ADVANCED POLYMERIC MEMBRANES FOR CARBON CAPTURE

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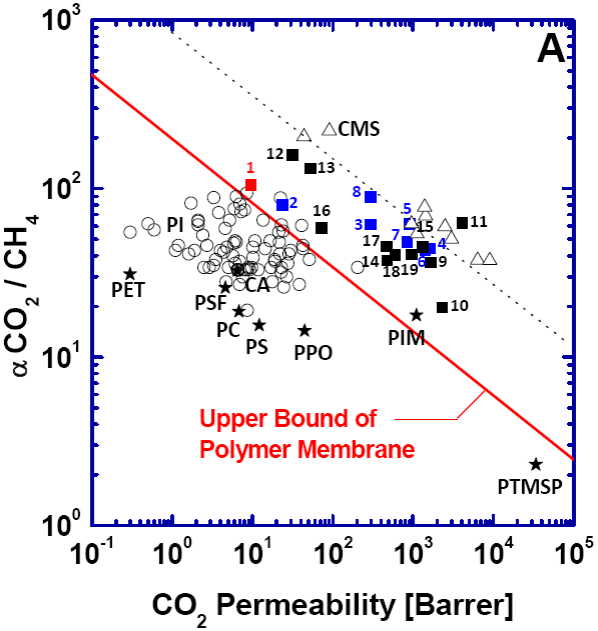
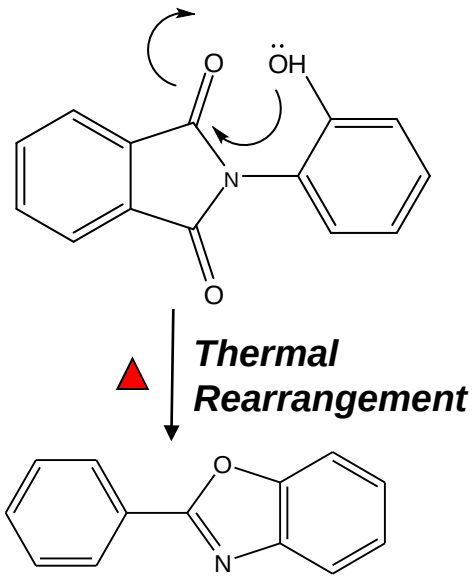
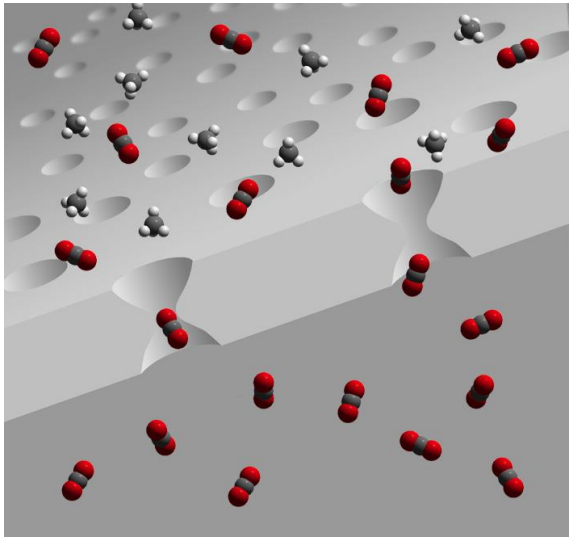
Thermally Rearranged (TR) polymers have the highest combinations of selectivity and permeability known, are thermally and chemically stable, and can be processed by conventional hollow fiber spinning technology.



Polyimide Precursor
(Soluble, processable)



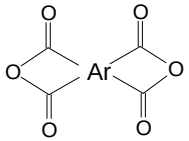


Polybenzoxazole TR Product
(Ultrahigh Transport Properties
Insoluble, Chemically & Thermally Stable)

H.B. Park et al., Polymers with Cavities Tuned for Fast, Selective Transport of Small Molecules and Ions, *Science*, 318, 254-258 (2007).

Multiple Synthetic Pathways Are Available to Optimize Polymer Properties

1

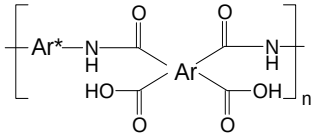


Aromatic dianhydride

+

$H_2N—Ar^*—NH_2$

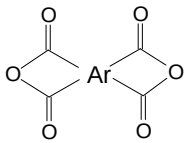
***ortho*-OH aromatic diamine**



Polyamic acid (PAA)

- **Thermal imidization**
- **Chemical imidization**
- **Microwave assisted**

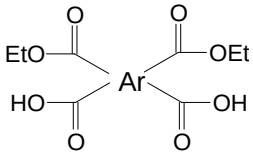
2



Aromatic dianhydride

+

EtOH, TEA

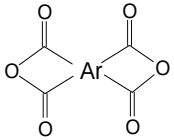


Ester-acid precursor

+

$H_2N—Ar^*—NH_2$

3



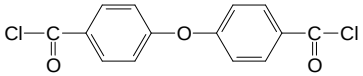
Aromatic dianhydride

+

$ClH_3N—Ar^*—NH_3Cl$

Diamine dihydrochloride

4

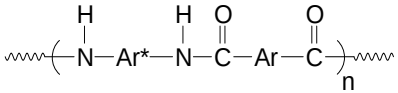


Aromatic dihydrochloride

+

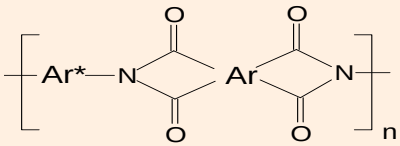
$H_2N—Ar^*—NH_2$

Fluorinated diamine



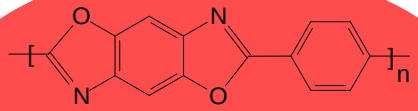
Polyhydroxy amide (PHA)

cyclodehydration



Aromatic polyimide (API)

Thermal Rearrangement (TR)



Polybenzoxazole (PBO)