

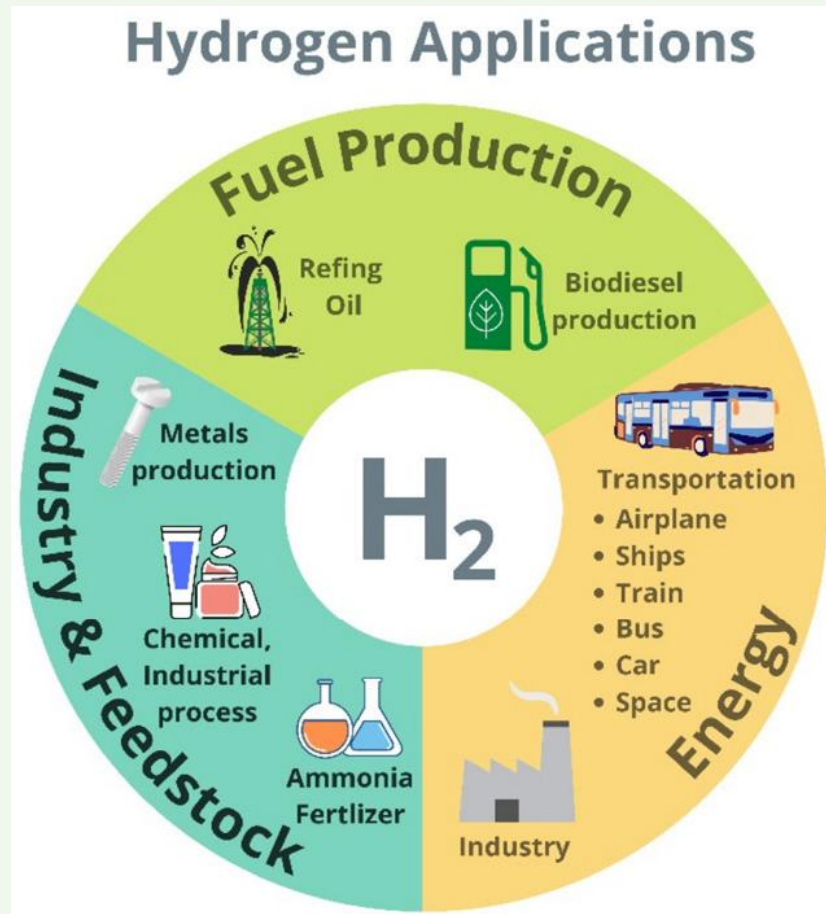
Overcoming Challenges: One-Step Synthesis of Micro-block sPPS polymers

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Hydrogen usage in industry

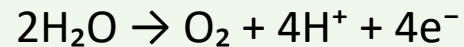


1. Petroleum Refining & Hydroprocessing
2. Oil Refining (Hydroprocessing)
3. Chemical Manufacturing (Ammonia & Methanol)
4. Steel and Metallurgy (Direct Reduction of Iron)
5. High-Tech Manufacturing and Electronics
6. High-Temperature Industrial Process Heat

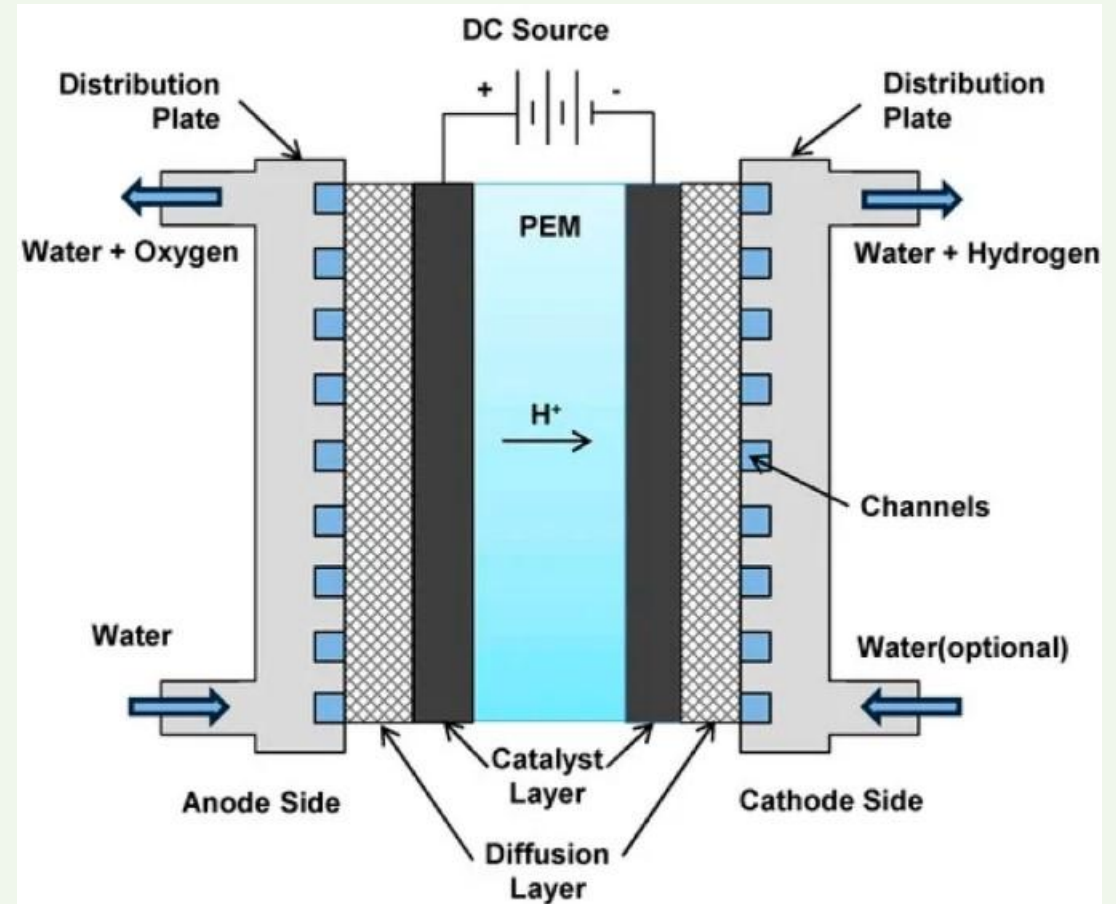
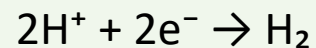
Hydrogen generation by a PEM electrolyzer

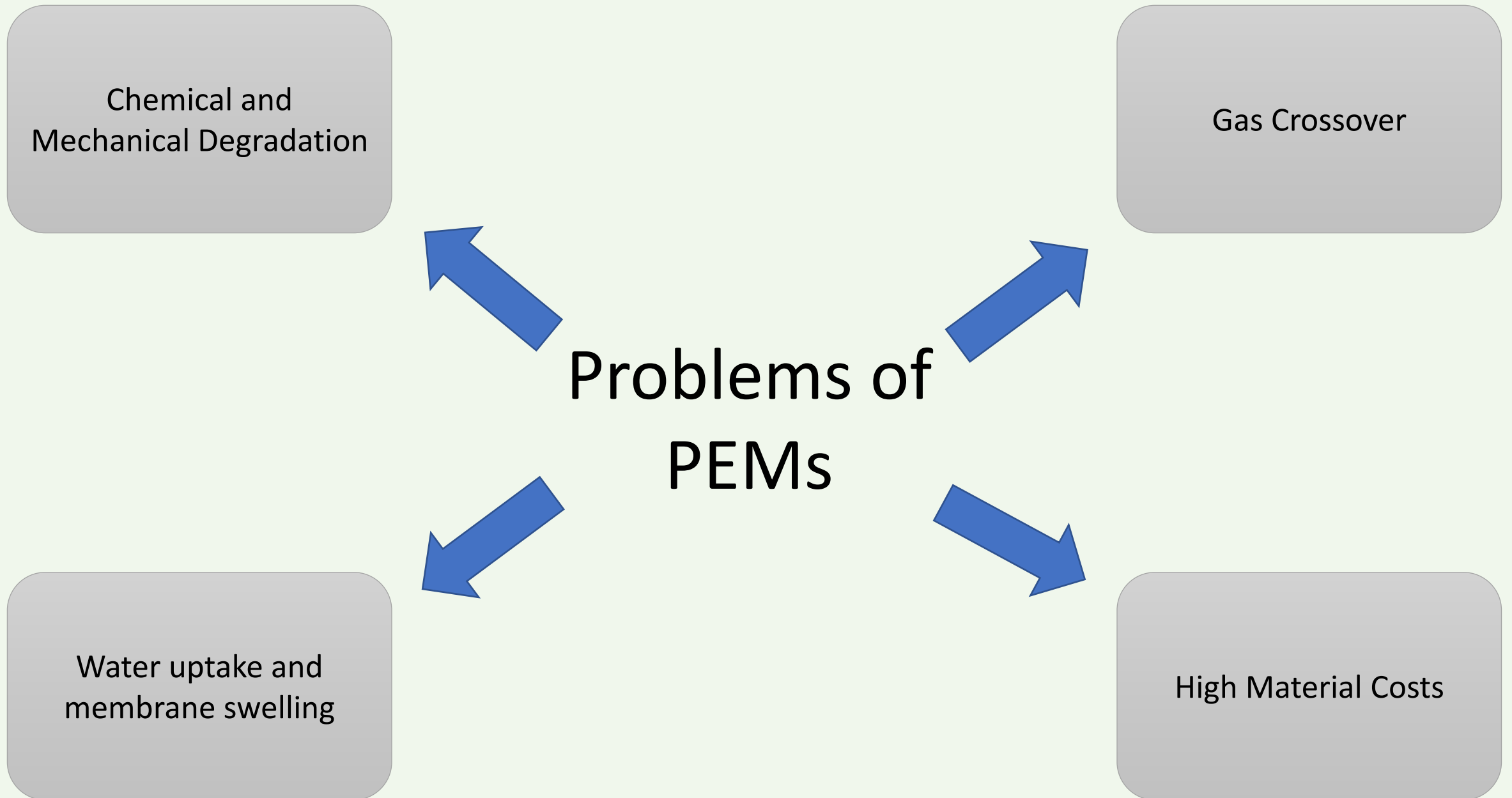
1. High Current Density
2. Rapid Dynamic Response
3. High-Pressure Output
4. high-purity gas

Oxygen Evolution Reaction

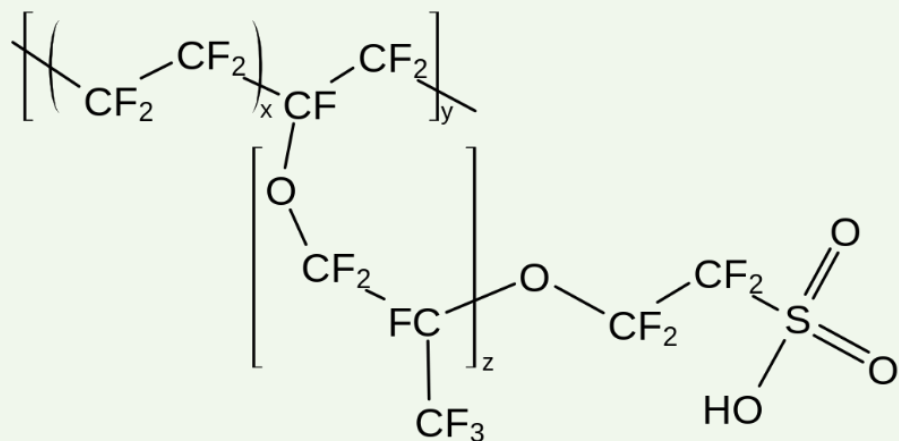
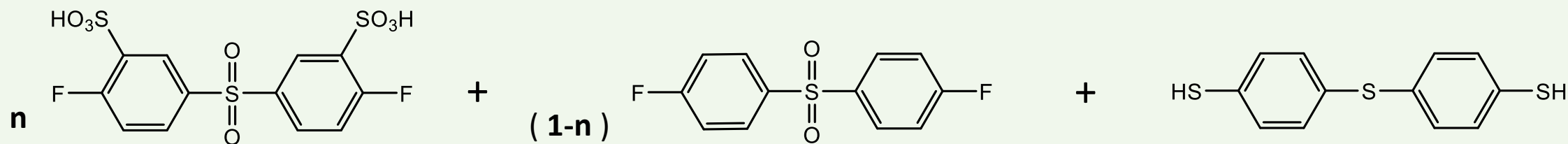


Hydrogen Evolution Reaction





sPPS 390 with DFDPS



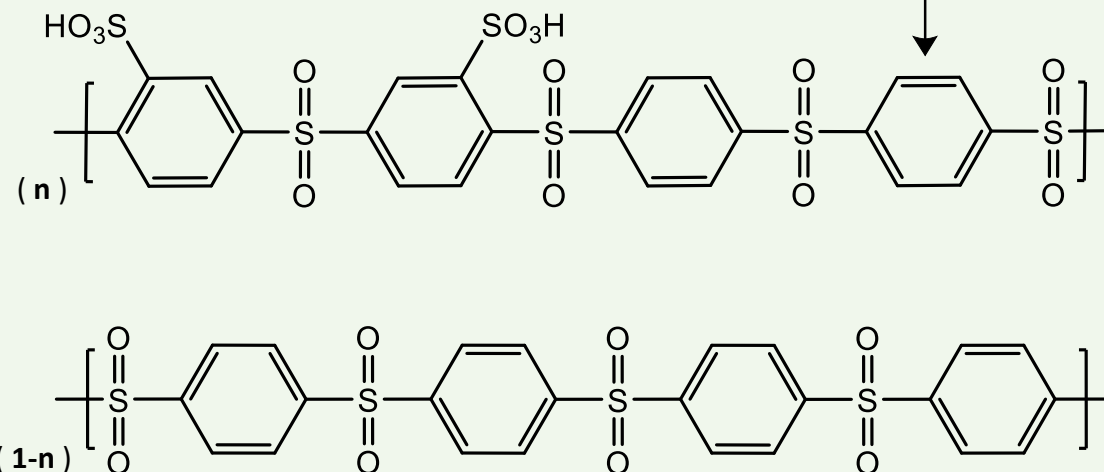
Nafion structure

when EW = 390
 $n = 0.9$
 $(1-n) = 0.1$

1. K_2CO_3 cyclohexane
 130 °C 4 h
 2. 200 °C 8 h

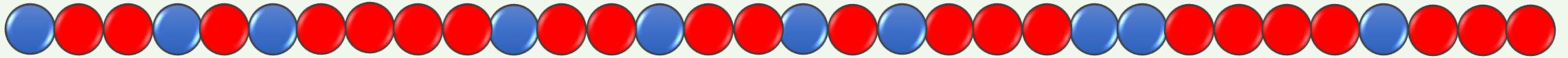
NMP

AcOH / H_2O_2
 Conc. H_2SO_4
 70 °C



XXL micro-bloc strategy

polymer chain arrangement of sPPS 390 synthesized by using DFDPS



polymer chain arrangement of sPPS XXL 390 synthesized by using XXL monomer



Sulfonated segment

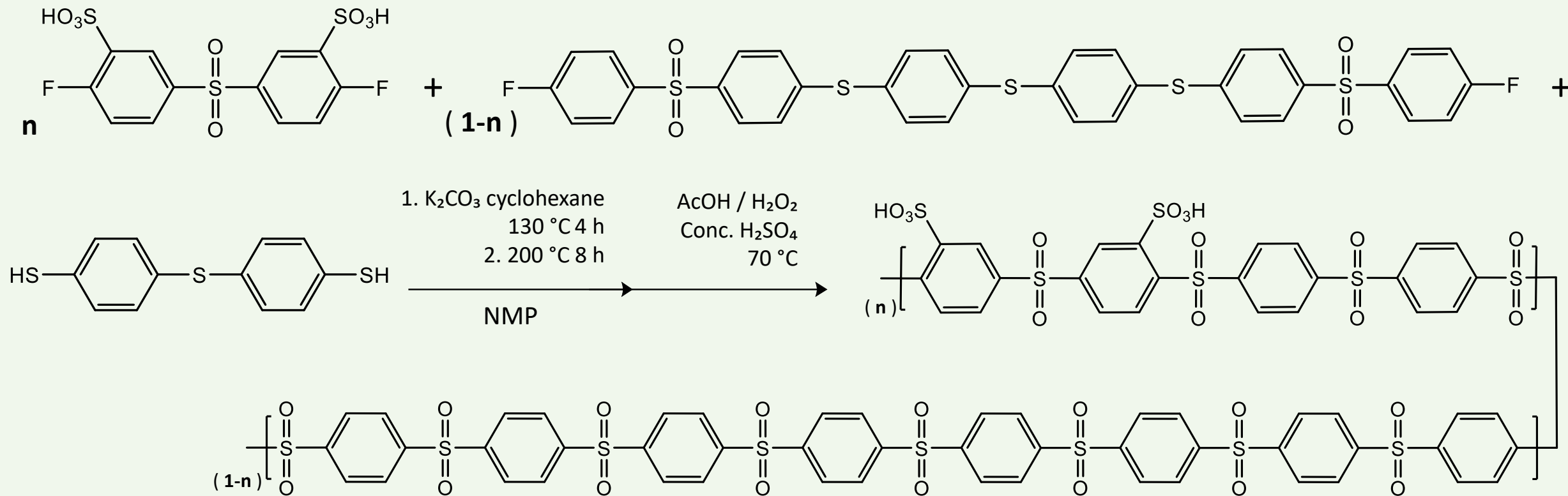


Non sulfonated segment



Non sulfonated micro-block

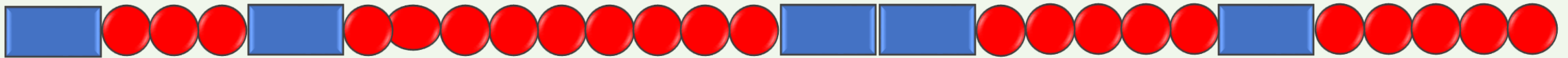
sPPS XXL 390 Micro-block strategy



When EW= 390 $n = 0.95$ $(1-n) = 0.05$

one step micro-block strategy

polymer chain arrangement of sPPS XXL 390 synthesized by using XXL monomer



polymer chain arrangement of sPPS 390 synthesized by using DCDPS



Sulfonated segment

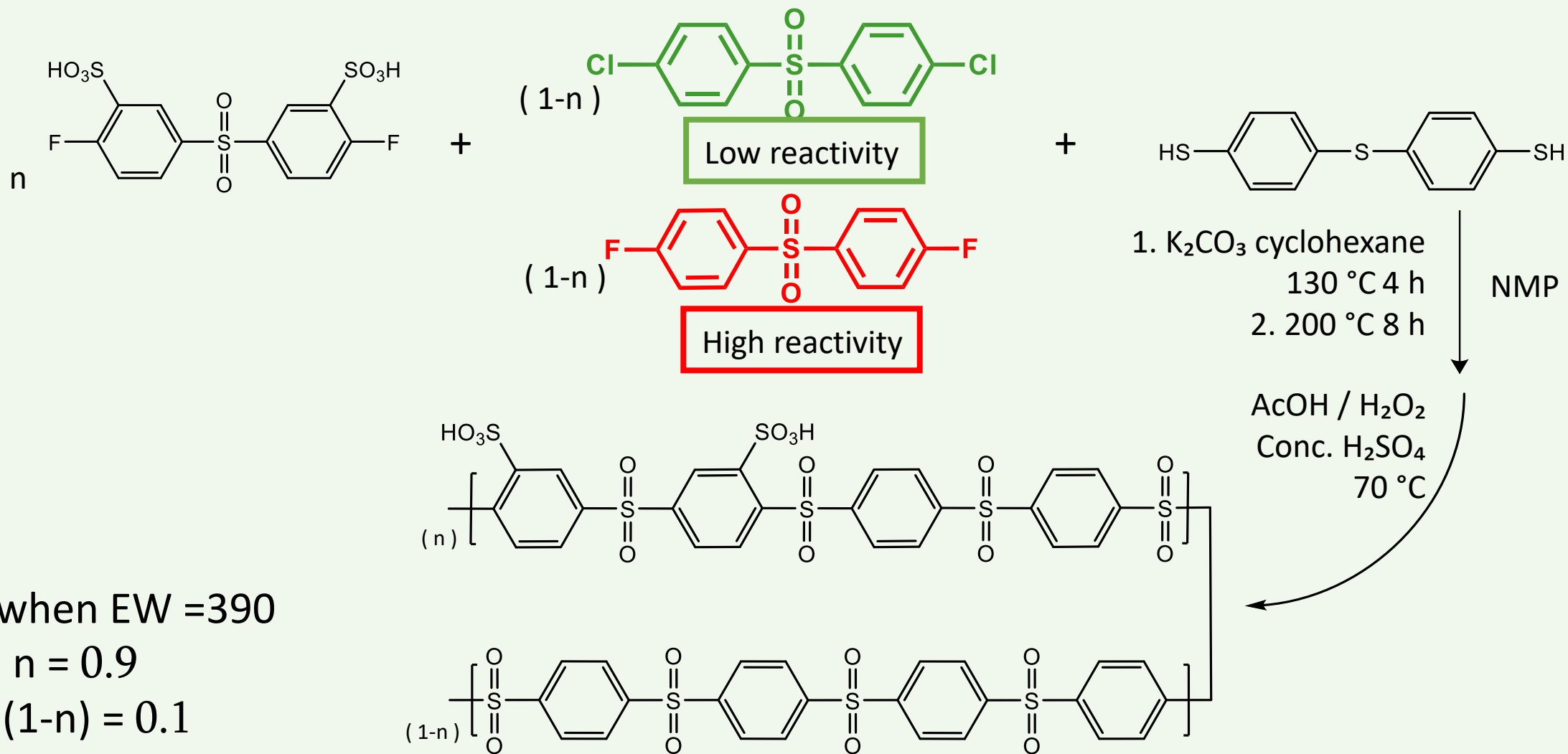


Non sulfonated segment



Non sulfonated micro-block

sPPS 390 with DCDPS



when EW = 390

$n = 0.9$

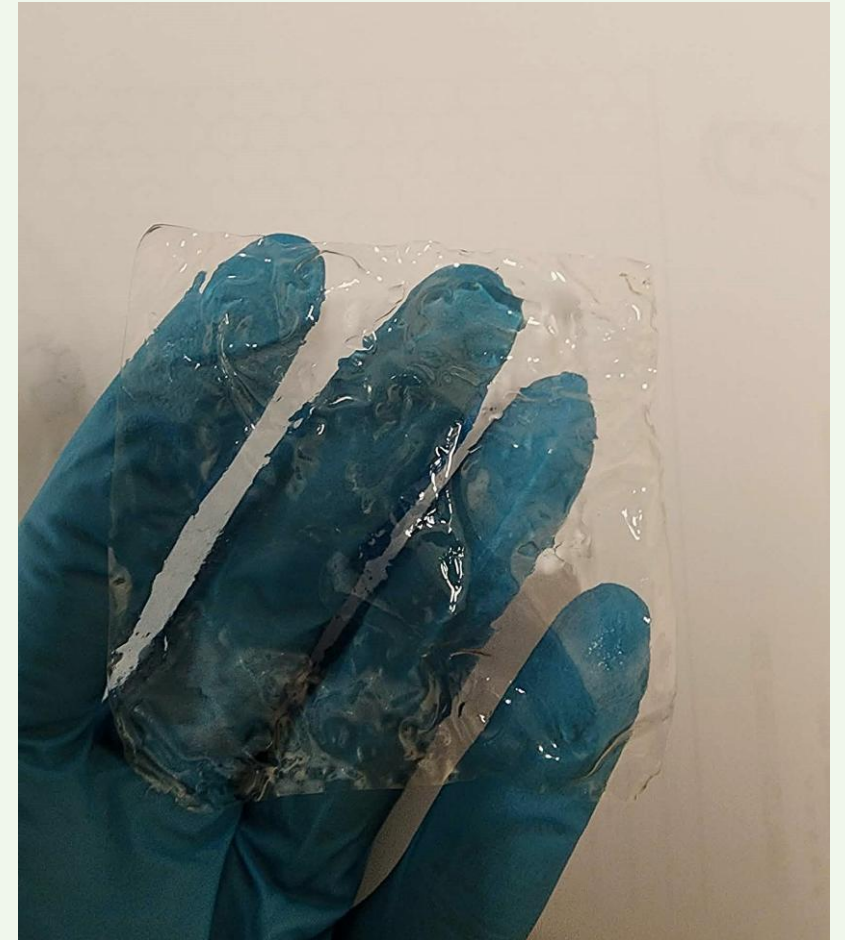
$(1-n) = 0.1$

Experimental



The synthesized polymer precipitated in i-PrOH, demonstrating a high molecular weight.

The synthesized polymer exhibits excellent film-forming ability.



Water uptake table

polymer	Water uptake at 80 °C
sPPS 390 standard	$\lambda = 35 \pm 1$
sPPS XXL 390 micro-block	$\lambda = 25.58 \pm 1$
sPPS 390 micro-block analog	$\lambda = 26.47 \pm 1$

Summary & Conclusion

Successful Synthesis: Target polymer successfully synthesized

good Processability: Synthesis route yielded membranes with good film-forming capability.

Suppressed Water Uptake: The new method effectively restricted swelling, matching the performance of the complex micro-block strategy.

Reaction Kinetics Approach: Changing monomer proved highly viable for creating pseudo-block structures.

Cost-Effective Alternative: Shifting from a multi-step to a one-step synthesis significantly simplifies and cheapens sPPS membrane production.

thank you
for your attention