	Coffee break		Coffee break			
11:00-11:30	<b>W.J. KOROS</b> Advanced membranes for more energy efficient separations	<i>Session IV – Chairs D. Hofmann and L. De Bartolo</i> Membranes engineering for regenerative medicine	<b>D. HOFMANN</b> Atomistic molecular modeling of biomaterials	Coffee break			
11:30-12:00	<b>B.D. FREEMAN</b> Novel reverse osmosis membranes with improved properties		<b>A. BADER</b> Development of bioreactors for tissue engineering and regenerative medicine	<b>T.Y. CATH</b> Progress and new applications of forward osmosis and enhanced and traditional direct contact membrane distillation	<b>M. WESSLING</b> Mixed matrix membrane adsorbers		
12:00-12:30	<b>G. RIOS</b> Keys for a good control of membrane integration in industrial processes		<b>M. ELLIS</b> Novel biodegradable hollow fibre membrane scaffolds for the production of clinical scale tissue engineered constructs	<b>E. CURCIO</b> Engineering of membrane crystallizers	<b>M.B. HÄGG</b> The potential of facilitated membranes for CO <sub>2</sub> -capture		
12:30-13:00	<b>R.W. BAKER</b> Natural Gas Processing with Membranes		<b>L. DE BARTOLO</b> Human lymphocyte membrane bioreactor as model for immunomodulatory molecule studies	<b>J. ZHAI</b> Treatment of acrylic fiber process wastewater with IMS for recycling, a pilot test study	<b>D.R. PAUL</b> Effect of film thickness on gas permeation characteristics of glassy polymer membranes		
13:00-14:00	<b>J. CARO</b> Perovskite hollow fibre membranes for the production of oxygen enriched air and synthesis gas (CO, H <sub>2</sub> ) – engineering aspects	Lunch			<b>G. BARBIERI</b> A short-cut method in membrane gas separation		
	Lunch				Lunch and Departure		

**Afternoon sessions**

15:30-16:00		<b>Session II – Chairs: K.K. Sirkar and T. Fane</b> Membrane Contactors (membrane distillation, membrane emulsification, ...	<b>K.K. SIRKAR</b> Multiscale studies of membrane distillation of saline water- experimental results and modeling	Sightseeing and visit to The University of Calabria and ITM-CNR	<b>Session VI- Chairs: L. Giorno and R.W. Baker</b> Catalytic membranes and membrane reactors	<b>E. NAGY</b> Mass transport through dense, polymeric, catalytic membrane layer with dispersed catalyst	
16:00-16:30			<b>A. URTIAGA</b> The integration of membrane contactors in the definition of sustainable treatment of wastewaters and effluents			<b>M. VAN SINT ANNALAND</b> Adiabatic reactor simulations of the reverse flow catalytic membrane reactor concept with perovskite membranes	
16:30-17:00	Registration		<b>B. NORDDAHL</b> A membrane contactor for ammonia stripping, pilot scale experiences, modeling and comparisons with alternative stripping methods			<b>V.V. TEPLYAKOV</b> Gas phase traffic control in nano-channels of ceramic catalytic membranes	
17:00-17:30			<b>R. MOLINARI</b> Studies on transport selectivity and stability in a supported liquid membrane by using the Cu <sup>2+</sup> as model ion			<b>A.Y. TREMBLAY</b> Membrane reactor for the production of biodiesel	
17:30-18:00		Chairs: A. Criscuoli, D. Bhattacharyya and J. Galuszka	Poster session A and Afternoon coffee		<b>V. VIOLANTE</b> Numerical simulation of a catalytic membrane reactor fuelling a PEM fuel cell loaded by a standard urban cycle		
18:00-18:30							
18:30-19:00	Welcome Cocktail				Poster session B and Afternoon coffee		
19:00-19:30							
20:00-	Dinner at Grand Hotel San Michele	Dinner at Grand Hotel San Michele wine cellar	Dinner at old Rende	Conference Dinner at Grand Hotel San Michele			