

High Conductivity in Copolymers with Varying Sulfonation

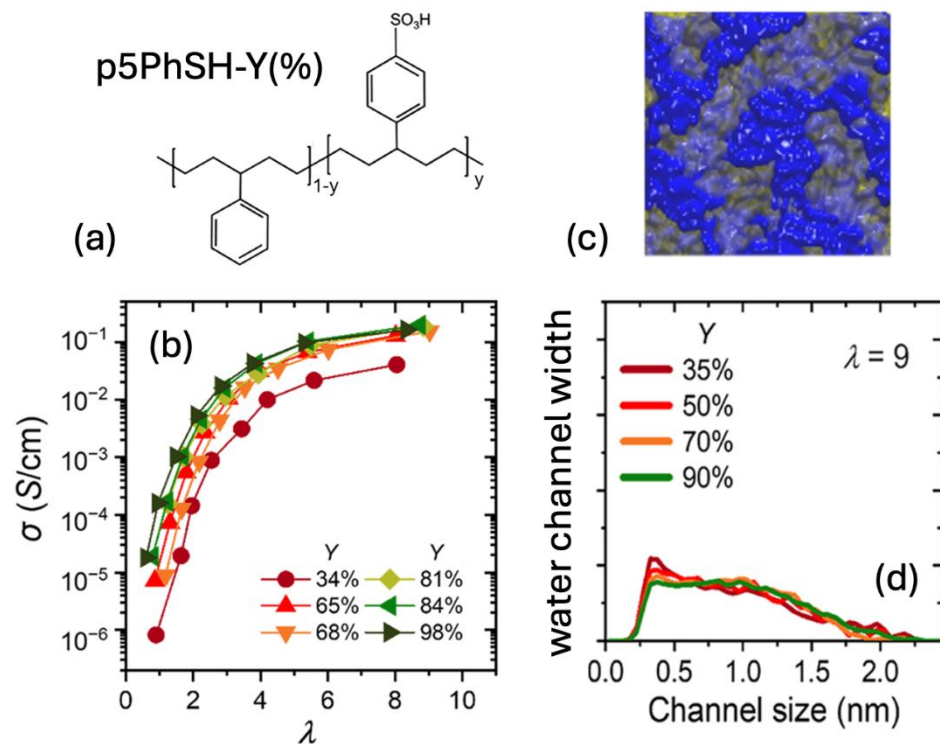


Figure: Copolymers (a) with Y% sulfonation exhibit high conductivity (b) especially at high water content λ (# waters/sulfonate). MD simulations show percolated water channels (c, blue) with widths mostly independent of sulfonation level (d).

Scientific Achievement

Demonstration of fluorine-free copolymers with high proton conductivity over a range of sulfonation levels, allowing tuning of properties.

Significance and Impact

This work demonstrates that proton conductivity depends strongly on water content but less on sulfonation level above 60%, providing flexibility in designing polymers.

Research Details

- New polymer synthesis enabled varying sulfonation levels.
- Atomistic MD simulations and X-ray scattering showed the formation of percolated water channels at the nanoscale.
- High conductivity was correlated to percolated water domains with sizes weakly dependent on sulfonation.

Oh, S. M.; Lee, V. S.; Drayer, W. F.; Win, M. S.; Jones, L. F.; Leo, C. M.; Kennemur, J. G.; Frischknecht, A. L.; Winey, K. I. Effect of Sulfonation Level on the Percolated Morphology and Proton Conductivity of Hydrated Fluorine-Free Copolymers: Experiments and Simulations. *JACS Au*. 2025.

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