What is claimed:

1. A composition comprising:

a silica-based aerogel including hydrophobic-bound silicon, wherein the silica-based aerogel includes guanidinium cations; and

wherein the silica-based aerogel is not surface-treated by a hydrophobizing agent..

2. The composition of claim 1, wherein the silica-based aerogel has surface groups consisting of hydrophobic groups of the formula Si-R, where R is a single alkyl group.

3. The composition of claim 2, wherein R is a single methyl group.

4. The composition of claim 1, wherein the composition has a heat of combustion less than 717 cal/g.

5. The composition of claim 1, wherein the composition has a heat of combustion in the range of 700 cal/g or less, 650 cal/g or less, 600 cal/g or less, 575 cal/g or less, 550 cal/g or less, 500 cal/g or less, 450 cal/g or less, 400 cal/g or less, 350 cal/g or less, 300 cal/g or less, 250 cal/g or less, 200 cal/g or less, 150 cal/g or less, 100 cal/g or less, 50 cal/g or less, 25 cal/g or less, or 10 cal/g or less.

6. The composition of any preceding claim, wherein the composition has an onset of thermal decomposition of hydrophobic organic materials of 350°C or higher.

7. The composition of any preceding claim, wherein the silica-based aerogel has a thermal conductivity less than 45 mW/M*K.

8. The composition of claim 7, wherein the silica-based aerogel has a thermal conductivity in the range of 40 mW/M*K or less, 35 mW/M*K or less, 30 mW/M*K or less, 25 mW/M*K or less,

20 mW/M*K or less, 18 mW/M*K or less,16 mW/M*K or less, 15 mW/M*K or less, 14 mW/M*K or less, 13 mW/M*K or less, 12 mW/M*K or less, or5 mW/M*K to 50 mW/M*K.

9. The composition of any preceding claim further comprising a reinforcement material.

10. The composition of claim 9, wherein the reinforcement material comprises a fiber reinforcement material or a foam reinforcement material.

11. The composition of any preceding claim further comprising an opacifying or fire-class additive.

12. The composition of claim 11, wherein the opacifying or fire-class additive is present in a range of about 0.1 wt% to about 10 wt%.

13. The composition of claim 11, wherein the opacifying or fire-class additive is selected from the group consisting of boron carbide, diatomite, manganese ferrite, manganese oxide, nickel oxide, tin oxide, silver oxide, bismuth oxide, titanium carbide, tungsten carbide, carbon black, titanium oxide, iron titanium oxide, zirconium silicate, zirconium oxide, iron oxide, iron (II) oxide, iron (III) oxide, manganese dioxide, iron titanium oxide, chromium oxide, silicon carbide, phyllosilicate clay, kaolin or kaolinite, metakaolin, halloysite, meta-halloysite, endellite, mica, diaspore, gibbsite, boehmite, montmorillonite, beidellite, pyrophyllite, nontronite, bravaisite, smectite, leverrierite, rectorite, celadonite, attapulgite, chloropal, volkonskoite, allophane, racewinite, dillnite, severite, miloschite, collyrite, cimolite and newtonite, sodium bicarbonate, magnesium hydroxide, magnesium dihydroxide, alumina trihydrate, gypsum, barringtonite, nesquehonite, lansfordite, hydromagnesite, dolomite, lithium carbonate or mixtures thereof.

14. The composition of any preceding claim, wherein the guanidinium cations are present in an amount of at least 0.1 wt %.

15. The composition of any preceding claim, comprising at most about 2 wt % of the guanidinium cations.

16. A method comprising:

providing a precursor solution comprising silica gel precursor materials and a solvent;

providing a basic catalyst solution, wherein the basic catalyst is a catalyst amount of guanidine hydroxide;

combining the precursor solution and the basic catalyst solution;

allowing the silica precursor materials to transition into a gel composition; and

extracting at least a portion of the solvent from the gel composition to obtain a silica-based aerogel composition, wherein the gel composition is hydrophobic without surface modification with a hydrophobizing agent.

17. The method of claim 16, wherein the precursor solution includes at least one silica gel precursor material having at least one hydrophobic group.

18. The method of claim16 or claim 17, wherein the precursor solution includes greater than 30% of at least one silica gel precursor material having a single alkyl group attached to silicon.

19. The method of claim 18, wherein the single alkyl group is a methyl group.

20. The method of any of claims 16 to 19, further comprising incorporating a reinforcement material into the silica-based aerogel composition.

21. The method of claim 20, further comprising incorporating an additive into the silica-based aerogel composition.

22. The method of claim 21, wherein the additive is present in a range of 0.1 wt% to 10 wt% of the silica-based aerogel composition.

23. The method of claim 21 or 22, wherein the additive is selected from the group consisting of boron carbide, diatomite, manganese ferrite, manganese oxide, nickel oxide, tin oxide, silver oxide, bismuth oxide, titanium carbide, tungsten carbide, carbon black, titanium oxide, iron titanium oxide, zirconium silicate, zirconium oxide, iron oxide, iron (II) oxide, iron (III) oxide, manganese dioxide, iron titanium oxide (ilmenite), chromium oxide, silicon carbide, phyllosilicate clay, kaolin or kaolinite, metakaolin, halloysite, meta-halloysite, endellite, mica, diaspore, gibbsite, boehmite, montmorillonite, beidellite, pyrophyllite, nontronite, bravaisite, smectite, leverrierite, rectorite, celadonite, attapulgite, chloropal, volkonskoite, allophane, racewinite, dillnite, severite, miloschite, collyrite, cimolite and newtonite, sodium bicarbonate, magnesium hydroxide, magnesium dihydroxide, alumina trihydrate, gypsum, barringtonite, nesquehonite, lansfordite, hydromagnesite, dolomite, lithium carbonate or mixtures thereof.