CLAIMS

1. A method for performing a gas separation, comprising:

contacting an adsorbent or membrane comprising ~~an 8-member ring zeolite or~~ an 8-member ~~ring~~ microporous material with a barrier compound under effective conditions to selectivate the adsorbent or membrane, ~~wherein~~ the barrier compound ~~has~~ having a minimum molecular dimension ~~of about 4.05 Angstroms to about 5.65 Angstroms~~ that is at least 0.4 Angstroms greater than the maximum dimension of the largest hard sphere that can diffuse along any direction of the adsorbent and a maximum dimension of about 25 Angstroms or less ~~for an 8-member ring zeolite or an 8-member ring microporous material~~; wherein the effective conditions for contacting the adsorbent or membrane with a barrier compound comprise a temperature from about 50°C to about 350°C and a total pressure of about 100 psig (about 690kPag) to about 2000 psig (about 13.8 MPag), wherein the barrier compound is present either as a liquid or as a gas with a partial pressure of the wherein compound that is at least about 10% of the saturation vapor pressure; wherein selectivation of the adsorbent or membrane comprises diffusion of at least one barrier compound molecule through the pores of the 8-member microporous material;

contacting the selectivated adsorbent or membrane with an input gas stream containing a first component and a second component to form a first gas stream enriched in the first component relative to the input gas stream; and

collecting a second gas stream enriched in the second component relative to the input gas stream.

2. The method of claim 1, wherein the 8-member ring ~~zeolite~~ microporous material is a DDR type zeolite, Sigma-1, ZSM-58, or a combination thereof.

3. The method of ~~any of the above claims~~ claim 1, wherein the barrier compound is a glycol, an amine, an alcohol, an alkane, a sulfur bearing compound, or a combination thereof, the barrier compound having a molecular weight of at least 50 g/mol.

4. The method of ~~any of the above claims~~ claim 1, wherein the barrier compound is ethylene glycol, triethylene glycol, methyl-diethyl-amine, dimethyl-ethyl-amine, dimethyl disilane, n-hexane, 2-octanol, or a combination thereof.

5. The method of claim 1, wherein the first component ~~comprises or~~ is CH_4 or a combination of CH_4 and H_2S.

6. The method of ~~any of the above claims~~ claim 1, wherein the second component ~~comprises or~~ is CO_2, N_2, H_2S, or a combination thereof.

~~7. The method of claim 1, wherein the effective conditions for contacting the adsorbent or membrane with a barrier compound comprise a temperature from about 50°C to about 350°C and a total pressure of about 100 psig (about 690 kPag) to about 2000 psig (about 13.8 MPag), wherein the blocking compound is present either as a liquid or as a gas with a partial pressure of the blocking compound that is at least about 10% of the saturation vapor pressure.~~

~~8.~~7. The method of claim ~~7~~ 1, wherein the effective conditions for contacting the adsorbent or membrane with a barrier compound comprise a temperature of at least about 150°C.~~, such as at least about 250°C.~~

8. The method of claim 1, wherein the first gas stream is a retentate stream and the second gas stream is a permeate stream.

9. The method of ~~any of the above claims~~ claim 1, wherein contacting the selectivated adsorbent with an input gas stream comprises adsorbing, by the selectivated adsorbent, at least a portion of the second component during the contacting, the method further comprising desorbing at least a portion of the adsorbed second component to form a desorbed second component portion, wherein the second gas stream comprises at least a portion of the desorbed second component portion.

10. The method of ~~any of the above claims~~ claim 1, further comprising desorbing at least a portion of the barrier compound during contacting the selectivated adsorbent or membrane with the input gas stream.

11. The method of claim 1, wherein the minimum dimension for the barrier compound is from about 4.05 Angstroms to about 5.65 Angstroms.

12. The method of claim 1, wherein the amount of barrier compound adsorbed by the microporous material is about 20% or less of the saturation loading (q_s).

~~11. The method of any of the above claims, wherein the adsorbent is part of a swing adsorber unit, the swing adsorber unit being a pressure swing adsorber unit or a temperature swing adsorber unit.~~

~~12. The method of claim 11, wherein the swing adsorber unit is a rapid cycle pressure swing adsorber unit or a rapid cycle temperature swing adsorber unit.~~

~~13. The method of claim 11 or 12, further comprising repeating said contacting, desorbing, and collecting for a plurality of cycles.~~

~~14. The method of any of claims 1-8 or 10, wherein the first gas stream is a retentate stream and the second gas stream is a permeate stream.~~

~~15. The method of any of the above claims, wherein the amount of barrier compound adsorbed by the microporous material is about 20% or less of the saturation loading (q_s).~~

~~16.~~13. A method for performing a gas separation in a swing adsorber unit, comprising:

contacting an adsorbent comprising a microporous material in a swing adsorber unit with a barrier compound under effective conditions to selectivate the adsorbent, the microporous material having pores characterized by a first dimension of a largest hard sphere that can diffuse along any direction in the pores and the

barrier compound having a second dimension representing a minimum dimension of the compound, wherein the second dimension is between 10% greater than and 60% greater than the first dimension; wherein the effective conditions for contacting the adsorbent or membrane with a barrier compound comprise a temperature from about 50°C to about 350°C and a total pressure of about 100 psig (about 690 kPag) to about 2000 psig (about 13.8 MPag), wherein the barrier compound is present either as a liquid or as a gas with a partial pressure of the wherein compound that is at least about 10% of the saturation vapor pressure; wherein selectivation of the adsorbent or membrane comprises diffusion of barrier compound molecules through the pores of the microporous material;

contacting the selectivated adsorbent with an input gas stream containing a first component and a second component to form an output gas stream enriched in the first component relative to the input gas stream, the selectivated adsorbent adsorbing at least a portion of the second component during the contacting;

desorbing at least a portion of the adsorbed second component to form a desorbed second component portion; and

collecting a gas stream comprising at least a portion of the desorbed second component portion, the gas stream being enriched in the second component relative to the input gas stream.~~, and optionally including the subject matter of any one or more of claims 3-15.~~