CLAIMS

1. An amorphous adsorbent composition for purifying hydrocarbon gas fractions, comprising:

a hydrolyzed, partially collapsed Linde Type A aluminosilicate zeolite; and

a plurality of pores characterized by a pore aperture size of from about 0.33 nm to about 0.38 nm;

wherein the composition is characterized by a carbon dioxide/methane equilibrium selectivity factor in a range of about 3.8 to about 40.

2. The composition of claim 1, wherein the composition has a Na/Al ratio in a range of from about 0.60 to about 1.00.

3. The composition of claim 1, wherein the composition is hydrolyzed using deionized water.

4. The composition of claim 3, wherein the deionized water is present in a phase selected from the group consisting of liquid, saturated steam and superheated steam.

5. The composition of claim 1, wherein the composition is decationized and calcined prior to hydrolysis.

6. The composition of claim 5, wherein the composition is calcined at a temperature between about 473 K and about 773 K.

7. The composition of claim 1, wherein the composition is operable at a temperature in a range of between about 273 K and about 323 K.

8. The composition of claim 1, wherein the composition is operable at a pressure in a range of between about 1 bar and about 8 bars.

9. The composition of claim 1, wherein the composition further comprises one or more cations selected from sodium, ammonium and combinations thereof.

10. A method for synthesizing an amorphous adsorbent material capable of purifying a gas fraction comprising:

combining at least a stoichiometric amount of a compound comprising at least one exchangeable cation with a stoichiometric amount of a sodium Linde Type A aluminosilicate zeolite compound under temperature and pressure conditions suitable for promoting cation

exchange between the compound comprising at least one exchangeable cation and the sodium Linde Type A aluminosilicate zeolite compound;

isolating the Linde Type A aluminosilicate zeolite compound comprising the exchangeable cation;

calcinating the Linde Type A aluminosilicate zeolite compound comprising the exchangeable cation under conditions such that the Linde Type A aluminosilicate zeolite compound undergoes at least a partial structural collapse and the exchangeable cation is removed to form a calcinated amorphous adsorbent precursor; and

hydrolyzing the calcinated amorphous adsorbent precursor under conditions appropriate for forming a plurality of pores characterized by a pore aperture size of from about 0.33 nm to about 0.38 nm.

11. The method of claim 10, wherein the compound comprising at least one exchangeable cation is ammonium nitrate.

12. The method of claim 10, wherein the step of calcinating is performed at a temperature in a range of about 473 K to about 773 K.

13. The method of claim 10, wherein the step of calcinating is performed at a pressure in a range of about 1 bar to about 8 bar.

14. A method for purifying a natural gas fraction comprising the steps of:

introducing a natural gas fraction into a vessel containing the composition of claim 1, where the introduced natural gas is a non-upgraded natural gas comprising non-combustible gases and where the amorphous adsorbent is characterized by a carbon dioxide/methane equilibrium selectivity factor in a range of about 3.8 to about 40;

contacting the natural gas fraction with the composition of claim 1; and

maintaining the natural gas fraction in the vessel containing the composition of claim 1 for a sufficient time such that the concentrations of the non-combustible gases are reduced in the natural gas fraction.