

**ION-EXCHANGE MEMBRANE PROCESSES:
THEIR PRINCIPLE AND PRACTICAL APPLICATIONS**
A 3-day intensive course

October 29 – 31, 2018, Rome, Italy

Lecturer Prof. Heiner Strathmann



Heinrich Strathmann is Professor Emeritus of the University of Twente, The Netherlands. He obtained his basic education in Physical Chemistry at the University of Darmstadt in Germany. He worked for several years in the membrane based industry in the United States and in Germany. He is also Associate Professor at the University of Stuttgart and Honorary Professor at South China Central University.

Dr. Strathmann is on the editorial board of various scientific journals and is author of three books on membrane science and technology. He was awarded the R.M. Barrer Prize by the European Membrane Society.

The seminar is directed towards professionals and students with the objective of providing a comprehensive introduction to ion-exchange membrane processes and their practical applications.

During the second half of the last century ion-exchange membranes and their practical utilization in electromembrane processes have gained significant technical and commercial importance in water deionization and purification as well as in electrochemical synthesis and in energy conversion and energy storage. Certain processes such as electrodialysis are mature state-of-the-art techniques, while other processes such as capacitive electrodeionization and electrodialysis with bipolar membranes or the use of ion-exchange membranes in fuel cells and energy conversion are more recent developments which show a large number of interesting applications.

The literature covering ion-exchange processes and their applications is very fragmented and contained in a number of scientific journals or in a large number of patents. This makes it difficult to gain an overview of today's available ion-exchange membrane processes and their applications.

The objective of this seminar is to provide a comprehensive description of the fundamentals of ion-exchange membrane processes and their applications. The subject is covered in six chapters. First, a very general overview of relevant ion-exchange membrane processes is given. Then some electrochemical and thermodynamic fundamentals are discussed. The preparation and characterization of ion-exchange membranes is described next. This is followed by a discussion of the various processes as unit operations and the design of systems and equipment. Finally, present and possible future applications of ion-exchange membrane processes are treated and research needs are pointed out.

CONTENT OF THE SEMINAR

Introduction to Ion-Exchange Membrane Processes

The structure of ion-exchange membranes
Ion-exchange membranes in separation processes
Ion-exchange membranes in electrochemical synthesis
Ion-exchange membranes in energy conversion and generation

Electrochemical and Thermodynamic Fundamentals

Basic electrochemical relations
Basic thermodynamic relations
Transport of ions in solutions and ion-exchange membranes
Electrical current and ion fluxes
The transport and transference numbers
Membrane permselectivity and the Donnan exclusion
Fluxes of none-ionic components through ion-exchange membranes

Preparation and Characterization of Ion-Exchange Membranes

Preparation of homogeneous ion-exchanged membranes
Preparation of heterogeneous ion-exchange membranes
Preparation of special property ion-exchange membranes
Determination of the mechanical properties of ion-exchange membranes
Determination of the electrical properties of ion-exchange membranes
Water transport in ion-exchange membranes

Operating Principle of Ion-Exchange Membrane Processes

The principle of electrodialysis with mono and bipolar membranes
The principle of chlorine-alkaline electrolysis
The principle of diffusion and Donnan dialysis
The principle of continuous electrodeionization
The principle of capacitive electrodeionization
The principle of polymer electrolyte fuel cell
The principle of energy generation by reverse electrodialysis

Ion-Exchange Membrane Process and Equipment Design

Design of electrodialysis processes and equipment
Operational problems in electrodialysis
Energy requirements process economics in electrodialysis
Design of bipolar membrane electrodialysis process and equipment
Operational problems in bipolar membrane electrodialysis
Diffusion dialysis process and equipment design
Operational problems and limitations in diffusion dialysis
Continuous electrodeionization process and equipment design
Capacitive electrodeionization process and equipment design
Operational problems in practical applications of electrodeionization
Reverse electrodialysis energy generation process design
Polymer electrolyte fuel cell design

Applications of Ion-Exchange Membrane Separation Processes

Practical application of electrodialysis

Brackish water desalination by electrodialysis Production of industrial water by electrodialysis Food processing by electrodialysis

Pre-concentration of salts by electrodialysis

Practical applications of bipolar membrane electrodialysis

Production of acids and bases by bipolar membrane electrodialysis

Applications of bipolar membrane electrodialysis in biotechnology

Practical applications of diffusion and Donnan dialysis

Practical applications of continuous electrodeionization

Practical applications of capacitive electrodeionization

Recent Developments and Research Needs in Ion-Exchange Membrane Processes

Development of better ion-exchange membranes

Improvements of equipment and process design

ION-EXCHANGE MEMBRANE PROCESSES: THEIR PRINCIPLE AND PRACTICAL APPLICATIONS

A 3-day intensive course

Lecturer Prof. Heiner Strathmann

October 29–31, 2018, Rome, Italy

REGISTRATION FORM

Surname _____ Name _____

Address _____

Country _____ Telephone _____

Fax _____ Email _____

Registration fee:

- EDS members **€2,500**
 Non-members **€2,700**

The fee includes 4 nights accommodation, lunches, coffee, dinners and course Workbook.

Payment can be made by:

Credit card

Visa Mastercard

Bank Transfer to be sent to the address
below and a copy emailed to us.

Card No. _____

Please take care of your own bank charges

Exp. date ____ Security code _____

Account name: European Desalination Society

Cardholder name _____

Account No. 11863.19

Banca Monte dei Paschi di Siena
67100 L'Aquila, Italy

Signature _____

ABI: 01030 *CAB:* 03600

Swift code: PASCITMMAQU

IBAN code: IT 92 | 01030 03600 000001186319

Please fill in the form and send as an attachment to:

balabanmiriam@gmail.com or fax to: +1 928 543 3066