

Hanqing Fan · 范汗青

Assistant Professor, Peking University

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FIELD OF SPECIALIZATION

Dr. Hanqing Fan focuses on transport phenomena in nano- and sub-nanometer porous membranes. By integrating physical modeling, molecular simulations, and instrumental characterizations, his research advances the fundamental understanding of microscopic transport mechanisms in pressure-driven and electrically-driven membrane processes and develops new separation principles for desalination, solvent separation, and resource recovery.

EDUCATION

Columbia University New York, NY, US	09/2017 -07/2022
Ph.D. in Earth and Environmental Engineering Advised by Prof. Ngai Yin Yip	
Stanford University Stanford, CA, US	09/2015 -03/2017
M.S. in Environmental Engineering	
Peking University Beijing, China	09/2011 -07/2015
B.S. in Environmental Science	

ACADEMIC APPOINTMENTS

Assistant Professor Peking University	03/2026 -now
College of Environmental Science and Engineering	
Postdoctoral Associate Rice University	01/2025 -01/2026
- Advised by Prof. Menachem Elimelech - Department of Civil and Environmental Engineering Rice Center for Membrane Excellence (RiCeME)	
Postdoctoral Associate Yale University	08/2022 -12/2024
- Advised by Prof. Menachem Elimelech - Department of Chemical and Environmental Engineering	

PUBLICATIONS

17 first-author (‡equal contribution) papers, 41 total, h-index = 24, citations = 3133

First-Author Publications

- Fan, H.**, Parkinson, M., Agrawal, K. V., Barboiu, M., Bocquet, L., Getachew, B. A., ... & Elimelech, M. 2026. A multiscale perspective for understanding transport mechanisms in desalination and ion-selective membranes. *Nature Water*, 4(2), 120-137.
- Fan, H.**[‡], He, J.[‡], Heiranian, M., Pan, W., Li, Y. and Elimelech, M., 2024. The physical basis for solvent flow in organic solvent nanofiltration. *Science Advances*, 10(24), p.eado4332.
- Fan, H.**, Wu, J., Qian, J. and Elimelech, M., 2026. Irreversible Compaction Governs Porosity Gradient in Nafion Membranes under Pressure-Driven Water Flow. *Journal of Membrane Science*, p.125834.

4. **Fan, H.**, Wang, R., Lin, S. and Elimelech, M., 2025. Revisiting the Apparent Experimental Basis of the Solution–Diffusion Model for Water Transport in “Dense” Polymer Membranes. *Journal of Membrane Science*, p.124869.
5. **Fan, H.**, Duan, Y. and Elimelech, M., 2025. Compaction of Pressure-Driven Polymer Membranes: Measurements, Theory, and Mechanisms. *Environmental Science & Technology*, 59(28), pp.14752-14763.
6. **Fan, H.** and Elimelech, M., 2025. Solvent Transport in Disordered and Dynamic Membrane Pores: Implications for Reverse Osmosis and Nanofiltration Membranes. *Environmental Science & Technology*. 10.1021/acs.est.5c07128
7. **Fan, H.**[‡], Wang, R.[‡], Jiao, Z. and Elimelech, M., 2025. A mechanistic framework for solvent transport in organic solvent nanofiltration membranes: Beyond empirical correlations. *Journal of Membrane Science*, p.124601.
8. **Fan, H.** [‡], Elimelech, M. [‡], and Biesheuvel, P.M. [‡], 2024. Theory of expansion and compression of polymeric materials: Implications for membrane solvent flow under compaction. *Journal of Membrane Science*, p.122576.
9. **Fan, H.**, Heiranian, M., and Elimelech, M., 2024. The solution-diffusion model for water transport in reverse osmosis: What went wrong?. *Desalination*, 580, p.117575.
10. He, J.[‡], **Fan, H.** [‡], Elimelech, M. and Li, Y., 2024. Molecular simulations of organic solvent transport in dense polymer membranes: Solution-diffusion or pore-flow mechanism?. *Journal of Membrane Science*, 708, p.123055.
11. **Fan, H.**, Huang, Y., Cruz-Grace, P. and Yip, N.Y., 2024. Hypersaline Electrodialysis Desalination: Intrinsic Membrane and Module Performance Trade-offs. *ACS ES&T Engineering*, 4, 9, 2294–2305.
12. **Fan, H.**, Huang, Y., and Yip, N.Y., 2023. Advancing ion-exchange membranes to ion-selective membranes: Principles, status, and opportunities. *Frontiers of Environmental Science & Engineering*, 17(2), p.25.
13. **Fan, H.**, and Yip, N. Y. 2022. Donnan Dialysis Desalination with a Thermally Recoverable Solute. *ACS ES&T Engineering*, 2, 11, 2076–2085.
14. **Fan, H.**, Huang, Y., Billinge, I. H., Bannon, S. M., Geise, G. M., and Yip, N. Y. 2022. Counterion Mobility in Ion-Exchange Membranes: Spatial Effect and Valency-Dependent Electrostatic Interaction. *ACS ES&T Engineering*, 2, 7, 1274–1286. (2022 ACS ES&T Engineering Best Paper Awards)
15. **Fan, H.**, Huang, Y., and Yip, N.Y., 2020. Advancing the conductivity-permselectivity tradeoff of electrodialysis ion-exchange membranes with sulfonated CNT nanocomposites. *Journal of Membrane Science*, p.118259.
16. **Fan, H.**, and Yip, N.Y., 2019. Elucidating conductivity-permselectivity tradeoffs in electrodialysis and reverse electrodialysis by structure-property analysis of ion-exchange membranes. *Journal of Membrane Science*, 573, pp.668-681.
17. **Fan, H.**, Li, X., Deng, J., Da, G., Gehin, E., and Yao, M., 2017. Time-dependent size-resolved bacterial and fungal aerosols in Beijing subway. *Aerosol and Air Quality Research*, 17(3), pp.799-809.

Other Publications

18. Pataroque, K. E., Mahajan, S., Mejia, J., del Cerro, M., Wu, J., **Fan, H.**, ... & Elimelech, M. 2026. Role of Frictional Forces in Salt and Water Transport through Polyamide Reverse Osmosis Membranes. *Journal of Membrane Science*, 125202.
19. Hu, X.F., Jiang, T., **Fan, H.**, Guan, Y.F., Chen, J.J., Yu, H.Q. and Elimelech, M., 2025. Dual-regulated covalent organic framework membranes with near-theoretical pore sizes for angstrom-scale ion separations. *Science Advances*, 11(46), p.eady3587.
20. del Cerro, M., Shocron, A., **Fan, H.**, Gilron, J. and Elimelech, M., 2025. Methods for evaluating transport parameters of low-salt-rejection reverse osmosis (LSRRO) membranes. *Desalination*, p.119588.
21. Wu, J., Quezada-Renteria, J.A., He, J., Xiao, M., Chen, Y., **Fan, H.**, Wang, X., Chen, F., Pataroque, K., Suleiman, Y. and Shahbazmohamadi, S., 2025. Ultrahigh pressure compaction-resistant thin film crosslinked composite reverse osmosis membranes. *Nature Communications*, 16(1), p.8165.

22. Wu, J., Suleiman, Y., He, J., Xiao, M., Mahyari, P., Li, M., Zhou, L., Chen, Y., **Fan, H.**, Sreejith, N.A. and Sitaraman, H., 2025. Nondestructive in operando imaging of thin film composite membrane compaction enhanced by AI-based segmentation. *Environmental Science & Technology Letters*, 12(8), pp.1069-1074.
23. Li, D., Liu, W., Wang, X., Lin, W., Zhai, J., **Fan, H.**, Xiao, K., Wang, K., Li, Y., Jin, Y. and Fang, J., 2025. Nodular networks in hydrated polyamide desalination membranes enhance water transport. *Science Advances*, 11(18), p.eadt3324.
24. Shang, B., Zhao, F., Suo, S., Gao, Y., Sheehan, C., Jeon, S., Li, J., Rooney, C.L., Leitner, O., Xiao, L. **Fan, H.**, ...2024. Tailoring Interfaces for Enhanced Methanol Production from Photoelectrochemical CO₂ Reduction. *Journal of the American Chemical Society*, 146(3), pp.2267-2274.
25. Pataroque, K., Wu, J., He, J., **Fan, H.**, Mahajan, S., Guo, K., Le, J., Au, K., Wang, L., Li, Y., Hoek, E.M. and Elimelech, M., 2024. Salt partitioning and transport in polyamide reverse osmosis membranes at ultrahigh pressures. *Journal of Membrane Science Letters*, p.100079.
26. Wu, J., He, J., Quezada-Renteria, J.A., Le, J., Au, K., Guo, K., Xiao, M., Wang, X., Dlamini, D., **Fan, H.** and Pataroque, K., ...2024. Polyamide reverse osmosis membrane compaction and relaxation: Mechanisms and implications for desalination performance. *Journal of Membrane Science*, 706, p.122893.
27. Heiranian, M., **Fan, H.**, Wang, L., Lu, X. and Elimelech, M., 2023. Mechanisms and models for water transport in reverse osmosis membranes: history, critical assessment, and recent developments. *Chemical Society Reviews*, 52, pp.8455-8480.
28. Huang, Y., **Fan, H.**, and Yip, N.Y., 2023. Mobility of Condensed Counterions in Ion-Exchange Membranes: Application of Screening Length Scaling Relationship in Highly Charged Environments. *Environmental Science & Technology*, 58(1), pp.836-846.
29. Wang, L., He, J., Heiranian, M., **Fan, H.**, Song, L., Li, Y. and Elimelech, M., 2023. Water transport in reverse osmosis membranes is governed by pore flow, not a solution-diffusion mechanism. *Science Advances*, 9(15), p.eadf8488.
30. DuChanois, R.M., Mazurowski, L., **Fan, H.**, Verduzco, R., Nir, O. and Elimelech, M., 2023. Precise Cation Separations with Composite Cation-Exchange Membranes: Role of Base Layer Properties. *Environmental Science & Technology*, 57(15), pp.6331-6341.
31. Shah, K.M., Dach, E., Winton, R., **Fan, H.** and Yip, N.Y., 2023. Phase equilibria insights into amine-water-NaCl interactions in liquid-liquid biphasic systems for temperature swing solvent extraction desalination. *Desalination*, 548, p.116259.
32. Huang, Y., **Fan, H.** and Yip, N.Y., 2023. Influence of electrolyte on concentration-induced conductivity-permselectivity tradeoff of ion-exchange membranes. *Journal of Membrane Science*, 668, p.121184.
33. McCartney, S.N., **Fan, H.**, Watanabe, N.S., Huang, Y. and Yip, N.Y., 2022. Donnan dialysis for phosphate recovery from diverted urine. *Water Research*, 226, p.119302.
34. Shah, K. M., Billinge, I. H., Chen, X., **Fan, H.**, Huang, Y., Winton, R. K., and Yip, N. Y. 2022. Drivers, challenges, and emerging technologies for desalination of high-salinity brines: A critical review. *Desalination*, 538, 115827.
35. Boo, C., Qi, H., Billinge, I.H., Shah, K.M., **Fan, H.**, and Yip, N.Y., 2021. Thermomorphic hydrophilicity base-induced precipitation for effective descaling of hypersaline brines. *ACS ES&T Engineering*, 1(9), pp.1351-1359.
36. Chen, H., Zhang, X., Zhang, T., Li, X., Li, J., Yue, Y., Wang, M., Zheng, Y., **Fan, H.**, Wang, J., and Yao, M., 2020. Ambient PM toxicity is correlated with expression levels of specific microRNAs. *Environmental Science & Technology*, 54(16), pp.10227-10236.
37. Li, J., Chen, H., Li, X., Wang, M., Zhang, X., Cao, J., Shen, F., Wu, Y., Xu, S., **Fan, H.**, ..., and Yao, M., 2019. Differing toxicity of ambient particulate matter (PM) in global cities. *Atmospheric Environment*, 212, pp.305-315.

38. Yang, S.S., Wu, W.M., Brandon, A.M., **Fan, H.**, ...and Criddle, C. S., 2018. Ubiquity of polystyrene digestion and biodegradation within yellow mealworms, larvae of *Tenebrio molitor* Linnaeus (Coleoptera: Tenebrionidae). *Chemosphere*, 212, pp.262-271.
39. Li, J., Cao, J., Zhu, Y.G., Chen, Q.L., Shen, F., Wu, Y., Xu, S., **Fan, H.**, ... and Yao, M., 2018. Global survey of antibiotic resistance genes in air. *Environmental Science & Technology*, 52(19), pp.10975-10984.
40. Yang, S.S., Brandon, A.M., Flanagan, J.C.A., Yang, J., Ning, D., Cai, S.Y., **Fan, H.**, ... Criddle, C. S., and Wu, W.M., 2018. Biodegradation of polystyrene wastes in yellow mealworms (larvae of *Tenebrio molitor* Linnaeus): Factors affecting biodegradation rates and the of polystyrene-fed larvae to complete their life cycle. *Chemosphere*, 191, pp.979-989.
41. Wei, K., Zheng, Y., Li, J., Shen, F., Zou, Z, **Fan, H.**, Li, X., Wu, C.Y., and Yao, M., 2015. Microbial aerosol characteristics in highly polluted and near-pristine environments featuring different climatic conditions. *Science Bulletin*, 60(16), pp.1439-1447.

SELECTED AWARDS

Rising Stars in Desalination (2025)	03/2026
Best Perspective Paper in Desalination 2022-2024	12/2024
The 2022 ACS ES&T Engineering Best Paper Awards	11/2023
Elias Klein Founders' Travel Supplement, North American Membrane Society	02/2020
Graduate Student Award in Environmental Chemistry, American Chemical Society	02/2020
Professional Development Scholarship, School of Engineering, Columbia University	08/2019
May-4 th Memorial Fellowship, Peking University	10/2014
Yang Fuqing & Wang Yangyuan Scholarship, Peking University	10/2012