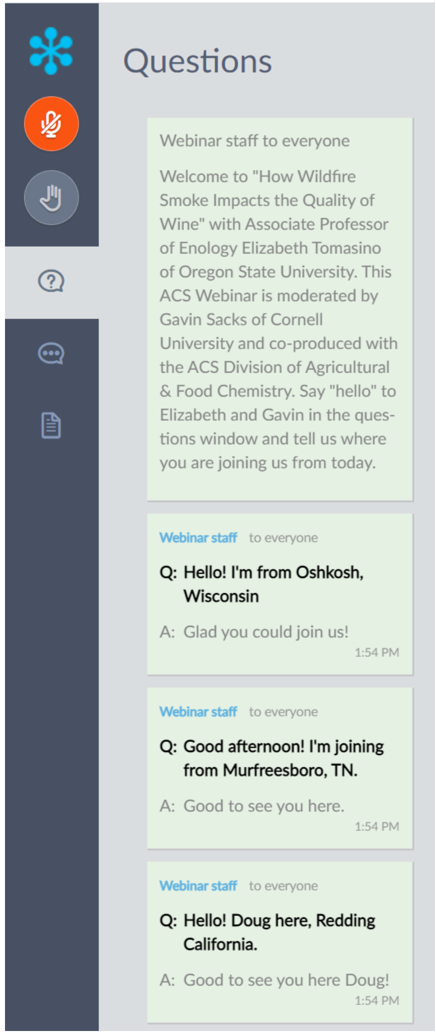
ACS Chemistry for Life®

ACS Webinars®
CLICK • WATCH • LEARN • DISCUSS

www.acs.org/acswebinars

Questions or Comments?

Type them into the questions box!



"Why am I muted?"

Don't worry. Everyone is muted except the Presenter and the Host. Thank you and enjoy the show.

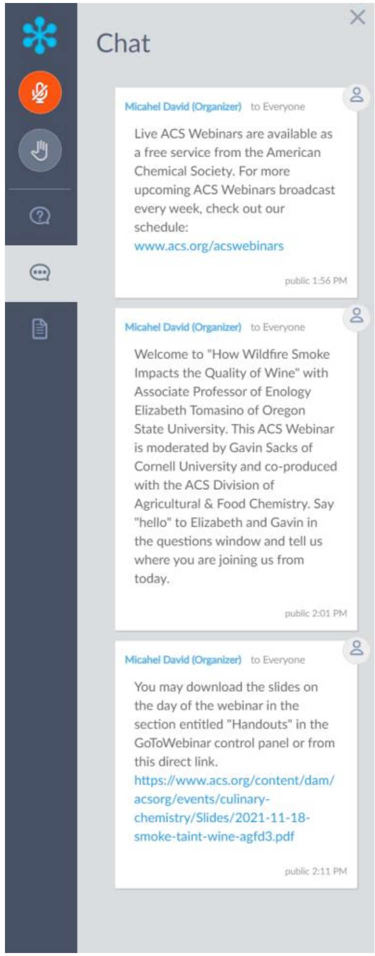
ACS Chemistry for Life®

ACS Webinars®
CLICK • WATCH • LEARN • DISCUSS

www.acs.org/acswebinars

Chat

Announcements and hyperlinks from our team



Let's Get Social!

Follow the American Chemical Society on Twitter, Facebook, Instagram, and LinkedIn for the latest news, events, and connect with your colleagues across the Society.

@AmerChemSociety

@AmericanChemicalSociety

@amerchemsociety

linkedin.com/company/american-chemical-society

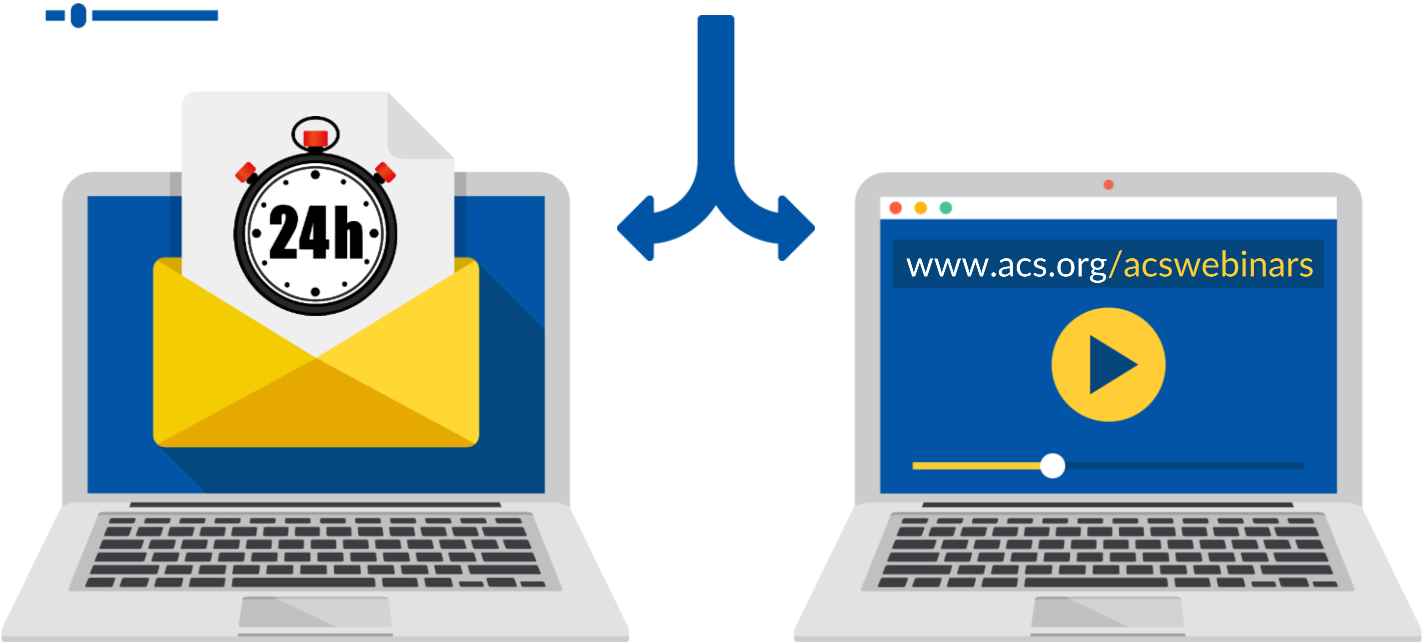
Contact ACS Webinars® at acswebinars@acs.org

ACS Chemistry for Life®

www.acs.org/acswebinars

ACS Webinars®
CLICK • WATCH • LEARN • DISCUSS

Where is the Webinar Recording?



All Registrants

Watch the unedited recording linked in the **Thank You Email for 24 hours.**

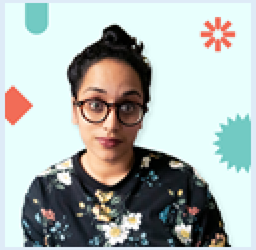
ACS Members w/Premium Package

Visit the ACS Webinars® Library to watch the **edited and captioned recording.**

ACS
Chemistry for Life®

A science podcast by the American Chemical Society about things small in size but BIG in impact.

Sam Jones, PhD
Science Writer & Exec Producer



Deboki Chakravarti, PhD
Science Writer & Co-Host

TO SUBSCRIBE
visit http://www.acs.org/tinymatters or
scan this QR code

From ACS Industry Member Programs

- **Industry Matters Newsletter**

  ACS Member-only weekly newsletter with exclusive interviews with industry leaders and insights to advance your career.

  Preview & Subscribe: acs.org/indnews

- in ACS Innovation Hub

  Connect, collaborate, and stay informed about the trends leading chemical innovation

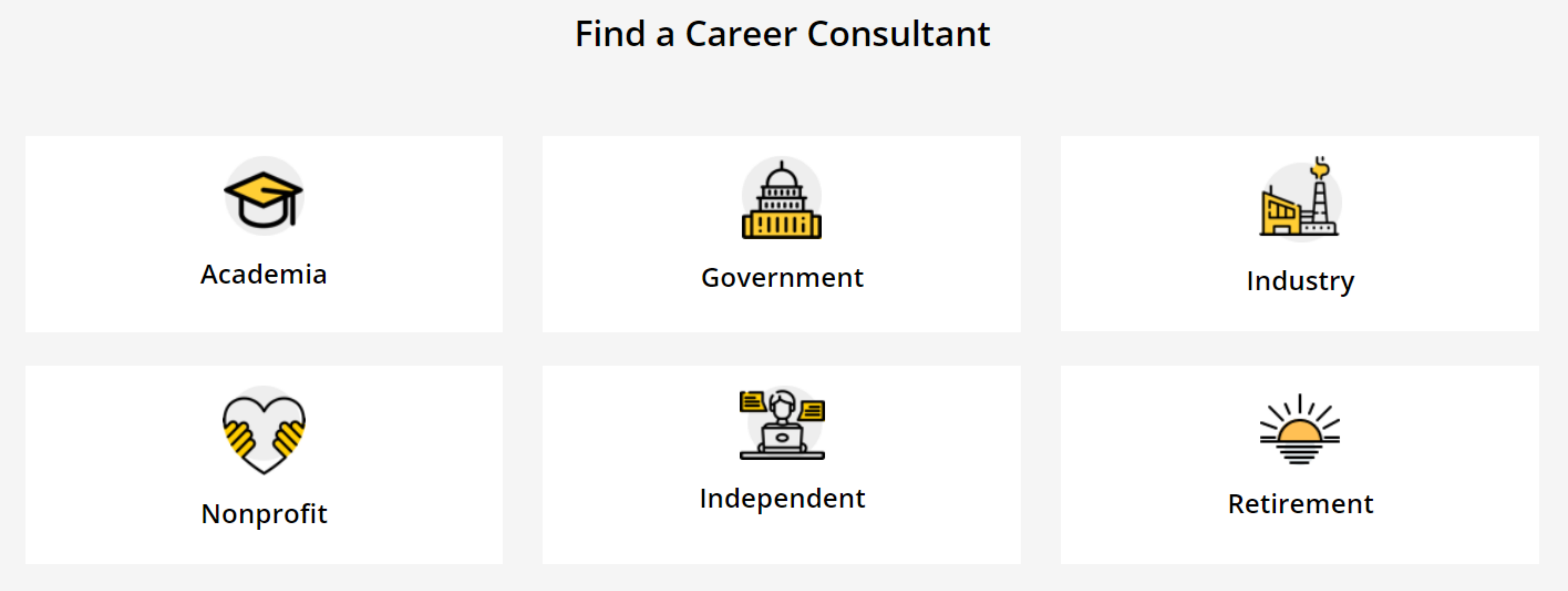
  Join: bit.ly/ACSinnovationhub

A Career Planning Tool For Chemical Scientists

ChemIDP is an Individual Development Plan designed specifically for graduate students and postdoctoral scholars in the chemical sciences. Through immersive, self-paced activities, users explore potential careers, determine specific skills needed for success, and develop plans to achieve professional goals. **ChemIDP** tracks user progress and input, providing tips and strategies to complete goals and guide career exploration.

https://chemidp.acs.org

Career Consultant Directory



- ACS Member-exclusive program that allows you to arrange a one-on-one appointment with a certified ACS Career Consultant.
- Consultants provide personalized career advice to ACS Members.
- Browse our Career Consultant roster and request your one-on-one appointment today!

www.acs.org/careerconsulting

ACS Scholar Adunoluwa Obisesan

BS, Massachusetts Institute of Technology, June 2021
(Chemical-biological Engineering, Computer Science & Molecular Biology)

"The ACS Scholars Program provided me with monetary support as well as a valuable network of peers and mentors who have transformed my life and will help me in my future endeavors. The program enabled me to achieve more than I could have ever dreamed! Thank you so much!"

GIVE TO THE ACS SCHOLARS PROGRAM

Donate today at www.donate.acs.org/scholars

Get in touch with the Office of Diversity, Equity, Inclusion & Respect

The Office of Diversity, Equity, Inclusion & Respect (DEIR) is the central hub at the American Chemical Society that coordinates, supports, and guides all efforts by staff, members, and governance toward Strategic Goal 5, “Embrace and Advance Inclusion in Chemistry.” The Office of DEIR at ACS is committed to empowering everyone, irrespective of lived experience and intersectionality of identities, to fully participate in the chemistry enterprise. The Office of DEIR welcomes comments, suggestions, and questions around issues of diversity, equity, inclusion, and respect from members at any time. Please do not hesitate to reach out to the Office through this form.

Please do not hesitate to reach out to the Office of DEIR at diversity@acs.org

https://fs7.formsite.com/acsdiversity/ACSMemberFeedback/index.html


Atlantic Basin Conference on Chemistry
Linking the World Through Chemistry
13-16 DECEMBER 2022 | MARRAKECH, MOROCCO
Visit ABCChem.org for more information
ABCChem
ATLANTIC BASIN CONFERENCE ON CHEMISTRY
#ABCChem2022

ACS Career Resources

Professional **Development & Education**

ACS Professional Education

Courses and training opportunities from leading experts to help you stay current and advance your career.

ACS Leadership Development

A suite of face-to-face and online courses for growing your leadership skills in today's global economy.

ACS Institute

An online learning portal that offers a robust collection of learning and training resources taught by leading experts.

Virtual Classrooms

Brought to you by ACS Career Pathways™, free online sessions with skilled experts to help you achieve your career goals.

ACS Webinars

Hundreds of webinars presented by subject matter experts in the chemical enterprise.

Career Events

Free workshops and networking opportunities for mid-career chemistry professionals.

ACS on Campus

Free events where students can network with top researchers, learn publishing from ACS editors, and get career tips.

Postdoc to Faculty Workshop

An annual workshop for postdoctoral fellows interested in faculty positions in the chemical sciences.

Career Kick-Starter Workshop

A two-day career development workshop for graduate students and postdoctoral scholars.

Managing **Your Career**

ACS Career Pathways™

Helping budding and career chemists navigate careers in industry, higher education, government, and working for yourself.

Career Consultants

Personalized consulting services to help you make meaningful career decisions and find success in your job search.

ChemIDP™

ACS's Individual Development Plan tools for graduate students and postdoctoral scholars.

Résumé Review

Tips to help you prepare a résumé and find references to support your job applications.

Register for a 2022 Virtual Office Hour

7 APR	How to Write a Resume	April 7, 2022
5 MAY	Careers in Government	May 5, 2022
2 JUN	Entrepreneurship	June 2, 2022
7 JUL	Networking	July 7, 2022
4 AUG	Is Grad School Right for Me?	August 4, 2022
1 SEP	Leadership and Soft Skills Development – What You Need to Advance in Your Career	September 1, 2022

https://www.acs.org/content/acs/en/careers/personal-career-consulting.html

https://www.acs.org/content/acs/en/careers/developing-growing-in-your-career.html

ACS
Chemistry for Life®

www.acs.org/acswebinars

ACS Webinars®
CLICK • WATCH • LEARN • DISCUSS

Wed., May 11, 2022 | 2:00pm–3:00pm ET

Adapting to Climate Change: Insights from Indigenous Peoples

Co-produced with ACS Policy and the American Association for the Advancement of Science

Thurs., May 12, 2022 | 2:00pm–3:00pm ET

Careers in Chemical Safety for Chemists

Co-produced with the ACS Division of Chemical Health and Safety and the ACS Committee on Chemical Safety

Tues., May 17, 2022 | 1:00pm–2:00pm ET

From There to Here: My Asian American Journey

Co-produced with the Office of Diversity, Equity, Inclusion & Respect, ACS

Register for Free

Browse the Upcoming Schedule at www.acs.org/acswebinars

ACS POLY Exclusive Member Benefits

ACS Technical Division
Polymer Chemistry (POLY)

- 1st Year Free Membership!
- Eligibility for awards (including Member of the Month!)
- Alerts for academic, national lab, and industrial job opportunities shared through the POLY list serve
- Networking and professional development events at local/national ACS meetings and local POLY/PMSE chapters
- Industrial scientist support and networking through IAB (Industrial Advisory Board)
- Polymer science-related conferences and workshops advertised through the POLY list serve
- Online educational webinar and webshop series covering cutting-edge polymer research
- Opportunity to vote for the executive committee (annually)
- Recognition for membership (5th, 10th, 20th, and 30th anniversaries)
- Student support – student awards, student symposia, career panels at ACS meetings, support for student chapters.
- An excellent support group for building strong networks in the polymer community!

https://polyacs.org

ACS
Chemistry for Life®

www.acs.org/acswebinars

THIS ACS WEBINAR®
WILL BEGIN SHORTLY...

Say hello in the questions window!

ACS Chemistry for Life®

www.acs.org/acswebinars

Download the Presentation Slides Under Handouts

ACS Webinars®
CLICK • WATCH • LEARN • DISCUSS

Role of Polymer Science in Water Purification Membranes

ABHISHEK ROY, Ph.D.

Senior Staff Scientist, National Renewable Energy Laboratory

GEOFFREY GEISE, Ph.D. M.S.E.

Associate Professor of Chemical Engineering and Materials Science and Engineering (by courtesy), and ChE Undergraduate Program Coordinator, University of Virginia

SYED ISLAM, Ph.D.

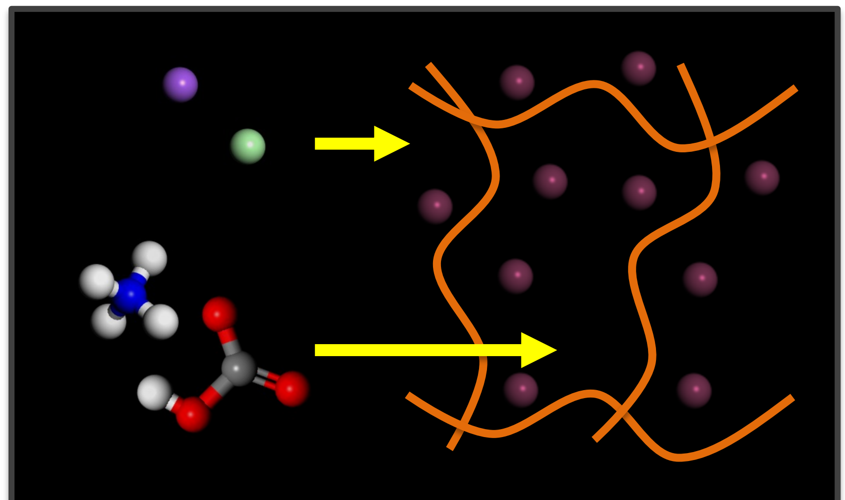
R&D Associate Staff, Chemical Sciences Division, Oak Ridge National Laboratory

This ACS Webinar® is co-produced with the ACS Division of Polymer Chemistry.

Controlling desalination via polymer membrane chemistry

Geoffrey M. Geise

The University of Virginia
Charlottesville, Virginia



Role of Polymer Science in Water Purification Membranes

May 5, 2022

University of Virginia
School of Engineering & Applied Science
Department of Chemical Engineering

Audience Survey Question

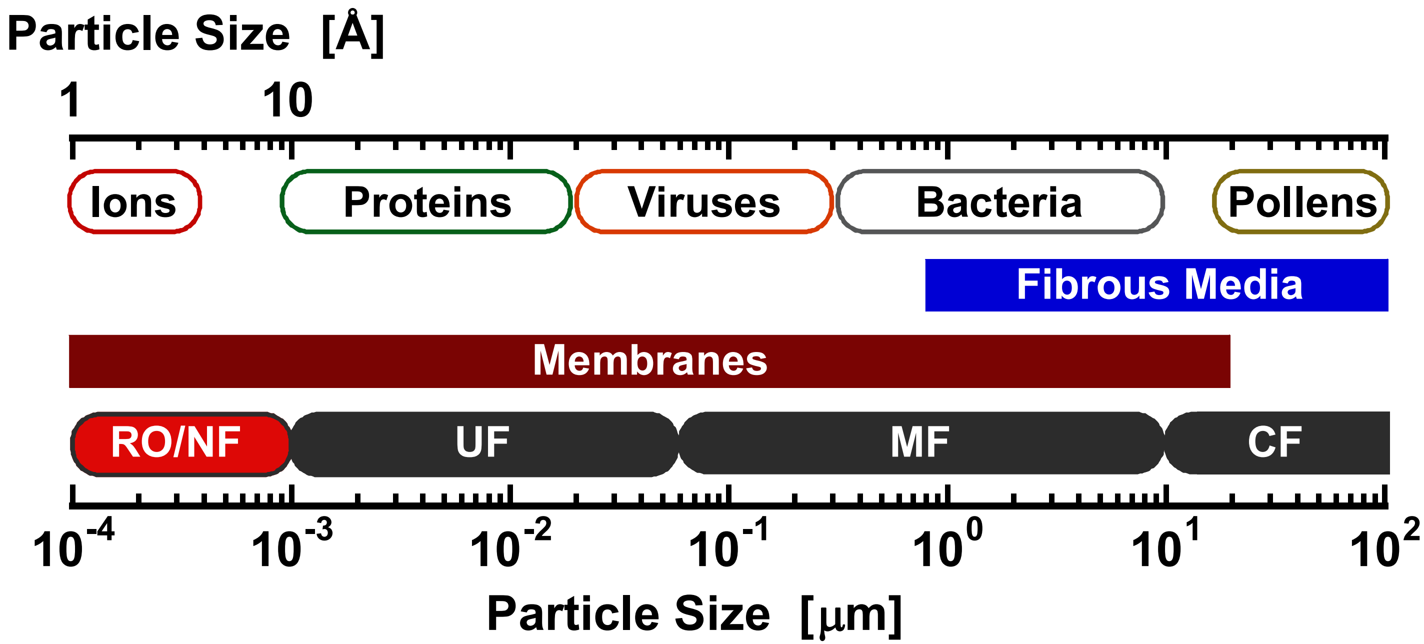
ANSWER THE QUESTION ON SCREEN IN ONE MOMENT

Which factors are most important for governing performance of polymeric desalination membranes (e.g., reverse osmosis membranes)?

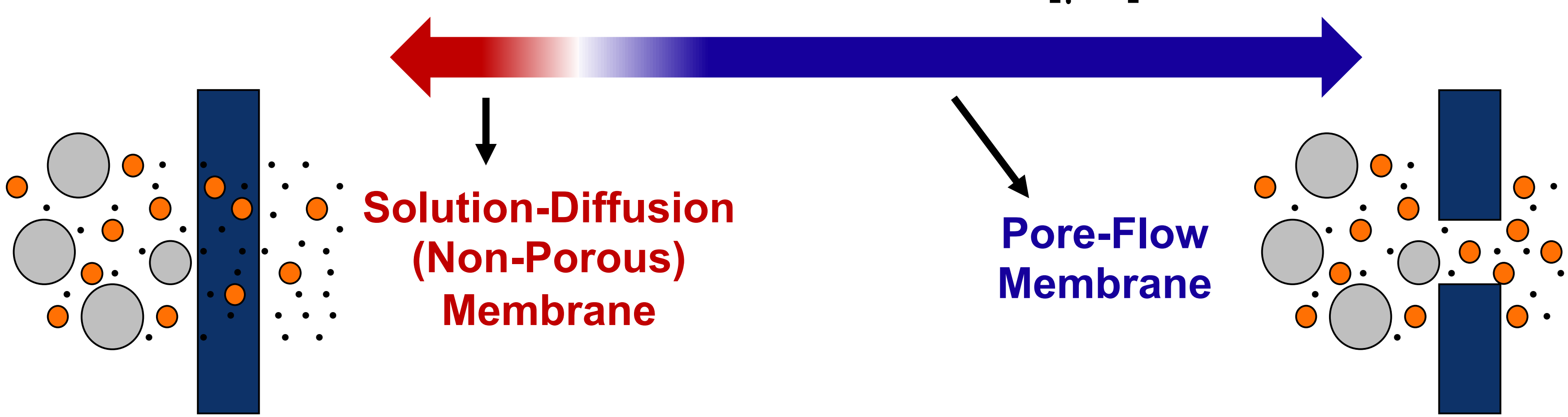
- Thermodynamic factors
- Kinetic/diffusive factors
- Both
- None

** If your answer differs greatly from the choices above tell us in the chat!*

Generally, ion selective membranes are considered to be solution-diffusion materials



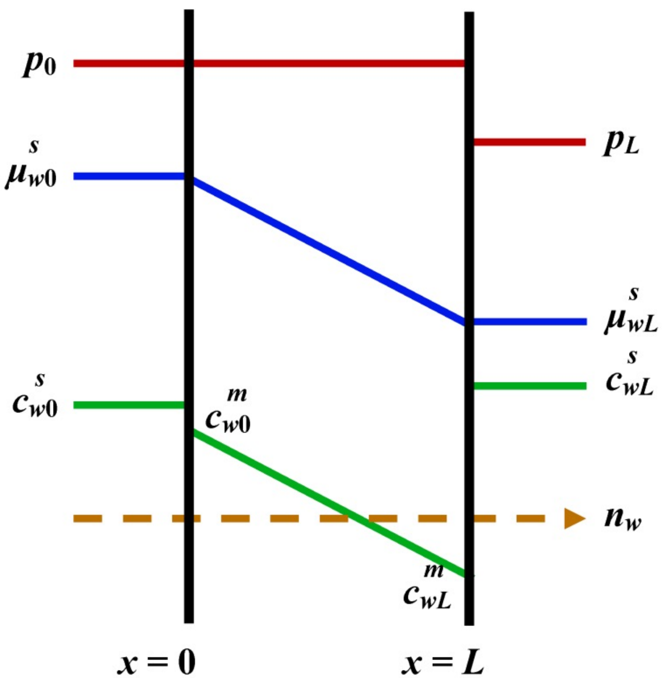
Geise, et al., *J. Polym. Sci. Part B,* **48** (2010) 1685-1718.



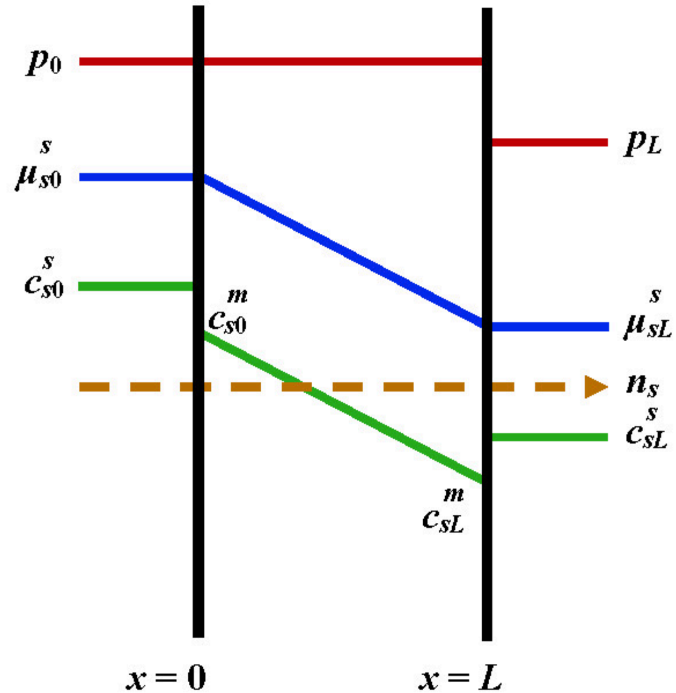
University of Virginia
School of Engineering & Applied Science
Department of Chemical Engineering

Water and salt transport in non-porous polymers is described by a solution-diffusion mechanism

Water Transport



Salt Transport



$$n_w = \frac{D_w}{L} \Delta c^m_w$$

$$P_i = K_i \times D_i$$

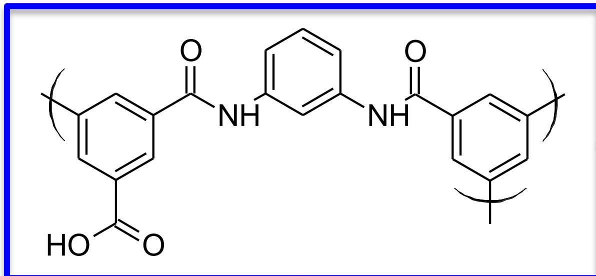
$$n_s = \frac{D_s}{L} \Delta c^m_s$$

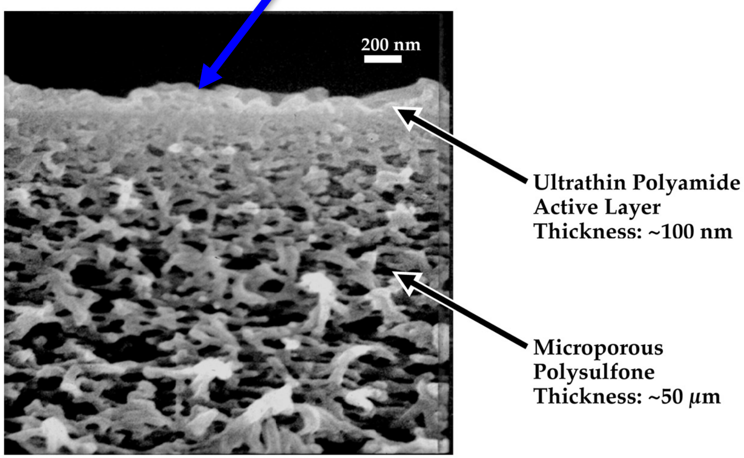
$$n_w = \frac{P_w}{L} \frac{\bar{V}_w}{RT} (\Delta p - \Delta \pi)$$

$$n_s = \frac{P_s}{L} \Delta c^s_s$$

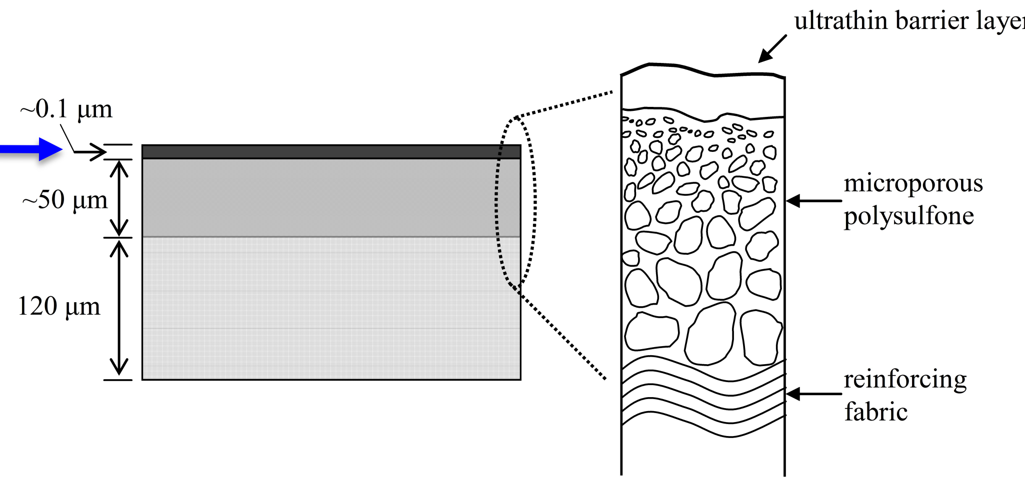
Geise, et al., *Prog. Polym. Sci.*, **39** (2014) 1-42.

Commercial RO membrane active layers sorb relatively little water





Geise, et al., *J. Polym. Sci. Part B: Polym. Phys.* **48** (2010) 1685.



Mass Fraction of Water in the PA Active Layer:

ESPA1 (low-energy RO): **0.02-0.08**
SWC1 (seawater RO): **0.04-0.06**

*Freger, *Environ. Sci. Technol.* **38** (2004) 3168.

DOW PA Active Layer Water Uptake ~5%

*A. Roy, Personal Communication, 2015.

RO membrane polymer water content:

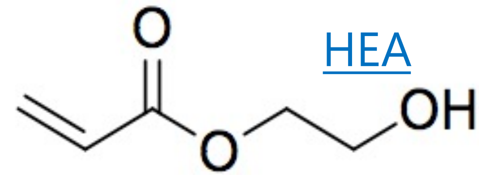
Different from ion exchange materials, such as Nafion (~30% water by volume)

*Paddison, Reagor, Zawodzinski, *Electroanal. Chem.* **459** (1998) 91.

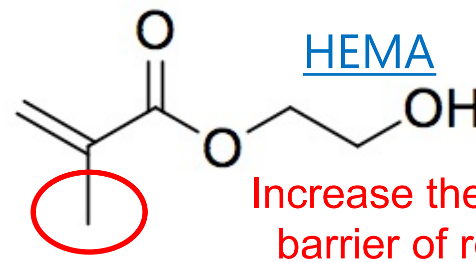
We are interested in understanding the influence of polymer backbone rigidity on water/salt selectivity

- **Choose materials with similar chemistry**
  - Ideally, only the backbone rigidities should be different
- **Prepare materials of comparable water content**
  - Transport properties are highly sensitive to water content
- **Consider ranges of water content that are relevant for desalination membranes**
  - 4-8% (by mass)
- **Study homogeneous polymers**
  - Avoid complications due to morphology

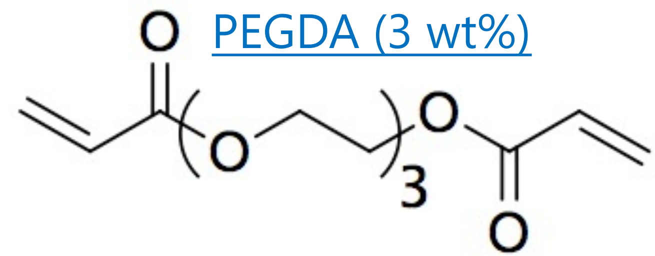
HEA



HEMA



PEGDA (3 wt%)



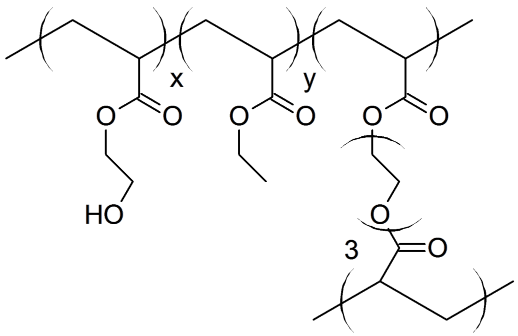
Crosslinked Polymer	Water Uptake [g(water)/g(dry polymer)]
XL-PHEA	1.6
XL-PHEMA	0.6

Chang, Xue, and Geise, *J. Membr. Sci.*, **552** (2018) 43.
Chang, Korovich, Xue, Morris, Madsen, Geise, *Macromolecules,* **51** (2018) 9222.

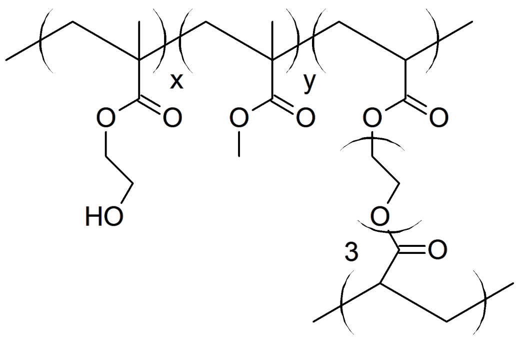
University of Virginia
School of Engineering & Applied Science
Department of Chemical Engineering

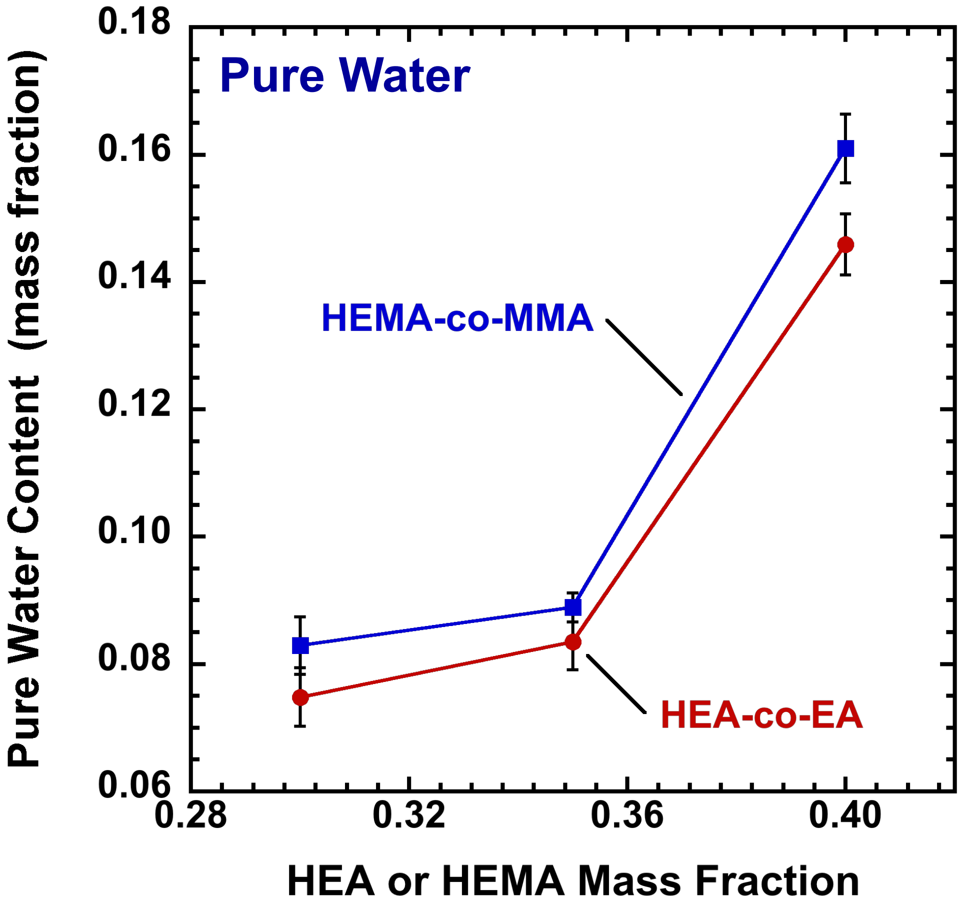
Copolymerizing HEA with EA and HEMA with MMA addressed the need to be able to prepare materials with comparable water content

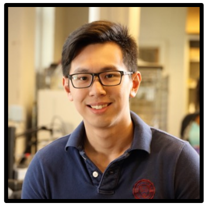
Poly(HEA-co-EA)



Poly(HEMA-co-MMA)







Kevin Chang

Tianyi Xue (M.S. 2015)

Chang, Korovich, Xue, Morris, Madsen, Geise, *Macromolecules,* **51** (2018) 9222.

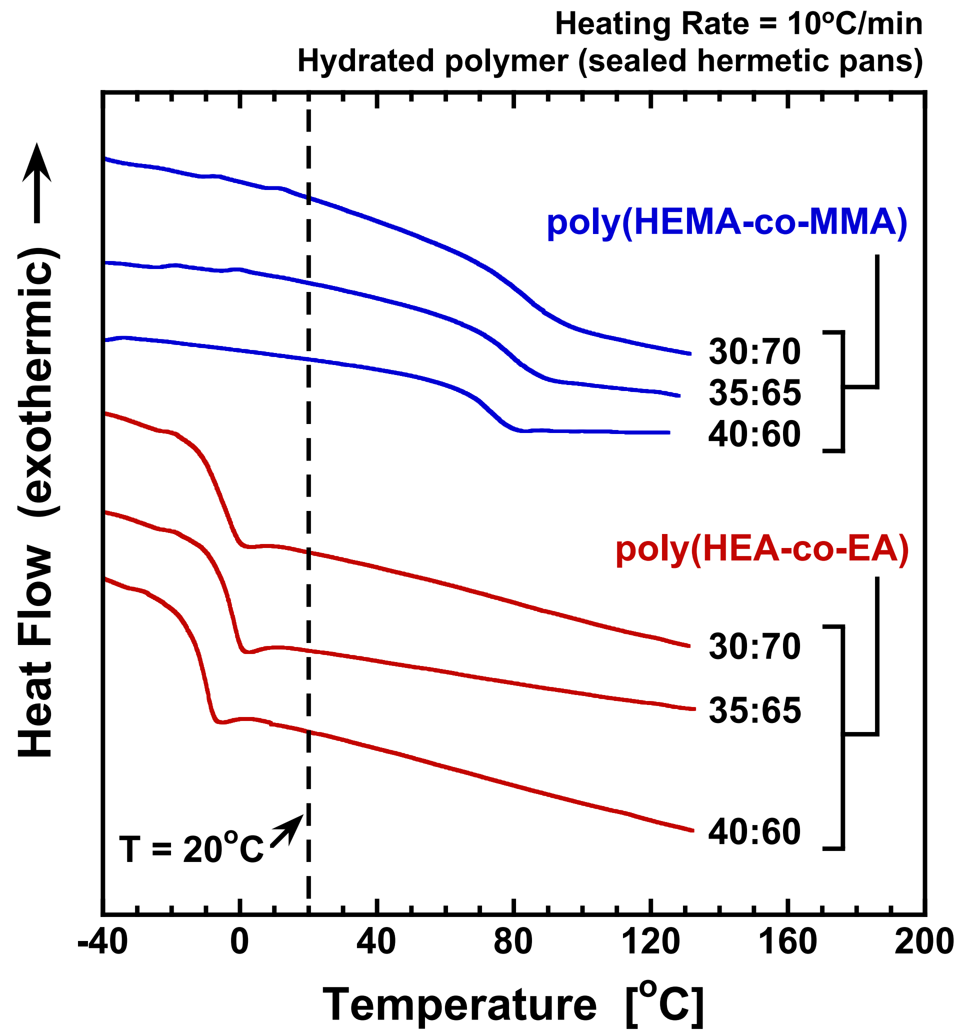
University of Virginia
School of Engineering & Applied Science
Department of Chemical Engineering

Segmental dynamics and homogeneity were probed by making DSC measurements on hydrated films

HEA-co-EA: Room temperature is above the glass transition meaning these films are in the *rubbery* state

HEMA-co-MMA: Room temperature is below the glass transition meaning that segmental dynamics are kinetically locked in a *glassy* state

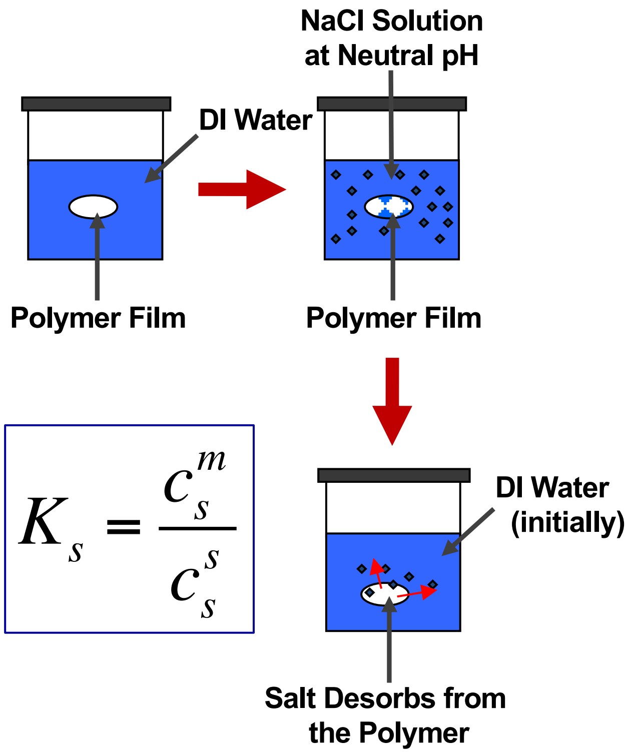
The observation of a single Tg in these copolymers suggests that they are relatively homogeneous



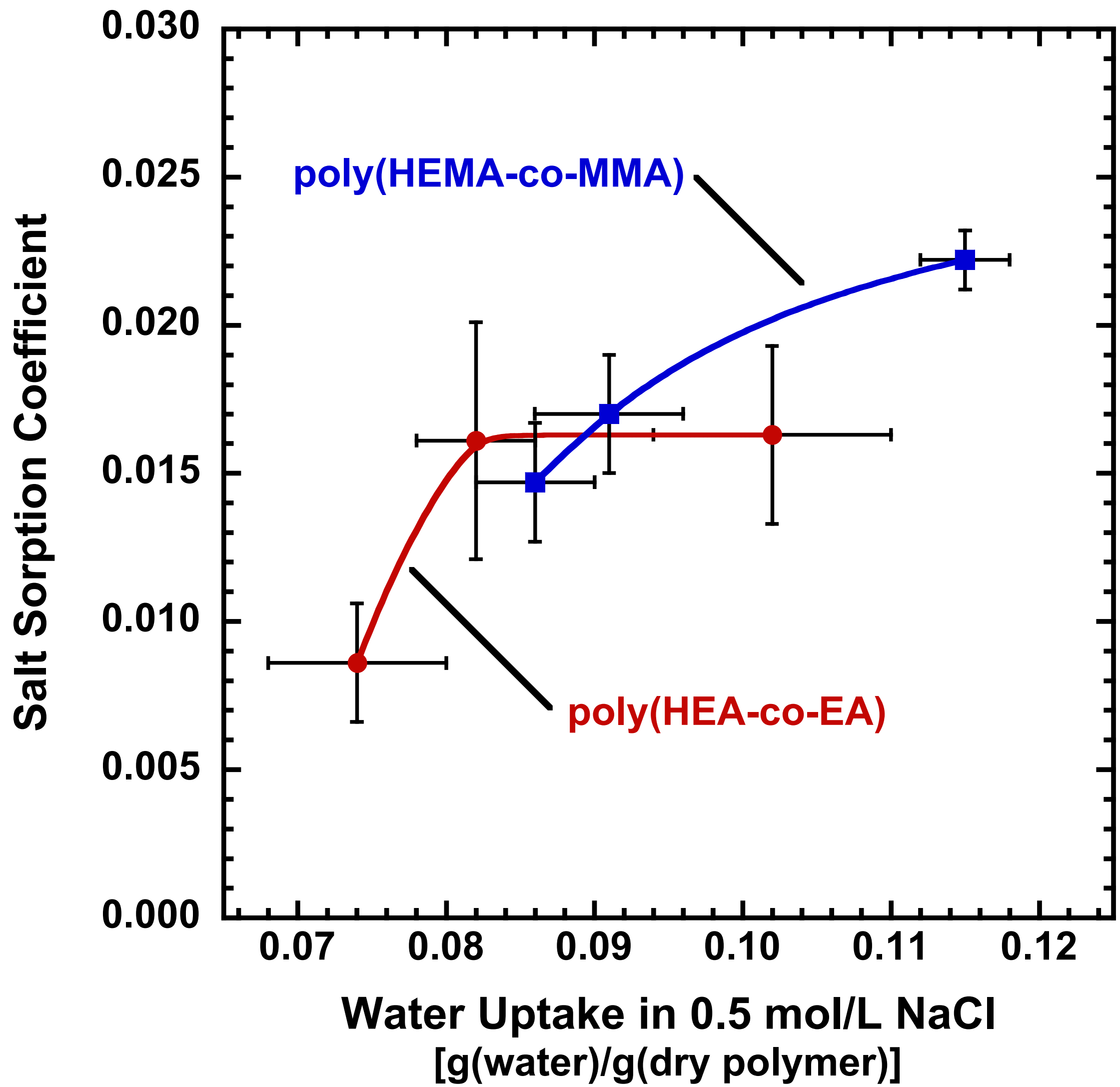
Chang, Korovich, Xue, Morris, Madsen, Geise, *Macromolecules,* **51** (2018) 9222.

UNIVERSITY of VIRGINIA
SCHOOL of ENGINEERING & APPLIED SCIENCE
Department of Chemical Engineering

Salt sorption coefficient curves overlay suggesting that polymer chemistry (from a salt sorption perspective) is similar in our materials

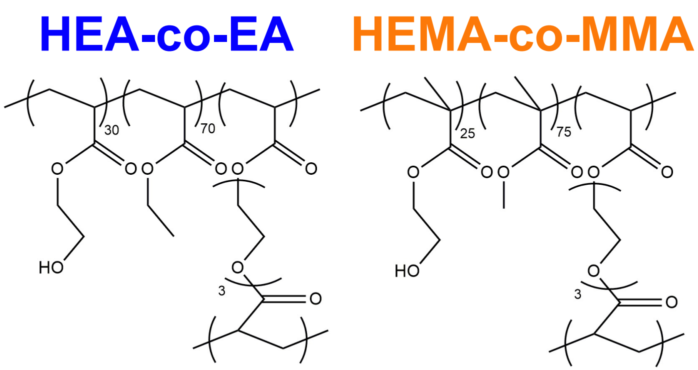


$$K_s = \frac{c_s^m}{c_s^s}$$



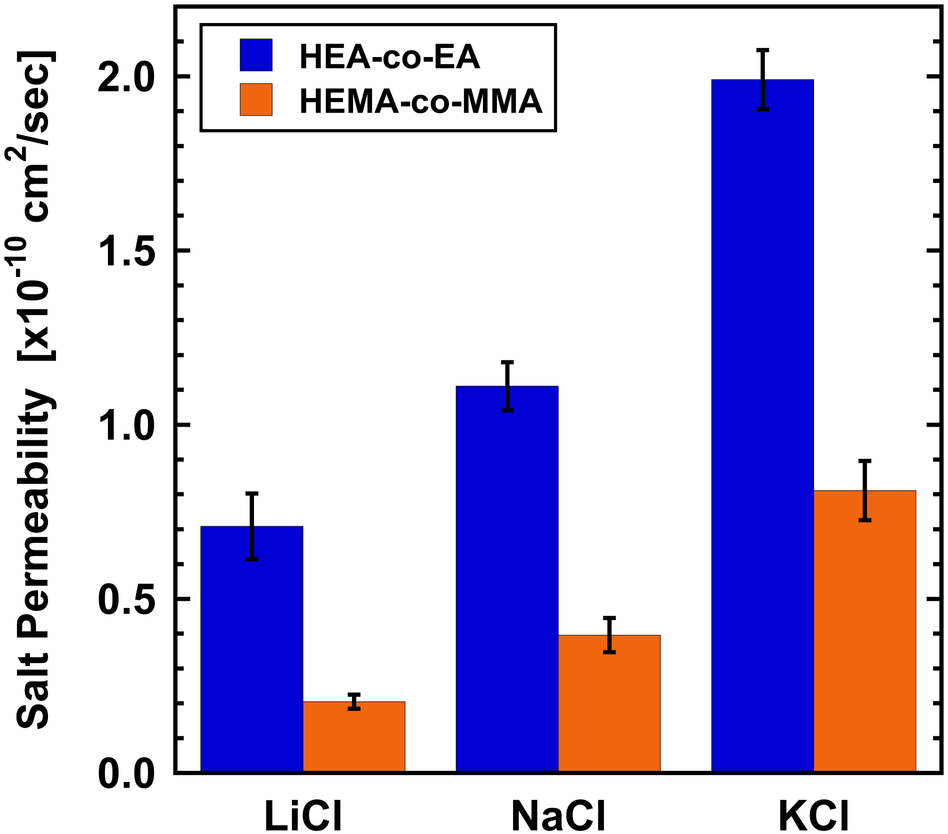
Chang, Korovich, Xue, Morris, Madsen, Geise, *Macromolecules*, **51** (2018) 9222.

Salt permeation is faster in HEA-co-EA compared to HEMA-co-MMA



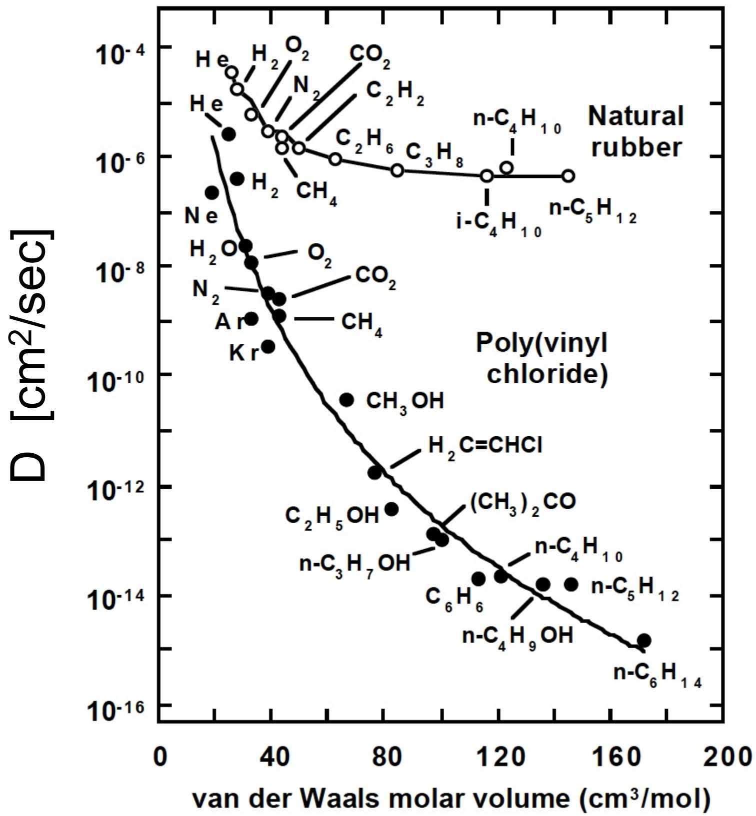
Water Uptake = 0.09 ± 0.01

Water Uptake = 0.09 ± 0.03

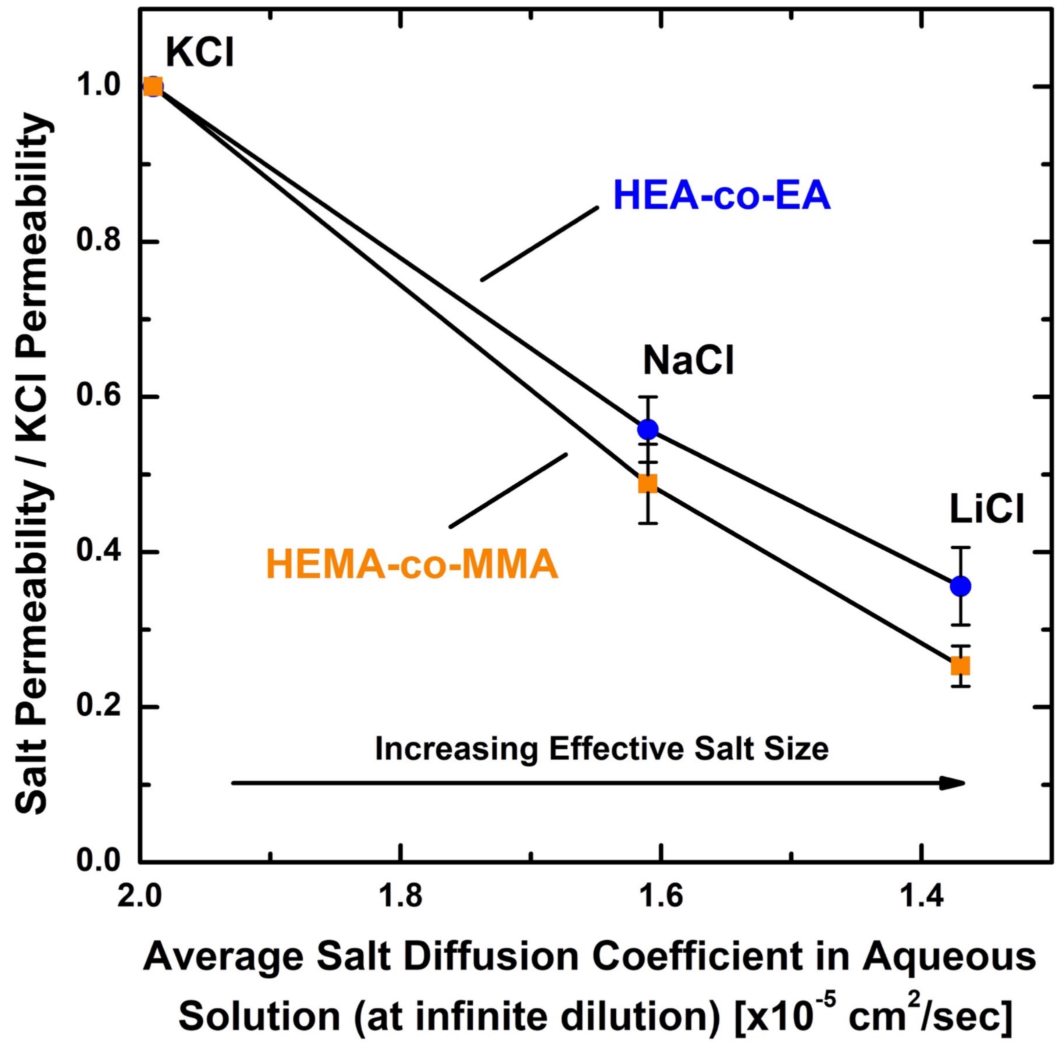


Chang, Xue, and Geise, *J. Membr. Sci.*, **552** (2018) 43.

Polymer backbone rigidity also enhances size selectivity



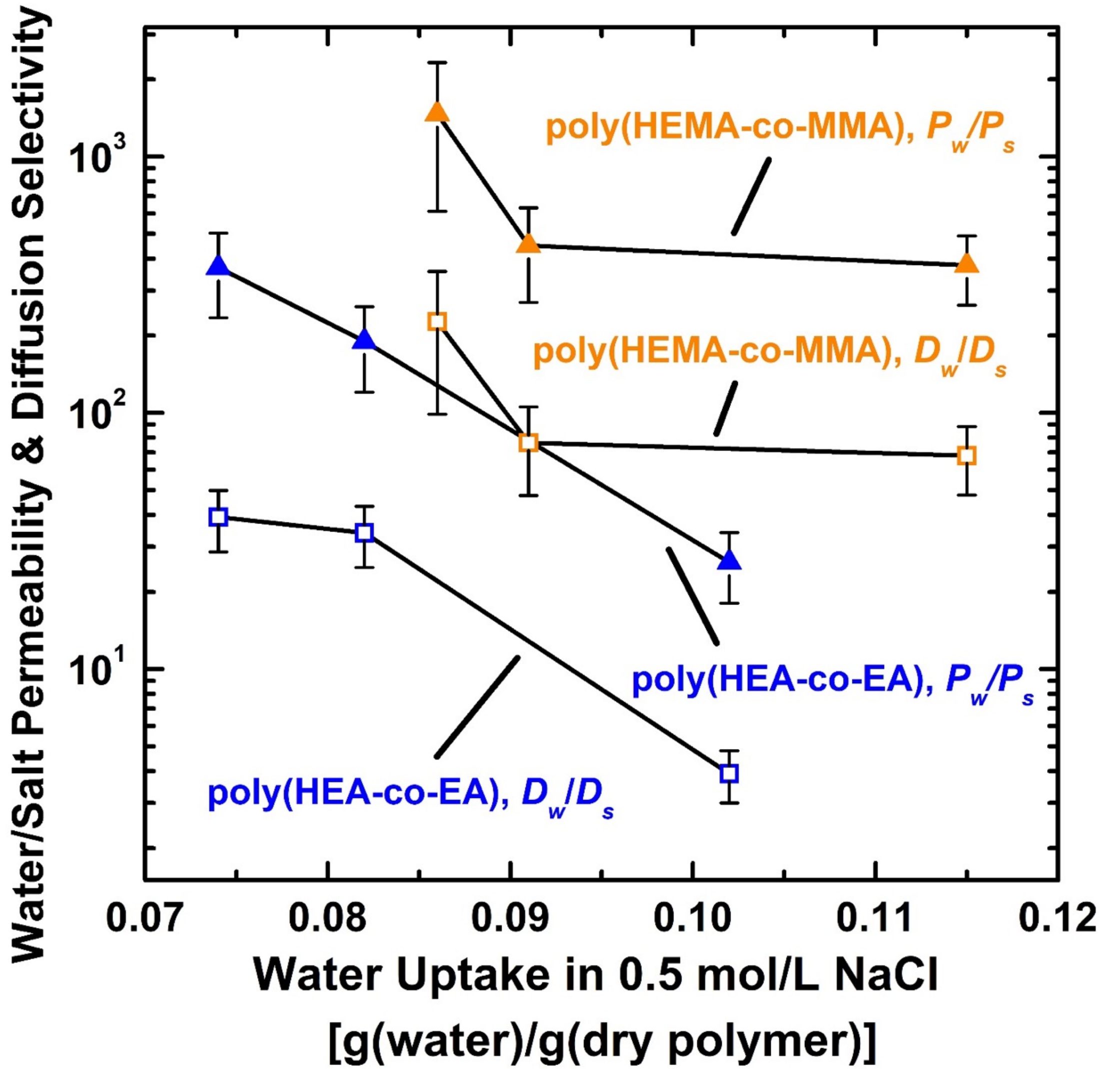
Baker, R. W.; Wijmans, J. G., Membrane separation of organic vapors from gas streams. In *Polymeric gas separation membranes*, Paul, D. R.; Yampolskii, Y. P., Eds. CRC Press: Boca Raton, 1994; pp 353-397.



Chang, Xue, and Geise, *J. Membr. Sci.*, **552** (2018) 43.

University of Virginia
School of Engineering & Applied Science
Department of Chemical Engineering

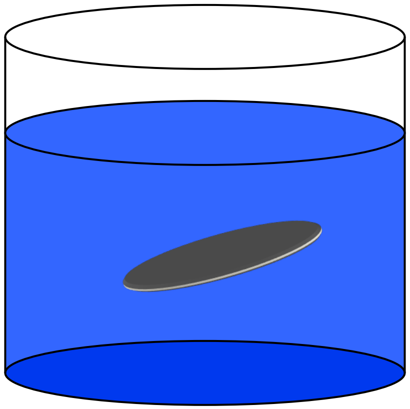
Water/salt permeability selectivity is higher in the more rigid copolymers compared to the more flexible copolymers



Chang, Korovich, Xue, Morris, Madsen, Geise, *Macromolecules,* **51** (2018) 9222.

Structure-property relationship questions

Suppressing ion sorption is critical for preparing highly selective polymers for a wide range of membrane processes



- **How do ions partition into the polymer?**
- **How do we control ion partitioning by controlling the molecular structure of the polymer?**

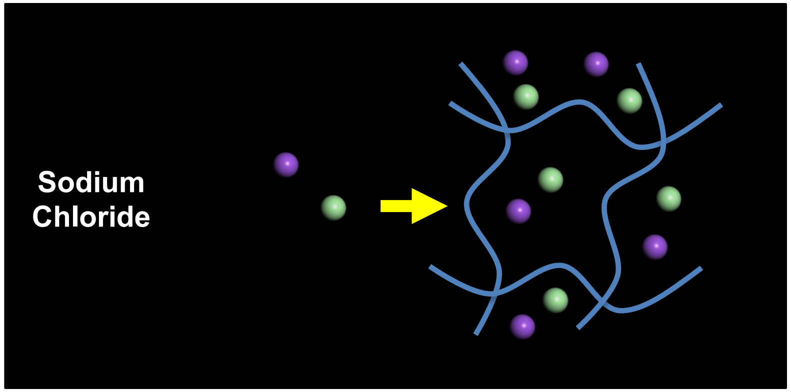
Thermodynamic view of ion sorption or partitioning

$$K_s \equiv \frac{c_X^m}{c_X^s} = \exp\left[-\frac{\Delta G_{X,sorption}}{RT}\right]$$

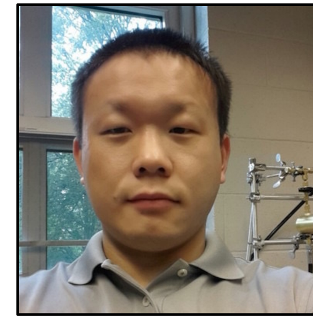
- **Electrostatics / charge density**
- **Dispersion forces**
- **Specific ion-polymer interactions**

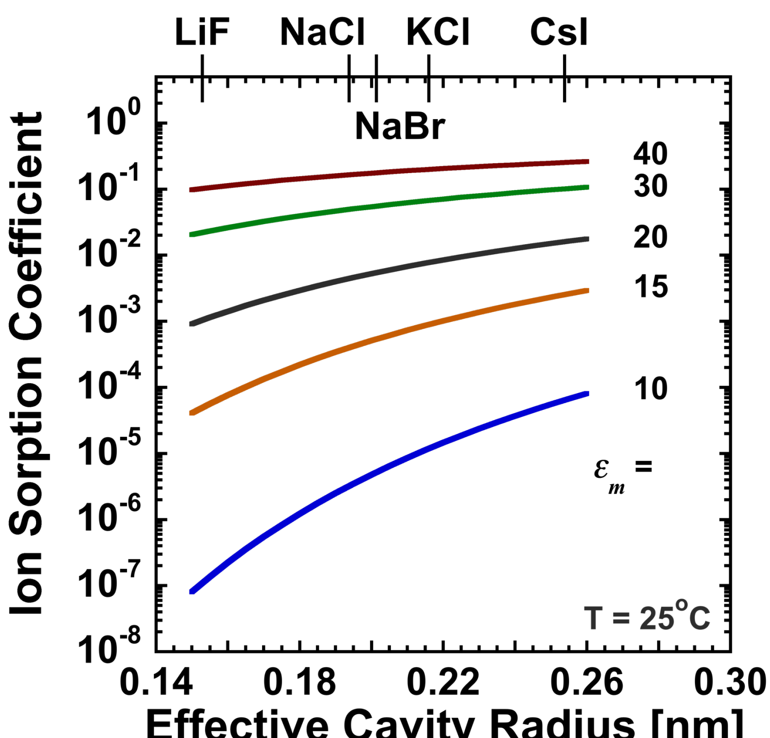
University of Virginia
SCHOOL of ENGINEERING & APPLIED SCIENCE
Department of Chemical Engineering

Contribution of electrostatics to ion sorption



Huan Zhang
(M.E. 2015)





$$\Delta G_{Born} = \frac{z_i^2 e^2}{8\pi\varepsilon_0 a_i}\left(\frac{1}{\varepsilon_w} - \frac{1}{\varepsilon_p}\right)$$

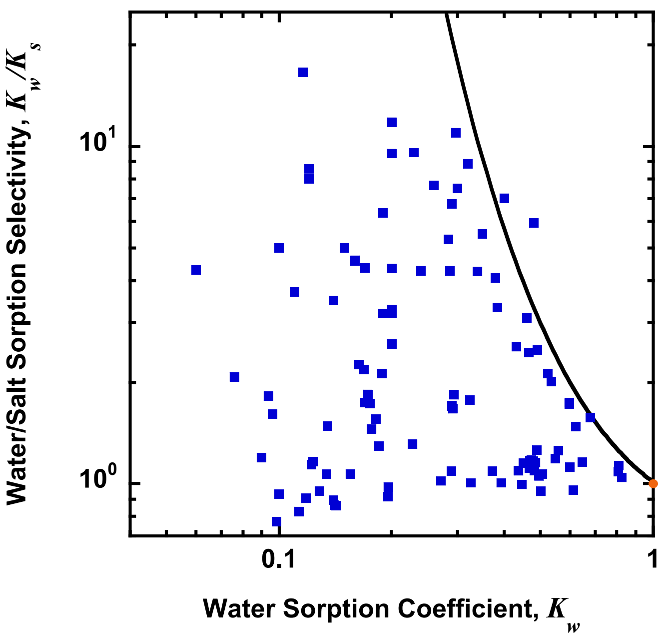
Charge density

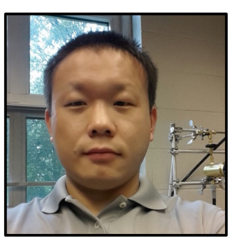
Hydrated Polymer Permittivity

$$K_s = \exp\left[-\frac{z_i^2 e^2}{8\pi kT\varepsilon_0 a_s}\left(\frac{1}{\varepsilon_m} - \frac{1}{\varepsilon_{sol}}\right)\right]$$

Need for relative permittivity information for hydrated polymers

$$\Delta G_{Born} = \frac{z_i^2 e^2}{8\pi\varepsilon_0 a_i}\left(\frac{1}{\varepsilon_m}-\frac{1}{\varepsilon_w}\right)$$





Huan Zhang
(M.E. 2015)

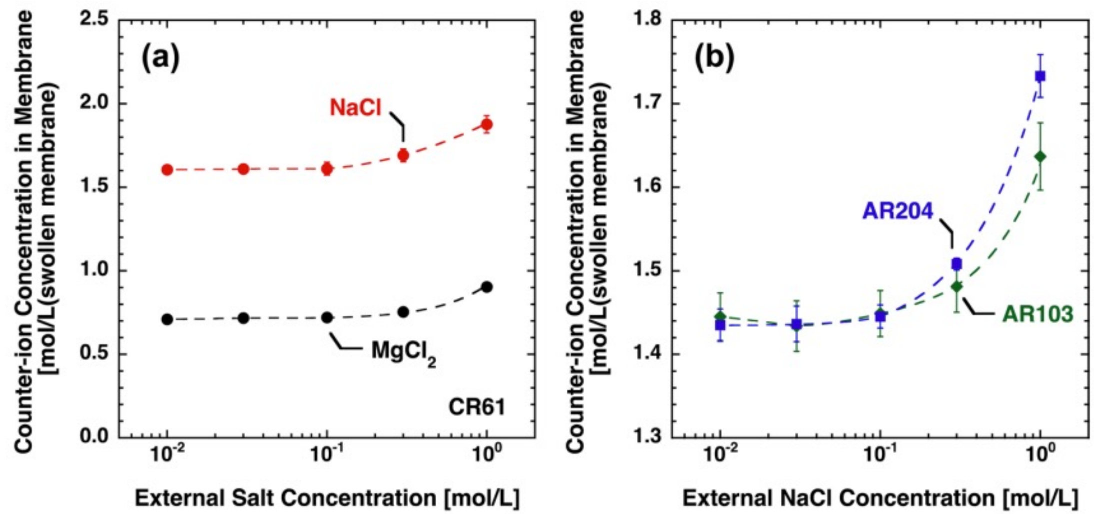
Zhang and Geise, *J. Membr. Sci.*, **520** (2016) 790.

$$\gamma_+^m\gamma_-^m = \frac{\frac{C_A^m}{\xi C_-^m}+1}{\frac{C_A^m}{C_-^m}+1}\exp\left[\frac{-\frac{C_A^m}{\xi C_-^m}}{2+\frac{C_A^m}{\xi C_-^m}}\right]$$

$$\xi = \frac{\lambda_B}{b} = \frac{e^2}{\varepsilon kTb}$$

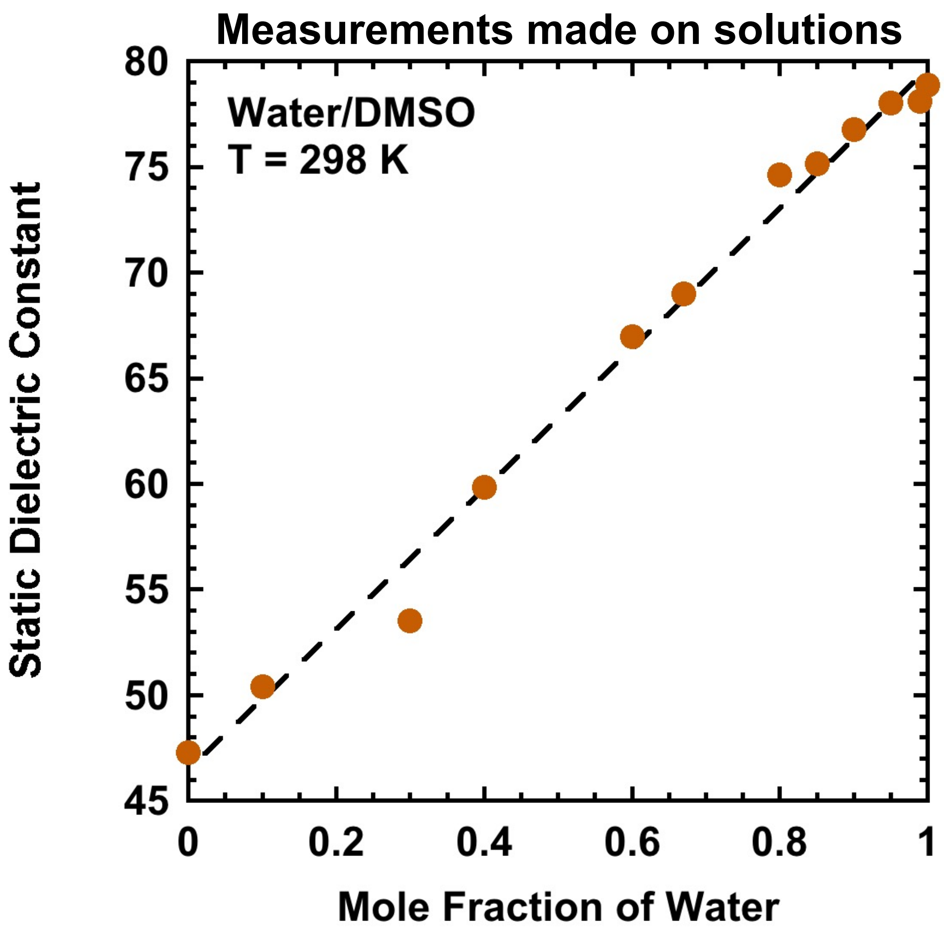
Bjerrum Length

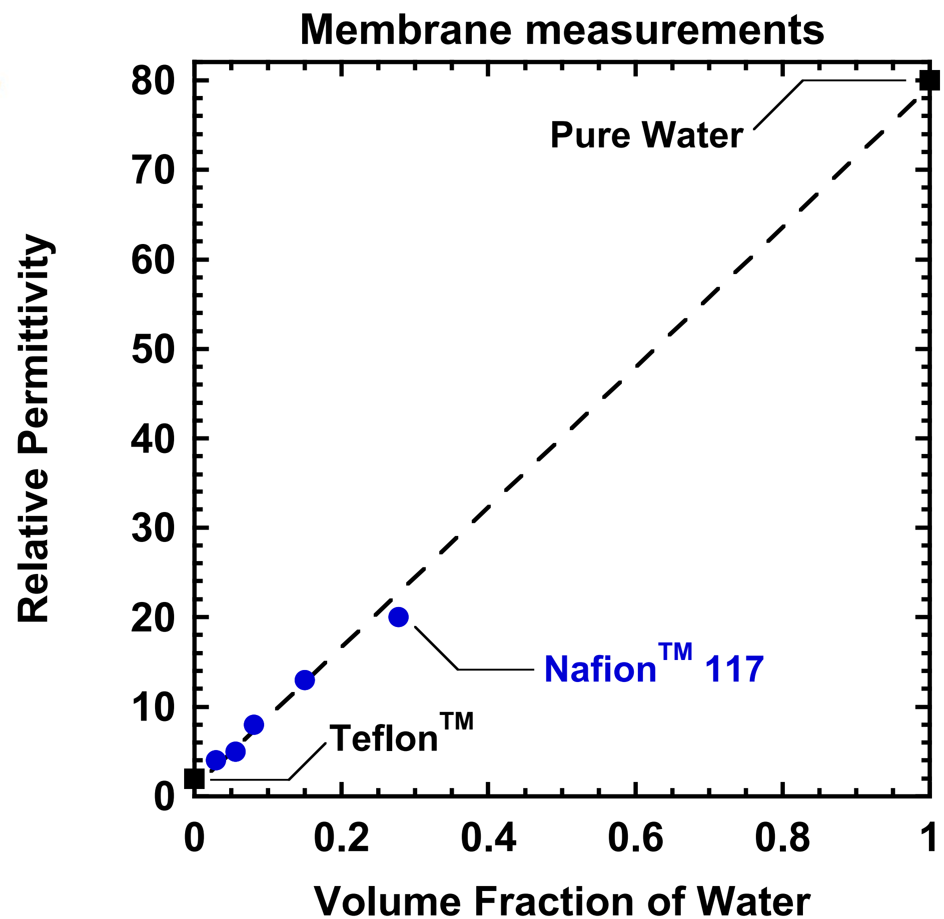
Distance between fixed charges



Manning, *J. Chem. Phys.*, **51** (1969) 924.
Kamcev, et al., *ACS Appl. Mater. Interfaces*, **9** (2017) 4044.

Linear relationships between relative permittivity and water content are observed for some solvent and polymer systems

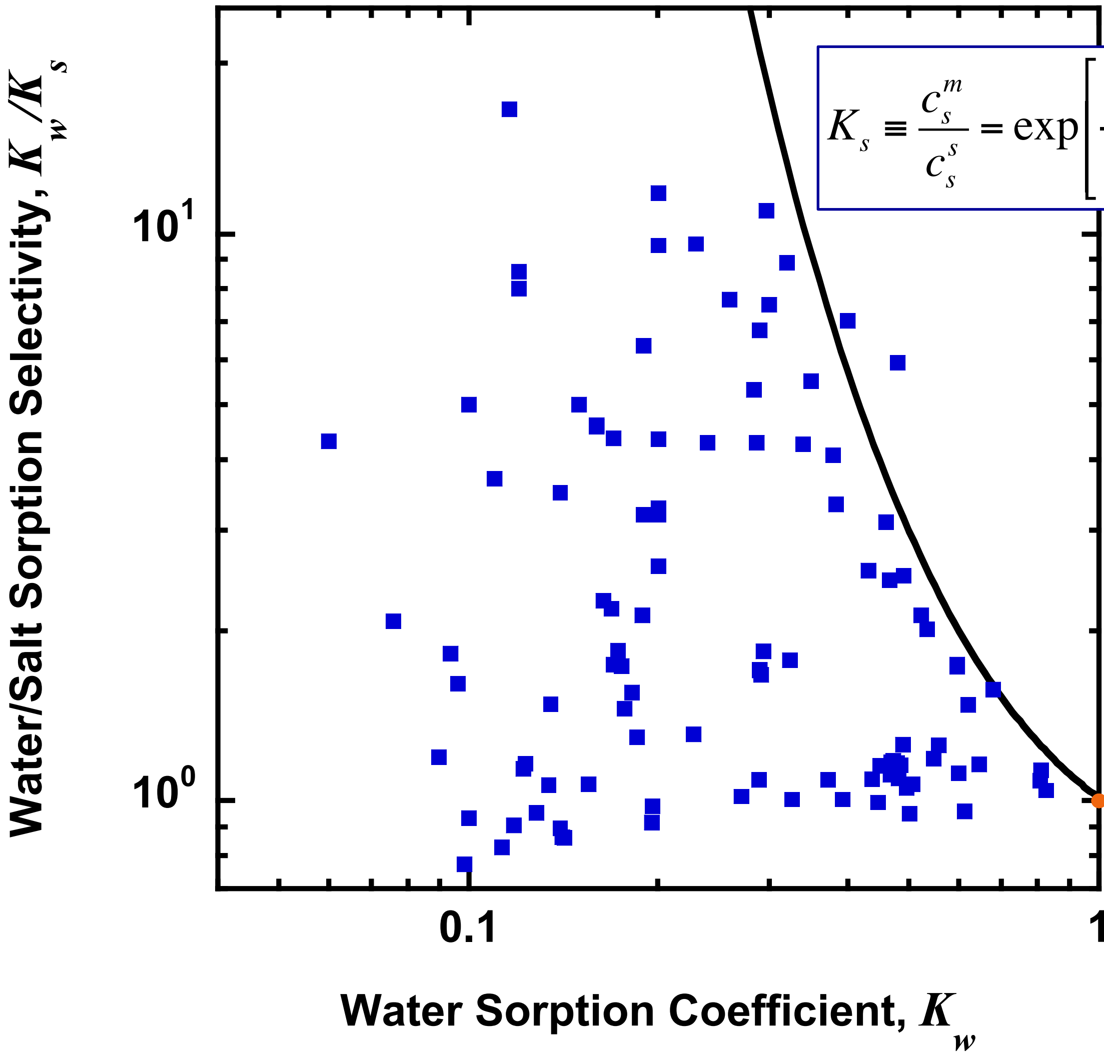




Zhang and Geise, *J. Membr. Sci.,* **520** (2016) 790.
Paddison, Reagor, Zawodzinski, *J. Electroanal. Chem.,* **459** (1998) 91.
Lu, et al., *J. Phys. Chem. A*, **113** (2009) 12207.

University of Virginia
School of Engineering & Applied Science
Department of Chemical Engineering

Maximum co-ion sorption selectivity appears to be well described by the electrostatic model

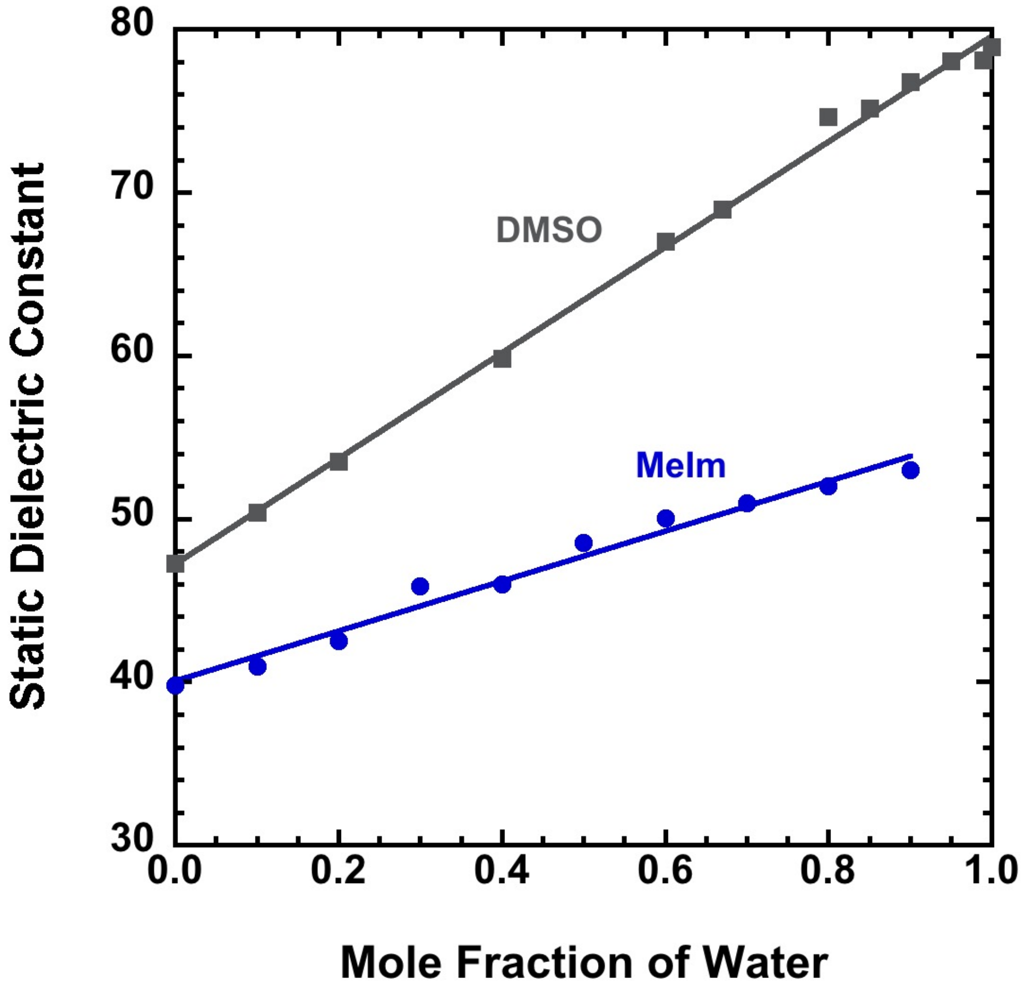


$$K_s \equiv \frac{c_s^m}{c_s^s} = \exp\left[-\frac{z_i^2 e^2}{8\pi kT\varepsilon_0 a_s}\left(\frac{1}{1.04+(78.3\times K_w)}-\frac{1}{\varepsilon_{sol}}\right)\right]$$

Zhang and Geise, *J. Membr. Sci.*, **520** (2016) 790.

University of Virginia
SCHOOL of ENGINEERING & APPLIED SCIENCE
Department of Chemical Engineering

A linear variation in the relative permittivity from the dry polymer to the static dielectric constant of water may not always be realized



Zhang and Geise, *J. Membr. Sci.*, **520** (2016) 790.

Lu, et al., *J. Phys. Chem. A*, **113** (2009) 12207.

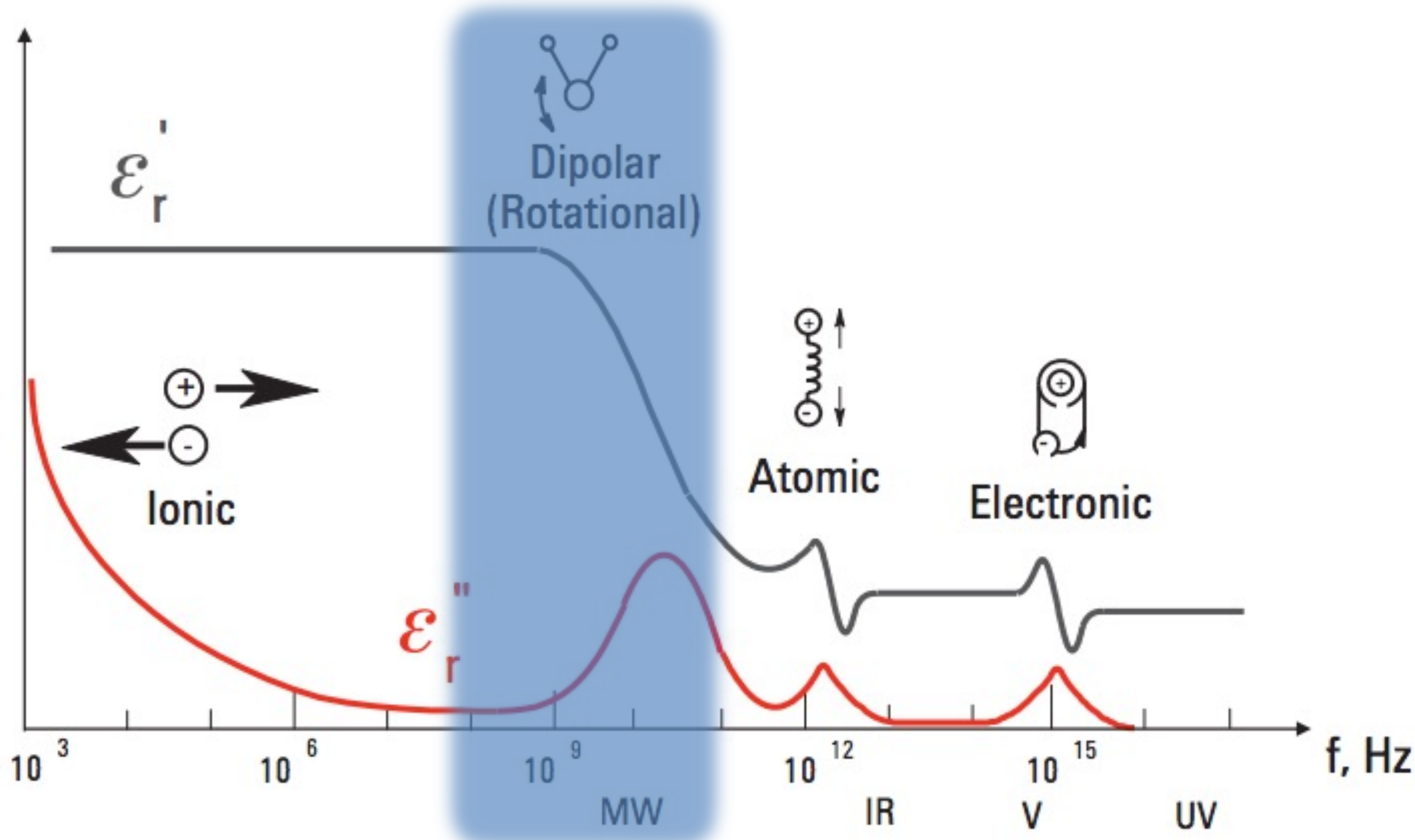
Liu, Jia, *Colloid. Polym. Sci.*, **293** (2015) 2053.

UNIVERSITY of VIRGINIA

SCHOOL of ENGINEERING & APPLIED SCIENCE

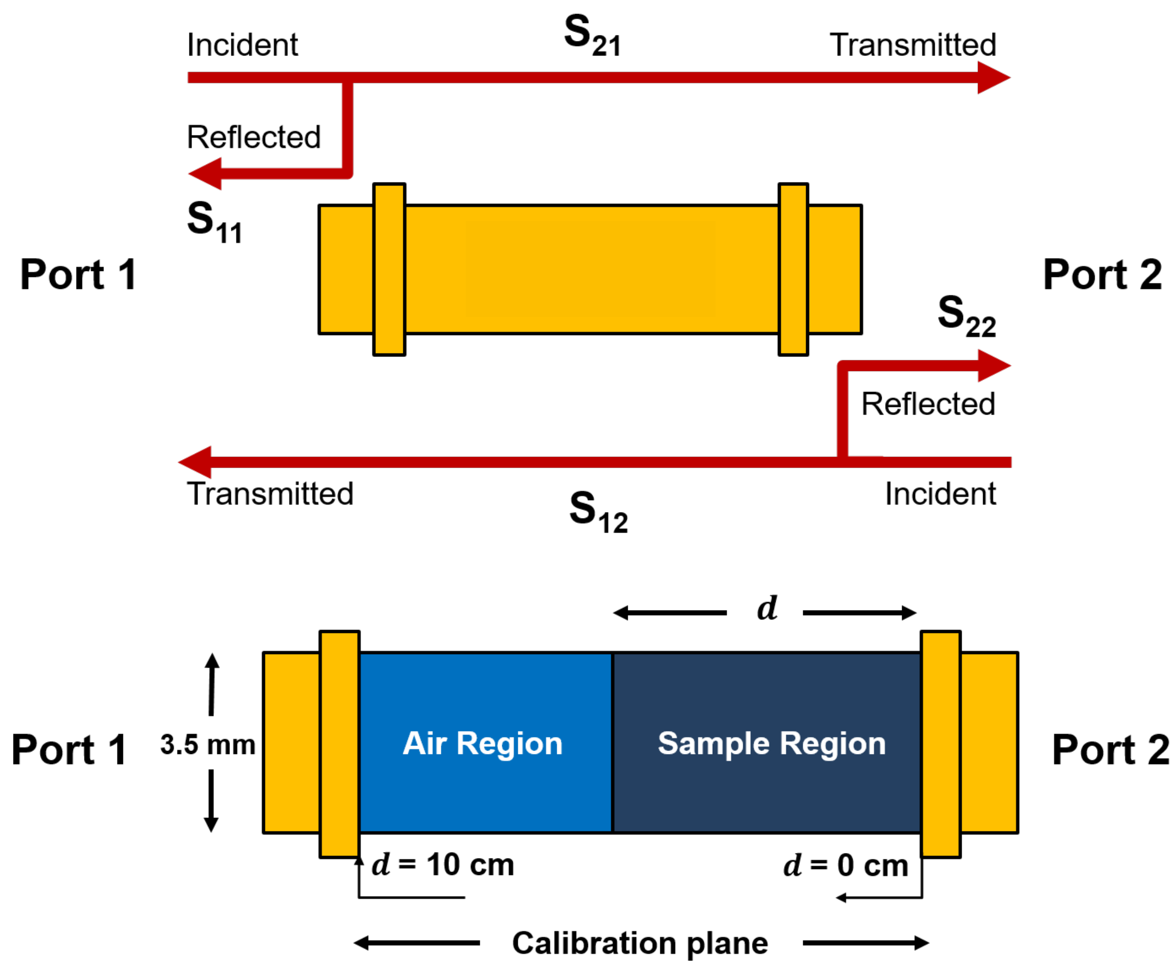
Department of Chemical Engineering

Molecular motions as a function of frequency



Keysight Technologies:
Basics of Measuring the Dielectric Properties of Materials, April 27, 2015.

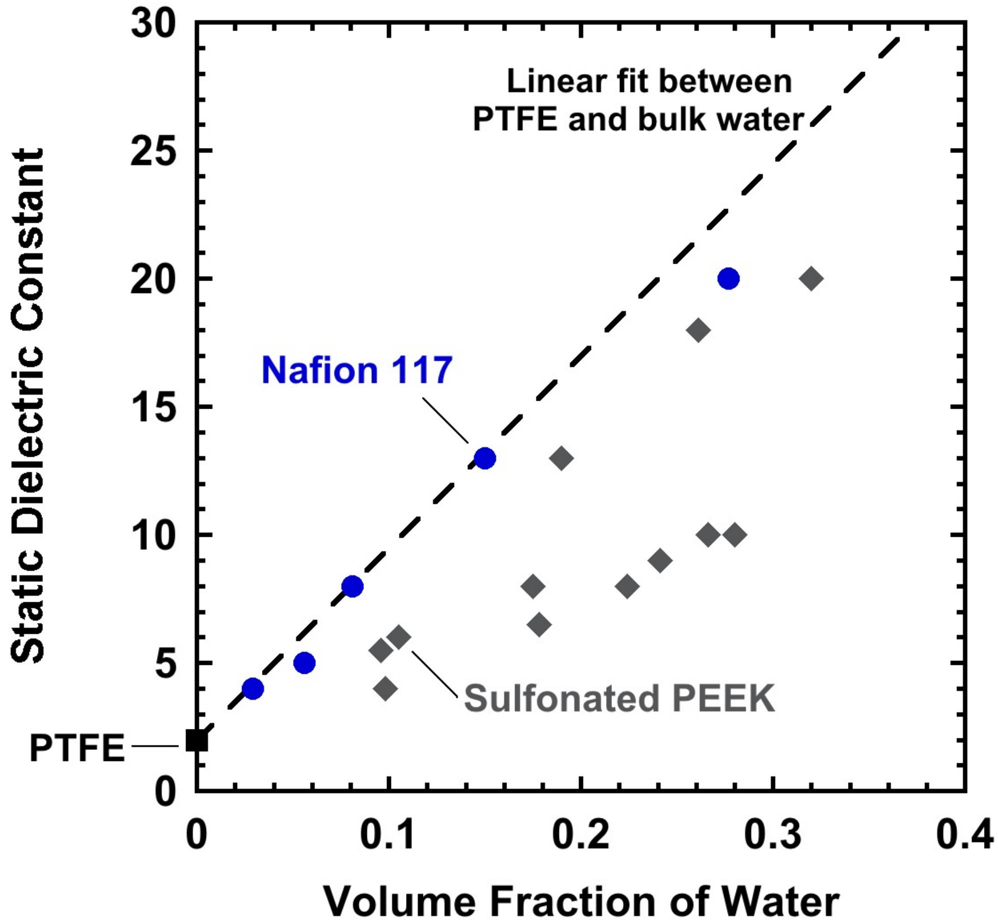
Measuring the dielectric properties of hydrated polymers in the microwave frequency region using a transmission line



Chang, Luo, Geise, *J. Membr. Sci.*, **574** (2019) 24.

University of Virginia
SCHOOL of ENGINEERING & APPLIED SCIENCE
Department of Chemical Engineering

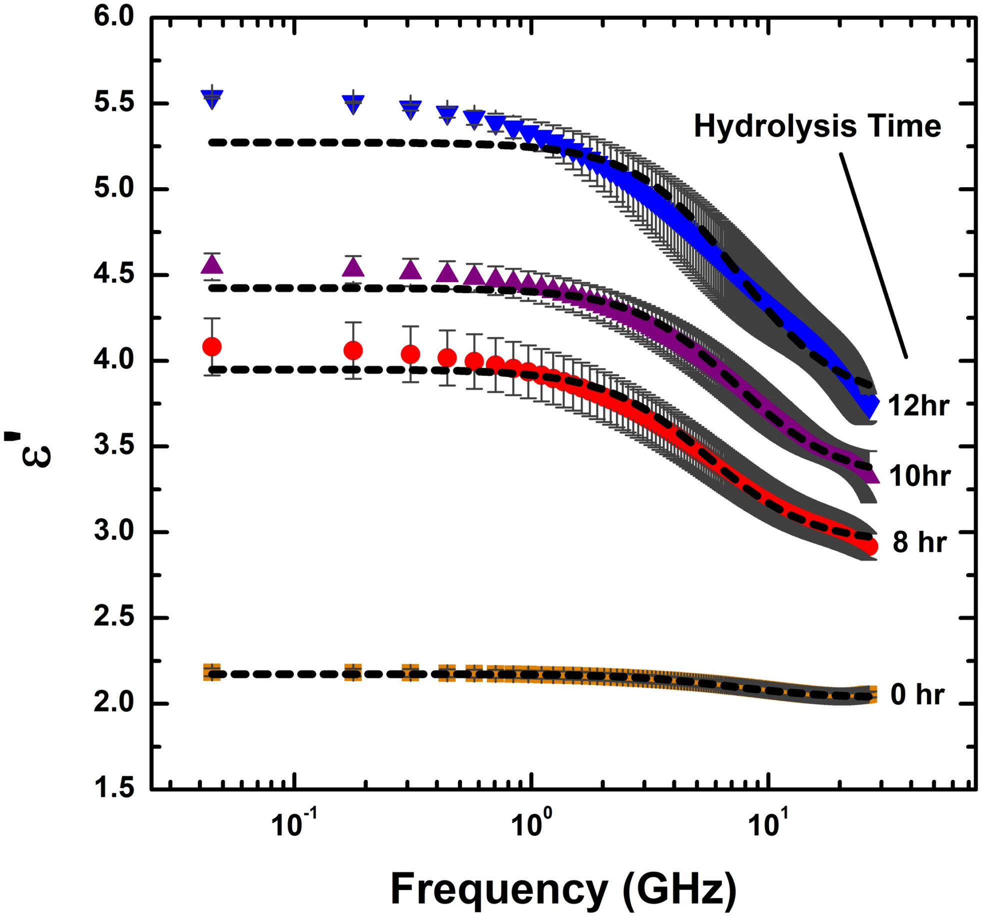
At a given water content, the static permittivity of hydrocarbon sulfonated polymers is often lower than that of Nafion

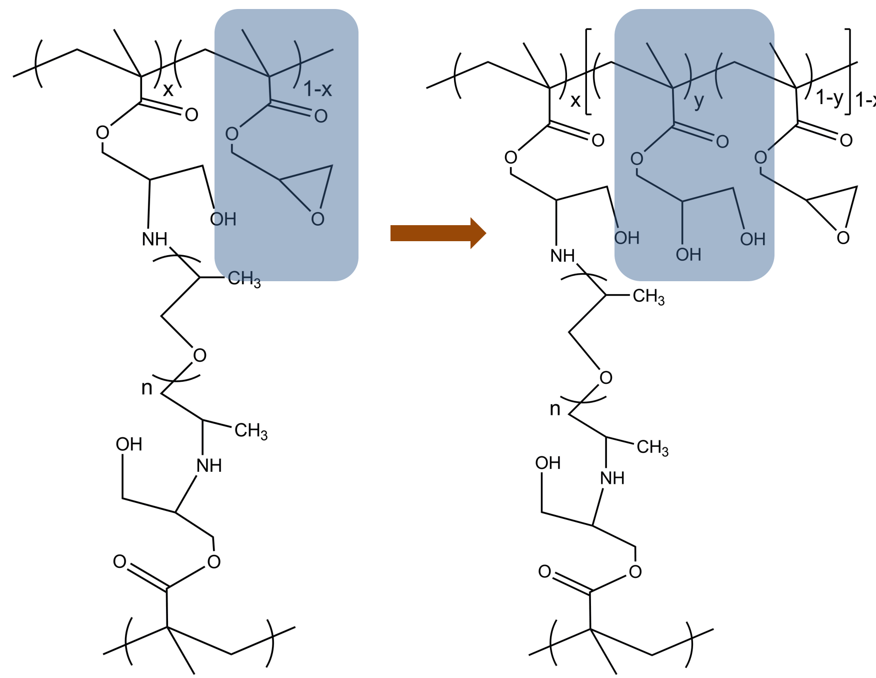


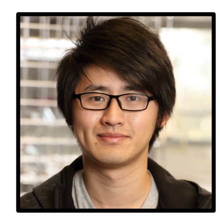
Paddison, Bender, Kreuer, Nicoloso, Zawodzinski, *J. New Mater. Electrochem. Syst.* **3** (2000) 293.
Paddison, Reagor, Zawodzinski, *J. Electroanal. Chem.*, **459** (1998) 91.

University of Virginia
School of Engineering & Applied Science
Department of Chemical Engineering

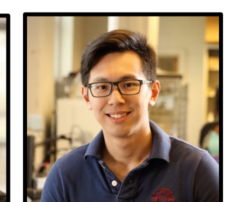
Hydrolysis increases both the water content and the relative permittivity of the polymer







Hongxi Luo

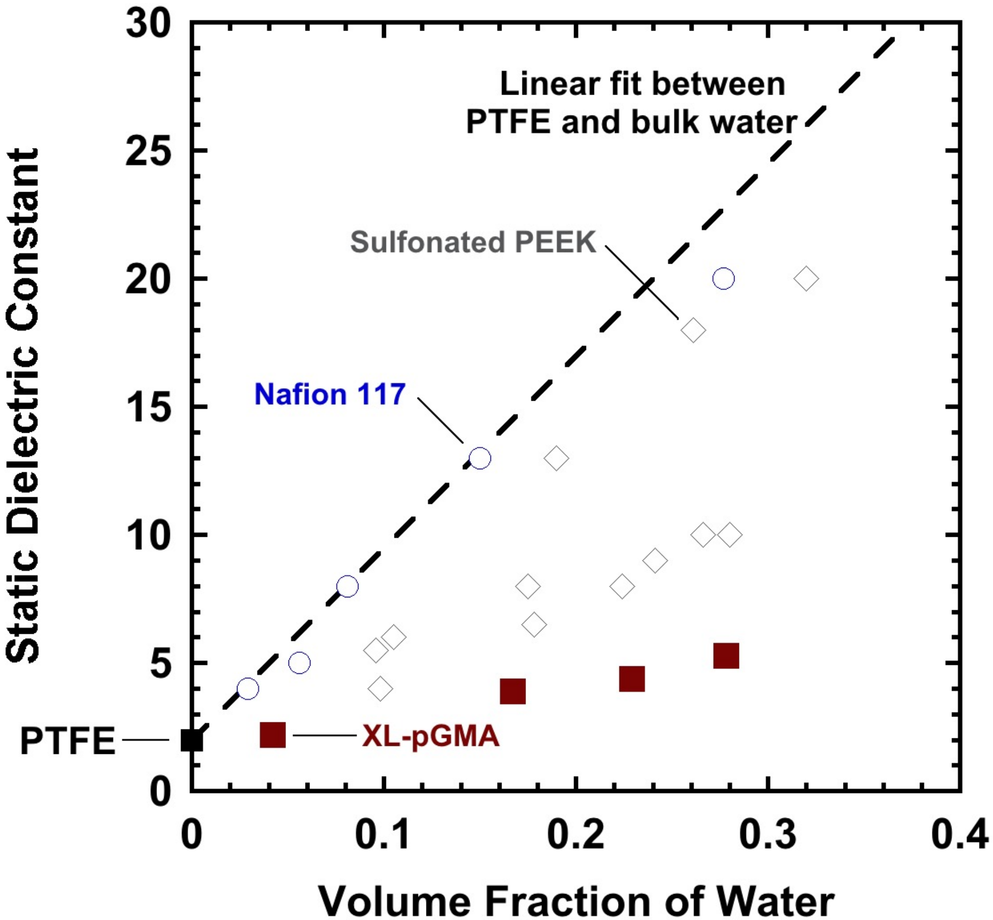


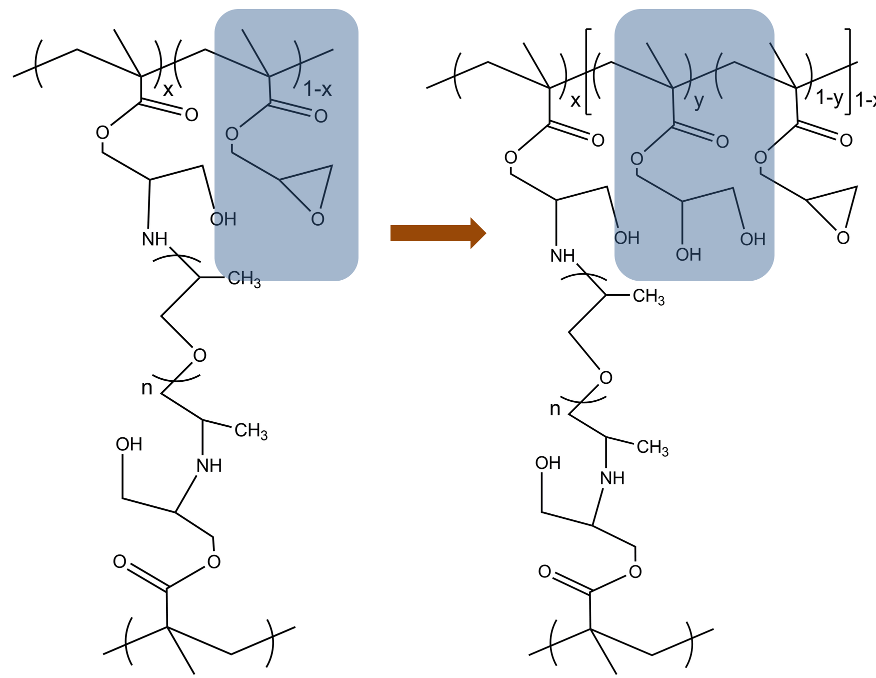
Kevin Chang

Chang, Luo, Geise, *J. Membr. Sci.*, **574** (2019) 24.

University of Virginia
School of Engineering & Applied Science
Department of Chemical Engineering

Ring-opening hydrolysis of a crosslinked glycidyl methacrylate increases water content accompanied by a slow increase in permittivity

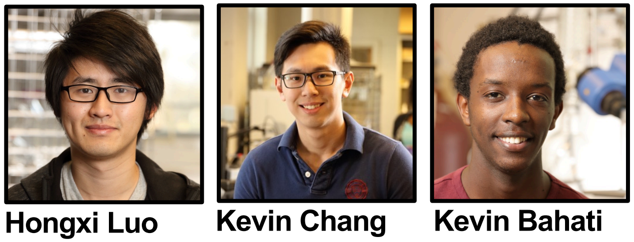


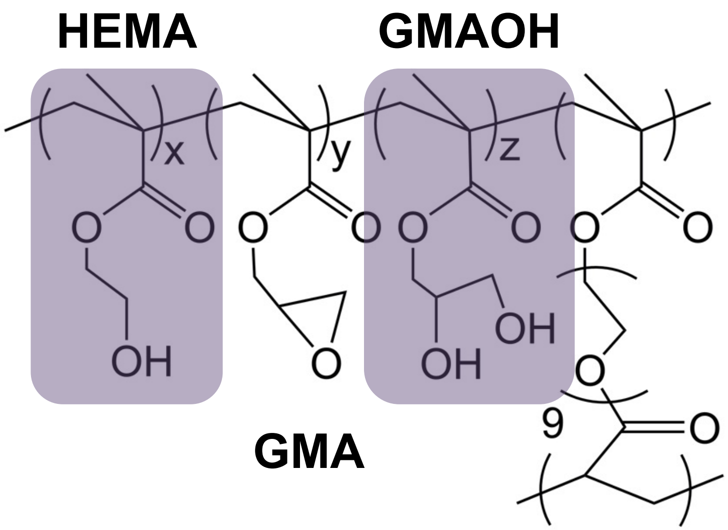


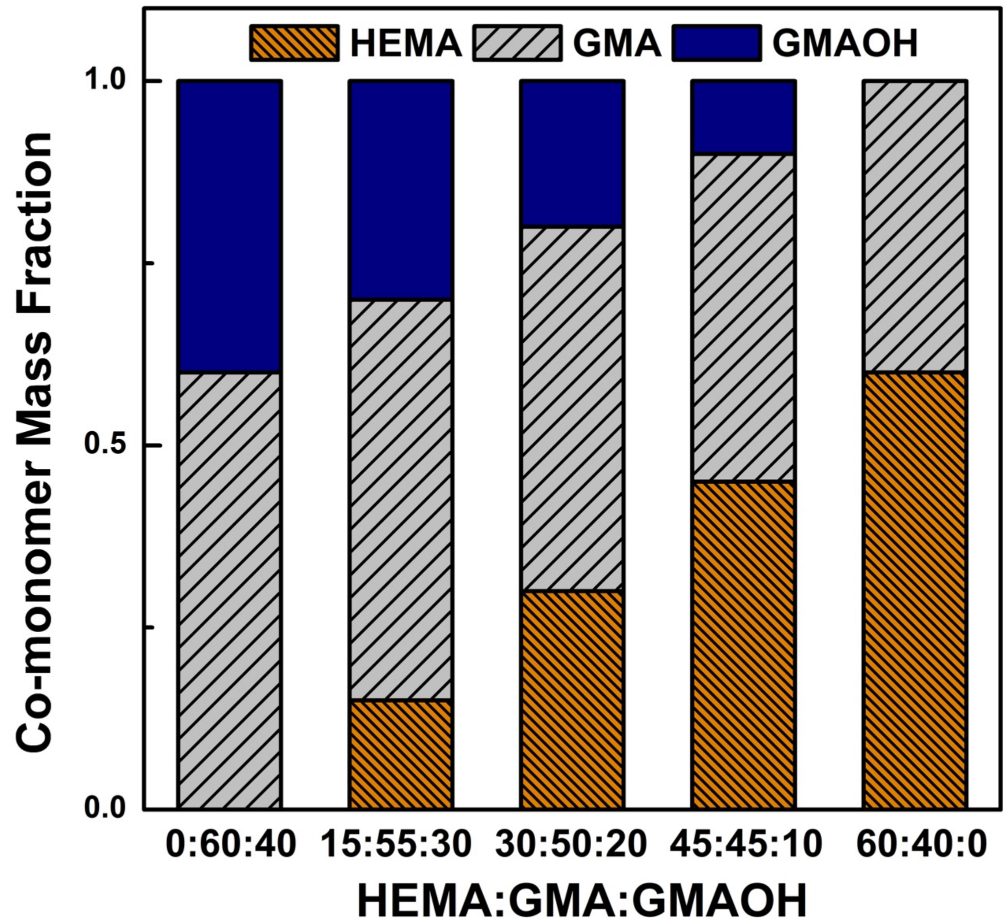
Paddison, Bender, Kreuer, Nicoloso, Zawodzinski, *J. New Mater. Electrochem. Syst.* **3** (2000) 293.
Paddison, Reagor, Zawodzinski, *J. Electroanal. Chem.*, **459** (1998) 91.
Chang, Luo, Geise, *J. Membr. Sci.*, **574** (2019) 24.

University of Virginia
School of Engineering & Applied Science
Department of Chemical Engineering

Can chemical functional group position be used to control desalination selectivity properties?





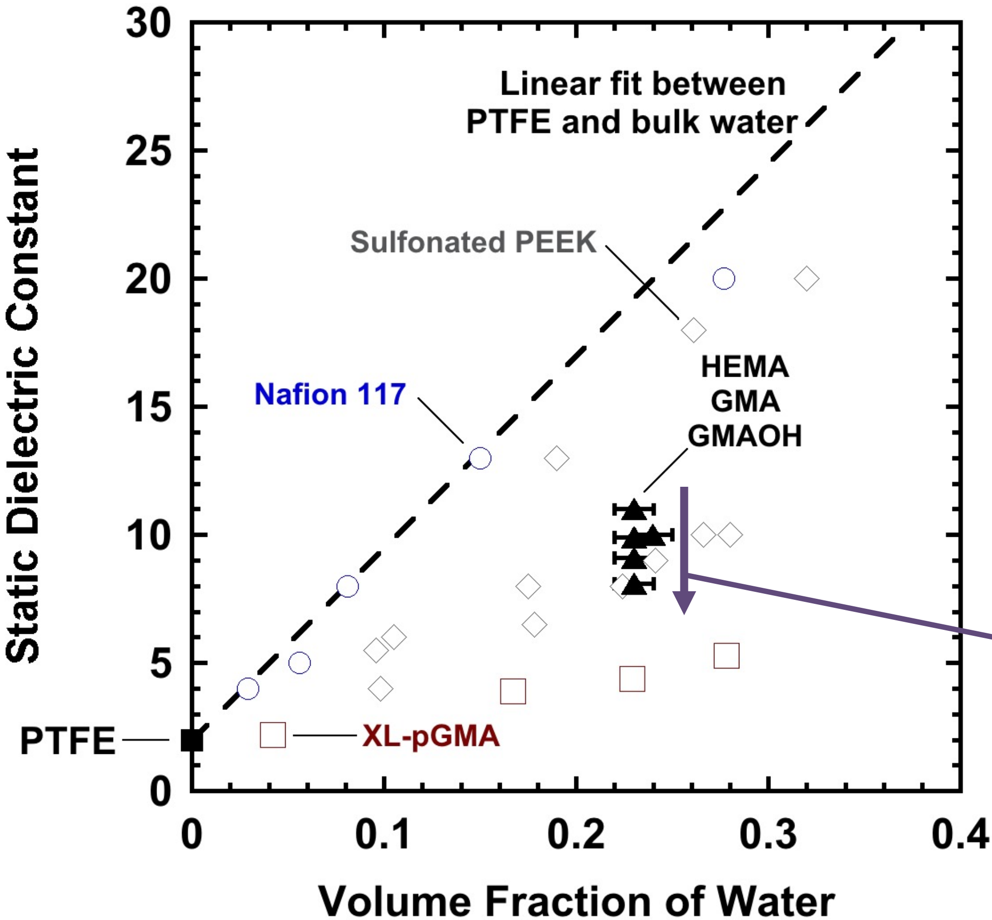


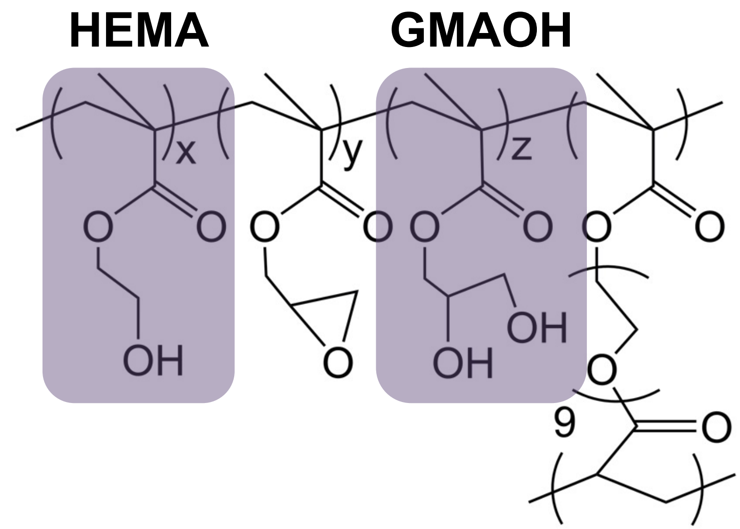
All five materials contain equivalent amounts of water

Luo, Chang, Bahati, Geise, *Environ. Sci. Technol.*, **6** (2019) 462.

UNIVERSITY of VIRGINIA
SCHOOL of ENGINEERING & APPLIED SCIENCE
Department of Chemical Engineering

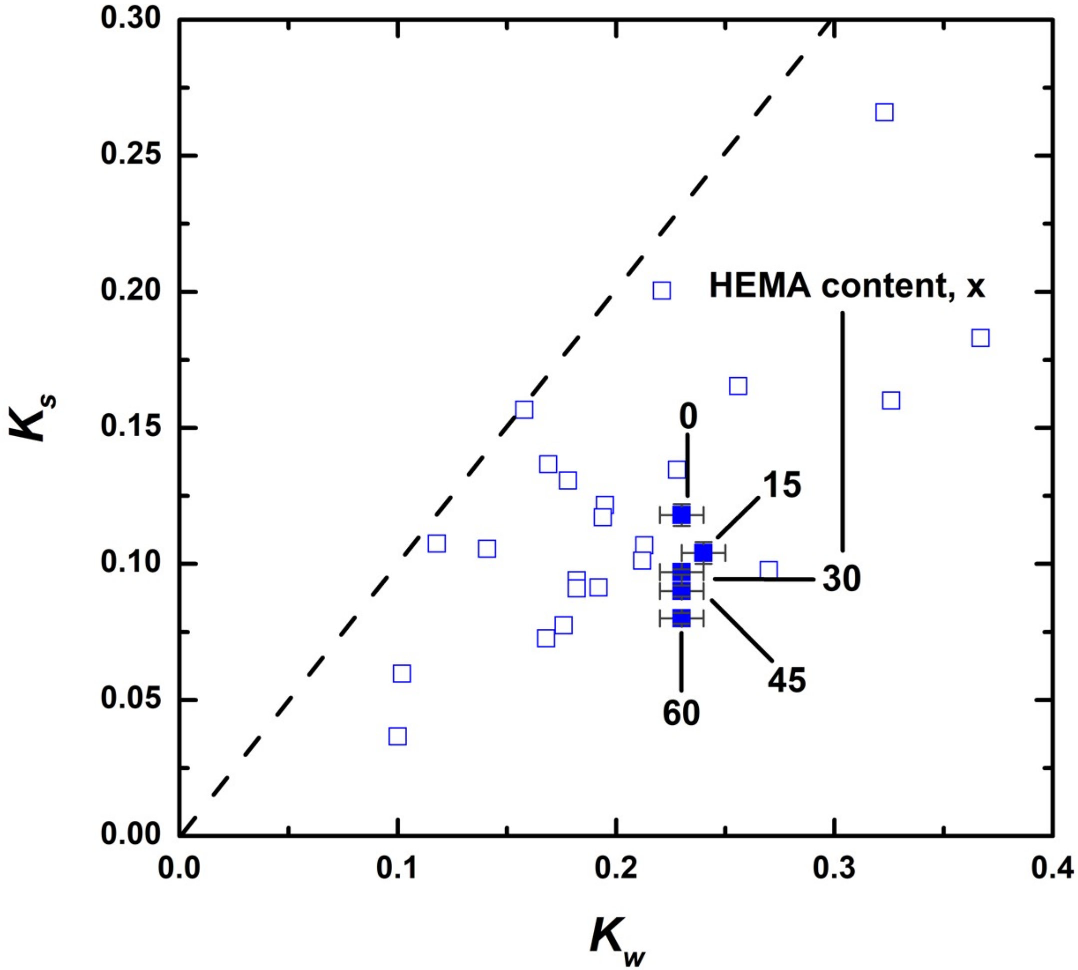
Distributing –OH functionality throughout the polymer matrix drives a modest reduction in permittivity at equivalent water content

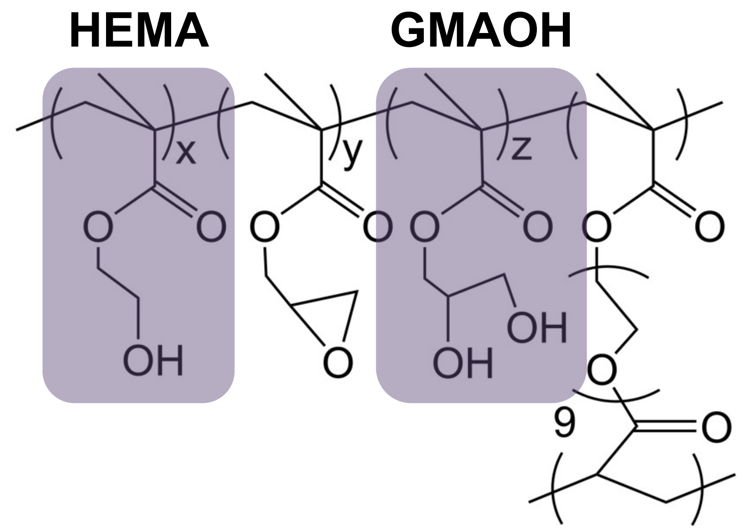




Paddison, Bender, Kreuer, Nicoloso, Zawodzinski, *J. New Mater. Electrochem. Syst.* **3** (2000) 293.
Paddison, Reagor, Zawodzinski, *J. Electroanal. Chem.*, **459** (1998) 91.
Chang, Luo, Geise, *J. Membr. Sci.*, **574** (2019) 24.
Luo, Chang, Bahati, Geise, *Environ. Sci. Technol.*, **6** (2019) 462.

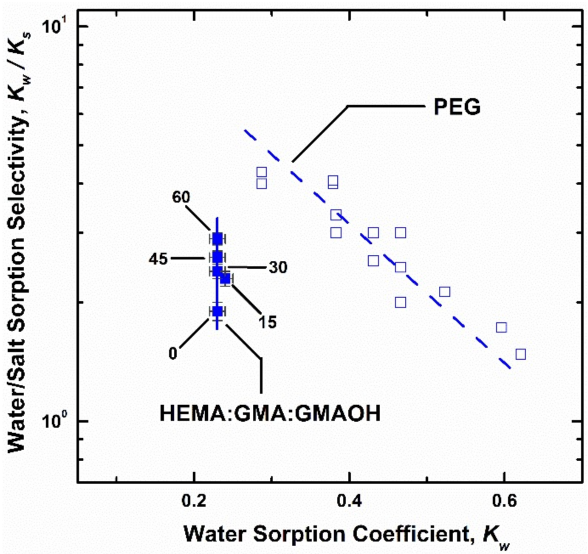
A decrease in salt sorption occurs as –OH groups are distributed more evenly throughout the polymer matrix

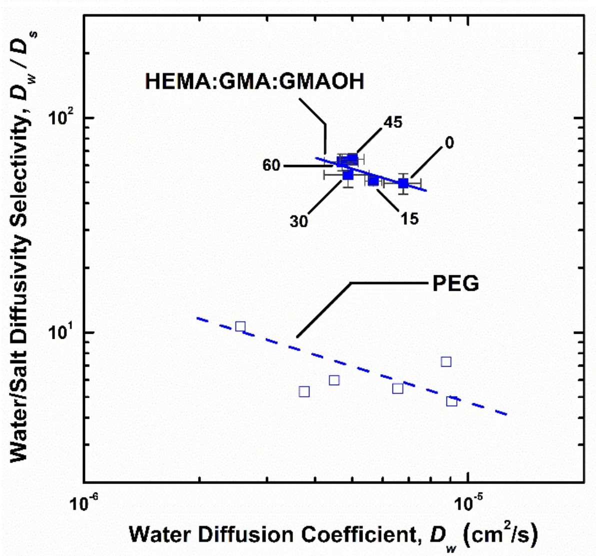


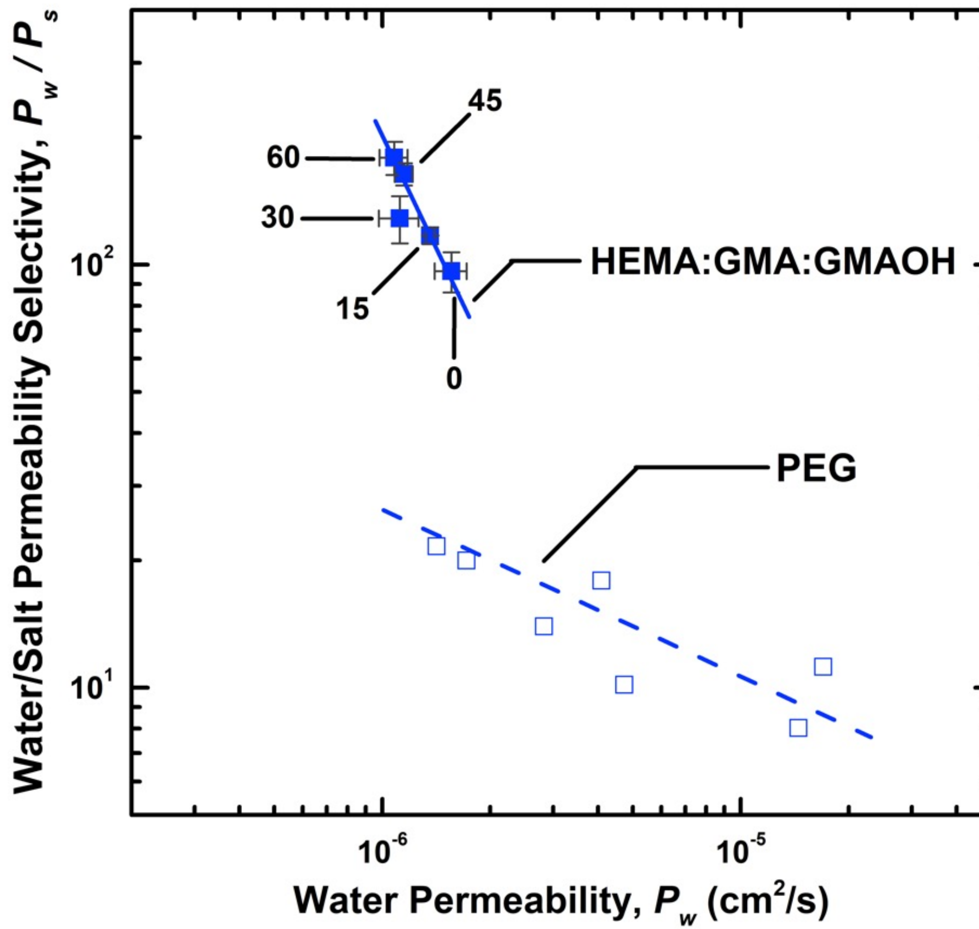


Luo, Chang, Bahati, Geise, *Environ. Sci. Technol.*, **6** (2019) 462.

The increase in water/salt sorption selectivity coupled with an increase in diffusivity selectivity gives rise to favorable permeability selectivity properties







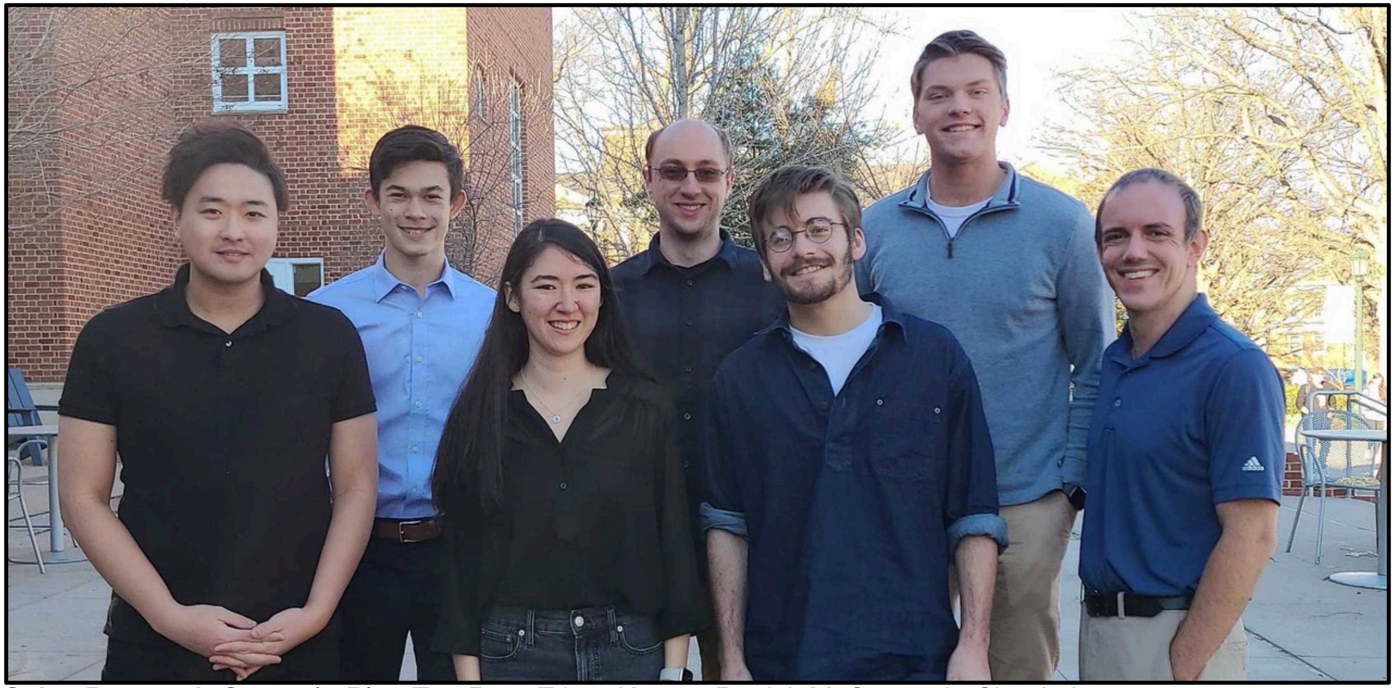
Luo, Chang, Bahati, Geise, *Environ. Sci. Technol.*, **6** (2019) 462.

Summary

- **Polymer chemistry is important for desalination membrane applications**
  - Thermodynamics
  - Kinetics
- **Rigid polymer backbones are more desalination selective than flexible backbones**
- **Polymer chemistry and/or the position of functional groups can be used to manipulate thermodynamic factors that influence salt transport**

University of Virginia
SCHOOL of ENGINEERING & APPLIED SCIENCE
Department of Chemical Engineering

Polymer membrane research at UVA



Geise Research Group (L-R): *Top Row*: Ethan Kutner, Patrick McCormack, Charlie Leroux;
Bottom Row: Dr. Jung Min (Luca) Kim, Lena Keesecker, Sean Bannon, Prof. Geise

SEAS Research Innovation Award
UVA Sustainability Research Grant

ACS PRF
American Chemical Society
Petroleum Research Fund
New Directions (ND) Award

NSF
U.S. National Science Foundation
CBET #1752048 (CAREER)

ORAU
Ralph E. Powe Junior Faculty
Enhancement Award

4-VA
Advancing The Commonwealth
4-VA Collaborative
Research Grant

ACS
Chemistry for Life®

www.acs.org/acswebinars

THE LIVE Q&A IS ABOUT TO BEGIN!

Keep submitting your questions in the questions window!

ACS POLY Exclusive Member Benefits

ACS Technical Division
Polymer Chemistry (POLY)

- 1st Year Free Membership!
- Eligibility for awards (including Member of the Month!)
- Alerts for academic, national lab, and industrial job opportunities shared through the POLY list serve
- Networking and professional development events at local/national ACS meetings and local POLY/PMSE chapters
- Industrial scientist support and networking through IAB (Industrial Advisory Board)
- Polymer science-related conferences and workshops advertised through the POLY list serve
- Online educational webinar and webshop series covering cutting-edge polymer research
- Opportunity to vote for the executive committee (annually)
- Recognition for membership (5th, 10th, 20th, and 30th anniversaries)
- Student support – student awards, student symposia, career panels at ACS meetings, support for student chapters.
- An excellent support group for building strong networks in the polymer community!

https://polyacs.org

www.acs.org/acswebinars

ACS Chemistry for Life®

ACS Webinars®
CLICK • WATCH • LEARN • DISCUSS

Wed., May 11, 2022 | 2:00pm–3:00pm ET

Adapting to Climate Change: Insights from Indigenous Peoples

Co-produced with ACS Policy and the American Association for the Advancement of Science

Thurs., May 12, 2022 | 2:00pm–3:00pm ET

Careers in Chemical Safety for Chemists

Co-produced with the ACS Division of Chemical Health and Safety and the ACS Committee on Chemical Safety

Tues., May 17, 2022 | 1:00pm–2:00pm ET

From There to Here: My Asian American Journey

Co-produced with the Office of Diversity, Equity, Inclusion & Respect, ACS

Register for Free

Browse the Upcoming Schedule at www.acs.org/acswebinars

ACS Chemistry for Life®

www.acs.org/acswebinars

ACS Webinars®
CLICK • WATCH • LEARN • DISCUSS

Learn from the best and brightest minds in chemistry!

Hundreds of webinars on a wide range of topics relevant to chemistry professionals at all stages of their careers, presented by top experts in the chemical sciences and enterprise.

Edited Recordings

are an exclusive benefit for ACS Members with the Premium Package and can be accessed in the ACS Webinars® Library at www.acs.org/acswebinars

Live Broadcasts

of ACS Webinars® continue to be available free to the general public several times a week generally from 2-3pm ET. Visit www.acs.org/acswebinars to register* for upcoming webinars.

*Requires FREE ACS ID

ACS Chemistry for Life®

ACS Webinars®
CLICK • WATCH • LEARN • DISCUSS

www.acs.org/acswebinars

ACS Webinars® does not endorse any products or services. The views expressed in this presentation are those of the presenter and do not necessarily reflect the views or policies of the American Chemical Society.

Contact ACS Webinars® at acswebinars@acs.org