

Polymeric and Inorganic Membrane Materials and Membrane Formation

Sunday

8:00 AM

Lecturers:

Henk Verweij, Ohio State University, Verweij.1@osu.edu

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ABSTRACT

This workshop includes synthesis and properties of polymeric and inorganic membranes.

MORNING SESSION

Inorganic Membranes: Henk Verweij

This session will cover the most important inorganic membrane types with an emphasis on transport properties of single- and multi-layer structures. After taking the work shop, participants will be able to quickly evaluate the design and viability of supported membrane concepts. The workshop is of interest for researchers, students, teachers, and project managers. It will be slow-paced with much participant interaction.

1. Overview (50'; 10' break).

- Definitions, representative dense and porous morphologies, chemical composition and structure.
- Application for gas and liquid filtration and separation, relation with pore size.
- Characterization with electron microscopy, Kelvin radius methods, ellipsometry, and gas and liquid transport.

2. Transport properties (50'; 10' break, 25')

- Membrane transport regimes vs pore size.
- Meso- and macro-porous membrane liquid transport, ion rejection.
- Meso- and macro-porous membrane gas transport.
- Micro-porous and dense membrane transport.
- Transport in composite membrane materials.
- Treatment of overall multi-layer permeance.

3. Synthesis, colloidal and wet processing (25'; 10' break, 50').

- Colloids and colloidal stability.
- Nano-particle synthesis, particle dispersion, and removal of agglomerates.
- Colloidal consolidation of membranes and supports.
- Electroless deposition of metal components.
- Defect control and abatement.
- Drying phenomena and crack-free drying.
- Conventional and rapid thermal processing.

AFTERNOON SESSION

Polymeric Membranes: Maria R. Coleman

The polymer membrane portion will provide an overview on material selection and fabrication techniques for production of polymeric membranes. The structures and separation properties of a variety of membranes for microfiltration, ultrafiltration, nanofiltration, reverse osmosis, gas

separation will be presented. If workshop facilities allow, there will be a practical demonstration of membrane casting as well as opportunities to participate. It will include the following topics:

1. Material Selection:
2. Basic principles of polymer science, transport mechanisms in polymers, material selection for different membrane separation processes, membranesstructure/property relationships.
Additional topics will include mixed matrix membranes and next generation membrane materials.
3. Formation of Polymer Membranes by Phase Separation:
4. Immersion precipitation, thermally- induced phase separation process, microporous membranes, dense, thin-skinned asymmetric membranes.
5. Formation of Thin-Film Composite Membranes:
6. Solution coating processes, interfacial composite membranes, multilayer composites.
7. Membrane Modifications: Methodology for surface and bulk modification by chemical and plasma techniques.