Rational Design of Zeolite Nanocrystals and Membranes at Different Length Scales for Carbon Dioxide Separation

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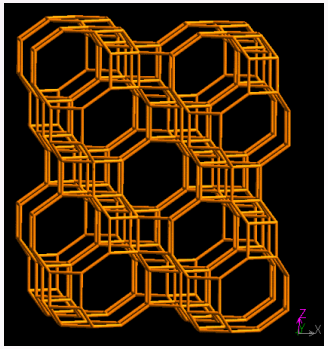
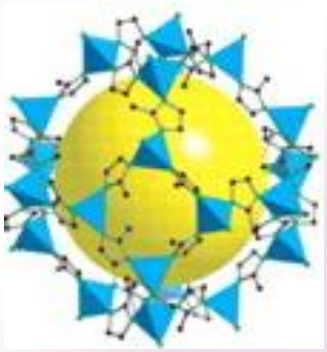
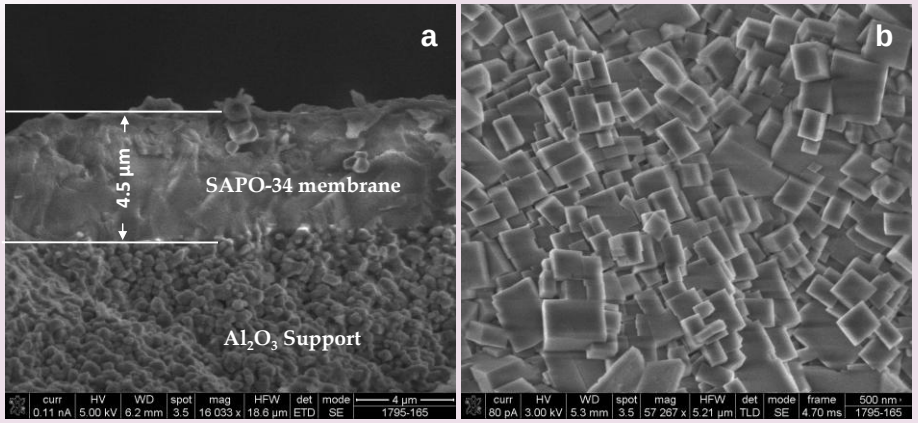
The proposed research focuses on the development of novel *self-assembly methods* for the molecular design of zeolite membranes displaying controlled crystal size at different length scales, controlled surface properties, and tunability of pore architectures for CO_2/CH_4 separation. Our results on SAPO-34 seeds demonstrate the benefits of one of the proposed self-assembly approaches in developing seeds displaying surface areas as high as 700 m^2/g, small crystal sizes in the 0.5- 0.7 μm range with narrow size distribution and unprecedented high CO_2/CH_4 sorption capacities. The small crystal size and remarkable high CO_2/CH_4 sorption capacities of the synthesized SAPO-34 seeds translated into high CO_2/CH_4 separation selectivities (> 250), while the > 5 μm thin membranes synthesized with these seeds led to CO_2 permeances as high as $1x10^{-6}$ mol/m^2 s Pa). In addition, we have recently developed novel metal organic framework membranes (ZIF-8) able to separate CO_2 from CH_4.



SAPO-34



ZIF-8



Continuous zeolite SAPO-34 and Metal organic framework ZIF-8 membranes have been synthesized in our lab.

SAPO-34 membranes effectively separate CO_2/CH_4 mixtures