



## Walter van der Meer new professor Membrane Process Technology

Since January 1, 2005, Dr. Walter van der Meer is appointed as part-time professor of the Membrane Process Technology group of the University of Twente. Walter van der Meer, who studied chemical technology and wrote his Ph.D thesis about mathematical modeling of NF and RO membrane filtration plants and modules. He currently works as research director at Vitens, one of the largest water supply companies in The Netherlands. As professor of the Membrane Process Technology Group, he will mainly focus on the application of membranes for drinking water and waste water treatment. Walter van der Meer will perform his academic research at the University of Twente in Enschede, but also partly at Wetsus in Leeuwarden where 4-5 Ph.D students of Membrane Process Technology perform their research.

Wetsus is a research institute for sustainable water technology located in the northern part of The Netherlands in which renowned universities and industrial partners have joined forces. To face the steadily increasing global water problems, Wetsus focuses upon the development of treatment technologies for sustainable water. The main added value lies in the multidisciplinary use of biotechnology and separation technology.



Professor W. van der Meer

### 1<sup>st</sup> edition of MNT!

Membrane research at the University of Twente is carried out in very different areas in various research groups. Information on progress and people carrying out the research is difficult to access, even for people working within the university. The Membrane Technology Group strives to make all research efforts more transparent to the outside world. To academic, governmental and industrial collaborators.

We hope that you will enjoy the newsletter and we welcome contributions and comments.

#### The Editors

Dr. Kitty Nymeijer  
Wilbert van de Ven, M.Sc.  
Piotr Długołęcki, M. Sc.  
Prof. Matthias Wessling

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## Introducing...

### Name

Piotr Długołęcki

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### Ph.D. Project

Power generation  
by Reversed Electro  
Dialysis (RED):

### Membrane Design

Reverse Electro Dialysis (RED) is a non-polluting, sustainable method to generate electricity. In RED, a concentrated salt solution and a fresh water phase are brought into contact through an alternating series of anion exchange membranes (AEM) and cation exchange membranes (CEM). Due to the concentration difference between both solutions, anions migrate through the AEM towards the anode and cations move through the CEM towards the cathode, thus generating electricity. A major factor that needs to be investigated to improve the RED performance is the development of new membranes. Properties of these membranes must be specially designed for the RED stack to maximize the power output at reduced membrane cost price.



J.N. Barsema, N.F.A. van der Vegt, G.H. Koops, M. Wessling, Ag-functionalized carbon molecular-sieve membranes based on polyelectrolyte/polyimide blend precursors, *Adv. Funct. Materials* 15-1 (2005) 69-75

D.F. Stamatiadis, H.H.M. Rolevink, J. Balster, G.H. Koops, Controlled drug delivery through tailor-made blend polymeric membranes, Proceedings of the Eight European Symposium on Controlled Drug Delivery 2004, *Journal of Controlled Release* 101 1-3 (2005) 302-303

M.H.V. Mulder, E.M. van Voorthuizen, J.M.M. Peeters, Membrane characterization Chapter 5 book 'Nanofiltration: principles and applications' / Editors A.I. Schäfer, A.G. Fane, T.D. Waite – *Elsevier ISBN 1-85617-405-0* (2005) 89-117

R.S. Gärtner, G.F. Wilhelm, G.J. Witkamp, M. Wessling, Regeneration of mixed solvent by electrodialysis: selective removal of chloride and sulfate, *Journal of Membrane Science* 250 (2005) 113-133

H.J. Zwijnenberg, G.H. Koops, M. Wessling, Solar driven membrane pervaporation for desalination processes, *Journal of Membrane Science* 250 (2005) 235-246

S.J. Metz, W.J.C. van de Ven, J. Potreck, M.H.V. Mulder, M. Wessling, Transport of water vapor and inert gas mixtures through highly selective and highly permeable polymer membranes, *Journal of Membrane Science* 251 (2005) 29-41

T. Visser, G.H. Koops, M. Wessling, On the subtle balance between competitive sorption and plasticization effects in asymmetric hollow fiber gas separation membranes, *Journal of Membrane Science* 252 (2005) 265-277

W. Nijdam, J. de Jong, C.J.M. van Rijn, T. Visser, L.A.M. Versteeg, G. Kapantaidakis, G.H. Koops, M. Wessling, High performance micro-engineered hollow fiber membranes by smart spinneret design, *Journal of Membrane Science* 256 (2005) 209-215

R.H.S. Jansen, J.W. de Rijk, A. Zwijnenburg, M.H.V. Mulder, M. Wessling, Hollow fiber membrane contactors – A means to study the reaction kinetics of humic substance ozonation, *Journal of Membrane Science* 257 (2005) 48-59

## Graduations

Ronald Jansen (May 20, 2005)  
Ozonation of humic substances in a membrane contactor

Ines Frenzel (June 3, 2005)  
Waste minimization in chromium plating industry

Laura Vogelaar (July 8, 2005)  
Phase separation micro molding

Jurgen Ooms (January 13, 2005)  
Membranes for direct methanol fuel cells

Bisani Ranganadh (May 19, 2005)  
Flue gas dehydration by membrane technology

Tanya Teerling (June 16, 2005)  
Modelling of mixed-matrix membrane adsorbers modules

Peter Koel (June 20, 2005)  
Star-shaped hollow fiber ultrafiltration membranes

Bouke Ankoné (July 4, 2005)  
Fabrication of thin porous microfluidic chips

Imam Akbarsyah (July 13, 2005)  
Fabrication and characterization of polymeric microsieves

## Microstructures on the cover of Small

The cover of the latest edition of *Small* features pictures of structures prepared in the laboratory of MTG. It displays SEM images of porous as well as dense microstructures: stars on the background, pillars, porous lines and a polymeric microsieve. The remainder of the cover shows a photograph of diffraction of sunlight through transparent microstructures floating in water.

The paper in *Small* (see *publications*) describes a new fabrication method for the preparation of microstructures from several materials (Phase Separation micro Molding). Some important characteristics of  $PS_{\mu M}$  are explained, like the possibility to introduce and tune porosity, the easy release from the mold and the wide range of materials, some yet unknown in micro-fabrication. The role of shrinkage in the process is discussed. It is the reason for the easy release, but also a challenge to overcome while replicating shallow molds





## “Particles in a membrane” spin-out into Mosaic Systems

Mosaic Systems is a spin-off company of the Membrane Technology Group founded at the end of 2003. Mosaic systems exploits a technology platform in which functional particles are embedded into a porous membrane matrix. The technology is based on research described in various articles of Magda Avramescu.

Mosaic Systems develops membrane modules with a variety of chromatography functions; such as ion exchange, hydrophobic interaction and affinity. The modules are based on membrane fibers. The module technology can be positioned between a packed bed and expanded bed with a very high sorption and flow capacity due to small adsorption particles and low pressure drop. Beginning of 2005, Mosaic Systems attracted venture capital by Innofonds and Biopartner to exploit the technology for markets such as biopharmaceuticals, food and beverage and analytics.

For more info: [www.mosaicsystems.nl](http://www.mosaicsystems.nl)

### Literature

M.E. Avramescu, W.F.C. Sager, Z.

Borneman, M. Wessling, Adsorptive membranes for bilirubin removal, *Journal of Chromatography B-Analytical Technologies in the Biomedical and Life Sciences* 803 (2): 215-223 APR 25 2004

M.E. Avramescu, M. Girones, Z.

Borneman, M. Wessling, Preparation of mixed matrix adsorber membranes for protein recovery, *Journal of Membrane Science* 218 (1-2): 219-233 JUL 1 2003

This picture appears to show a polymeric microsieve submerged in clear sea water. In reality, it is a dry sieve with a very thin polymeric layer on top, probably caused by the evaporation of acetone while phase separating the membrane.

**Picture by Miriam Gironès**

### Picture of the Month Competition

The picture of the month is chosen from all the pictures that were taken in the MTG group during the last month. The winner receives free drinks for one night and gets to pick the winner from next month's contributions. All the winners can be found on the website [www.membrane.nl](http://www.membrane.nl)

## 7th Edition of NYM a great success

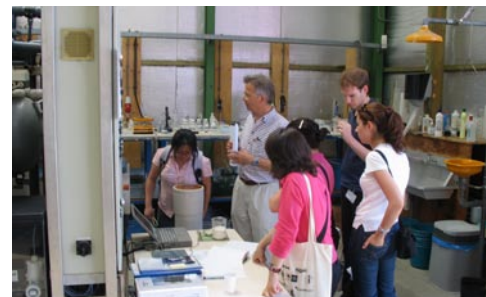
“The aim of the Network Young Membrains meetings is to bring together creative people, who are currently researching membrane technology either at Universities or in Industry, both Ph.D. and M.Sc. students.”

Formulated during the first meeting in Aachen in 1999, this aim still holds. It is shown by the impressive numbers from this year's edition. The annual 2 day conference, held at the University of Twente from 22-24 June, was attended by 87 people originating from 24 different countries working at various institutes and companies in Europe. During the first day of the NYM, young researchers, the age limit is 35, discussed membranes in 12 different workshops.

In these workshops the participants presented their work and discussed the results and problems among people with similar specialties. Afterwards the groups formulated the future trends and problems of their specific research area into a presentation before the other participants. On Friday, Professor Melin from Aachen and Dr. Nijmeijer from the EMI gave plenary lectures. During the afternoon, a research location and a nanofiltration plant of Dutch drinking water company Vitens were visited.

To promote networking, a welcome dinner and barbecue were organized.

*The 8th edition of the NYM will be held in Italy next year prior to the Euromembrane.*



Young membrains visiting Vitens



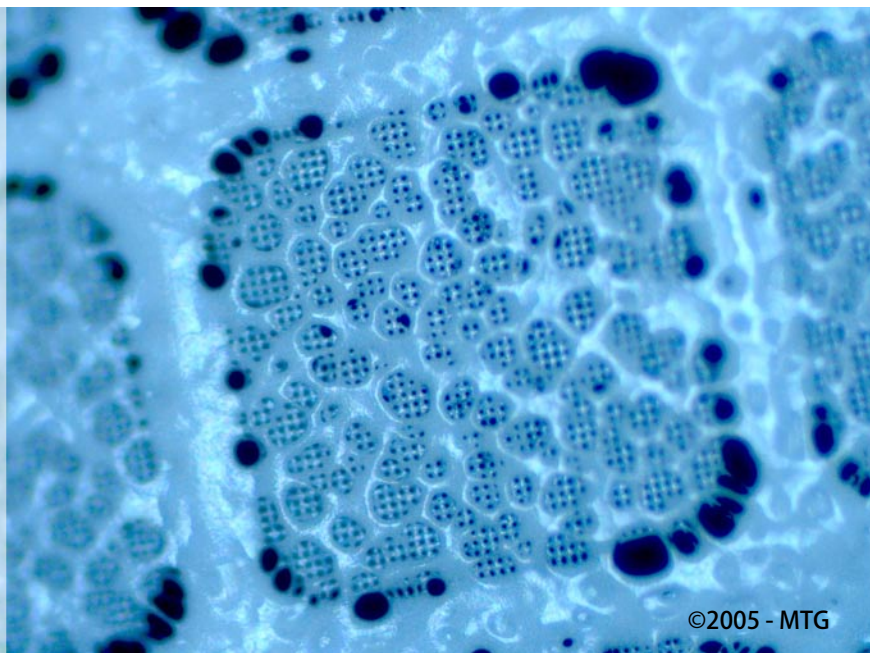
Networking at the barbecue

### Information

NYM website: <http://www.ivt.rwth-aachen.de/Eng/Tagungen/nym.html>

NYM-7 website: <http://www.membrane.nl/NYM7/>

picture of the month - April  
‘Under Water’



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# The Membrane Technology Group

## Multidisciplinary approach in membrane science and technology

The Membrane Technology Group focuses on the multi-disciplinary research area of membrane science and technology. We consider our expertise to be a multidisciplinary knowledge chain ranging from molecule to process. The knowledge chain comprises the following elements:

- Colloid and interface science
- Macroscopic mass transport characterization and modelling
- Material Science
- Material Processing
- Module and system design
- Process technology

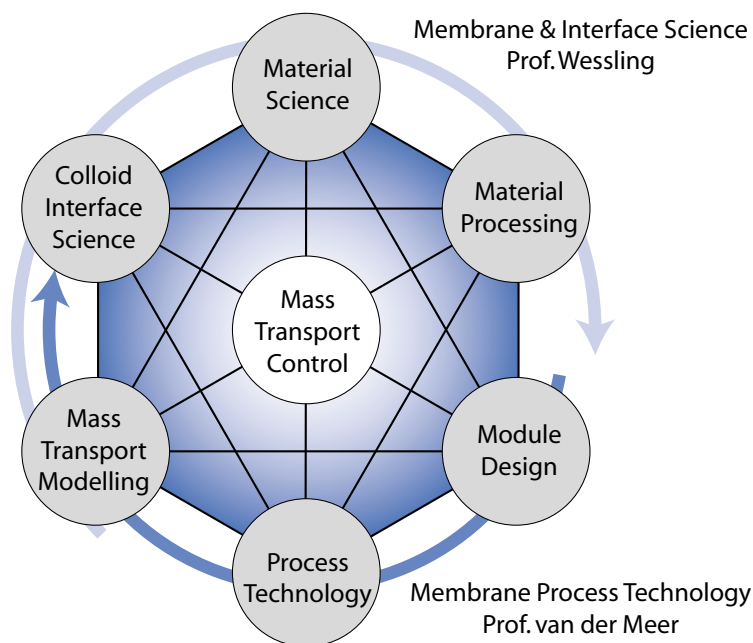
The research team is assembled such that permanent staff members cover one or more of the disciplines involved. The majority of the research deals with separation of molecular mixtures and selective mass transport. Our research program distinguishes four application clusters:

- Water, Energy and Sustainability
- Separation Technology
- Life Science
- Micro Systems Technology

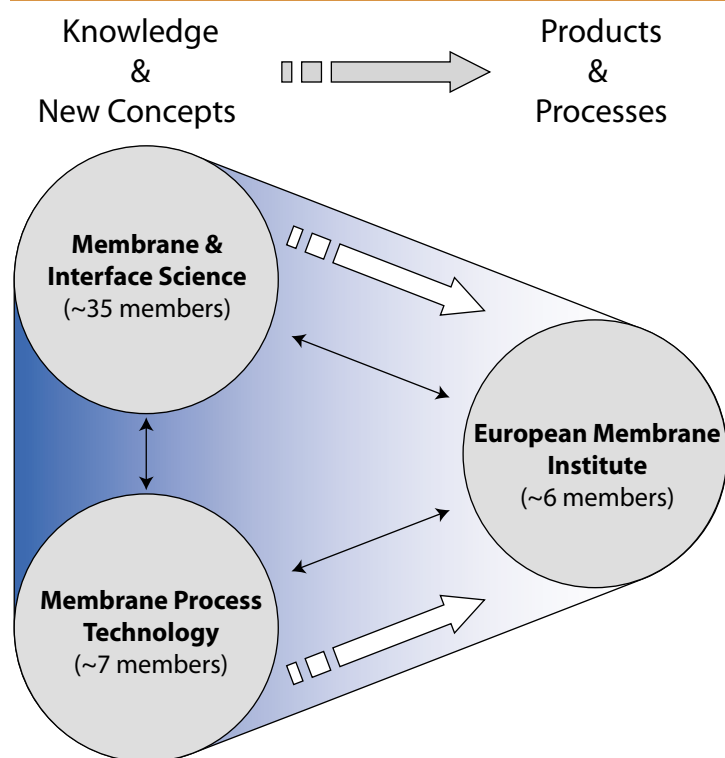
## Knowledge transfer and utilization

Next to academic research, our group has focused over the past years especially on knowledge utilization and transfer. Over the past decade, we experienced that the time scales for research are extremely different in industry and academia. Even within a particular industry, a significant difference exists in time-scales between small and medium enterprises and multi-national corporations. We have adjusted our organizational structure such that we can distinguish between long-term scientific activities and short-term technology transfer. We have established the European Membrane Institute (EMI) Twente for this purpose.

The EMI performs research and development work on new membrane products and processes. The work often focuses on the production of a tangible deliverable.



**Mass transport control by a multidisciplinary approach.** The Membrane & Interface Science group together with the Membrane Process Technology group cover the full spectrum of mass transfer phenomena in membrane separation. The disciplines reach out from the atomistic microscale to the macroscopic process scale.



**Interfacing academia and industry.** The traditional discrepancy between the needs of the industry and the research performed within universities is bridged by the European Membrane Institute.

## Links

<http://www.membrane-emi.nl>

<http://www.membrane.nl>

<http://www.wetsus.nl/nl/Themes6.htm>