What is claimed:

1) A method comprising:

a) Providing a precursor solution comprising silica gel precursor materials and a solvent;

b) Combining the precursor solution with a reinforcement material;

c) Allowing the silica gel precursor materials in the precursor solution to transition into a gel composition to form a reinforced, silica-based gel composition;

d) Extracting at least a portion of the solvent from the reinforced, silica-based gel composition to obtain a reinforced, silica-based aerogel composition; and

e) Exposing the reinforced, silica-based aerogel composition to one or more heat treatments in a reduced oxygen atmosphere at a temperature between 500 °C and 700 °C;

wherein the method further comprises incorporating at least one hydrophobic-bound silicon into the reinforced, silica-based aerogel composition prior to step e).

2) A method comprising exposing a silica-based aerogel composition comprising at least one hydrophobic-bound silicon to one or more heat treatments in a reduced oxygen atmosphere at a temperature between 500 °C and 700 °C.

3) The method of claim 1 or claim 2, wherein the total duration of the one or more heat treatments in reduced oxygen atmosphere of the reinforced, silica-based aerogel composition is between 1 minute and 60 minutes.

4) The method of any one of claims 1-3, wherein the reinforced, silica-based aerogel composition comprises a sheet of fiber reinforcement material.

5) The method of any one of claims 1-4, wherein the one or more heat treatments in a reduced oxygen atmosphere of the reinforced, silica-based aerogel composition does not include exposure to a temperature above 700°C.

6) The method of any one of claims 1-5, wherein the reinforced, silica-based aerogel composition has a hydrophobic organic content between 2 wt% and 12 wt% before the one or more heat treatments and after the one or more heat treatments.

7) The method of any one of claims 1-6, wherein the reinforced, silica-based aerogel composition after the one or more heat treatments has a lower liquid water uptake relative to the reinforced, silica-based aerogel composition before the one or more heat treatments.

8) An aerogel composition having the following properties: i) liquid water uptake of 40 wt% or less; ii) an onset of thermal decomposition of hydrophobic organic materials of 515 °C or more; iii) heat of combustion of 717 cal/g or less; and iv) thermal conductivity of between 15 mW/M*K and 40 mW/M*K.

9) The aerogel composition of claim 8, wherein the aerogel composition has the following properties: ii) onset of thermal decomposition of hydrophobic organic materials between 515°C and 635°C, and iii) heat of combustion between 265 cal/g and 717 cal/g.

10) The aerogel composition of claim 9, wherein the aerogel composition has the following properties: ii) onset of thermal decomposition of hydrophobic organic materials between 525°C and 635°C, and iii) heat of combustion between 265 cal/g and 600 cal/g.

11) The aerogel composition of claim 10, wherein the aerogel composition has one or more of the following properties: ii) onset of thermal decomposition of hydrophobic organic materials between 550°C and 635°C, or iii) heat of combustion between 265 cal/g and 550 cal/g.

12) The aerogel composition of claim 10, wherein the aerogel composition has one or more of the following properties: ii) onset of thermal decomposition of hydrophobic organic materials between 575°C and 635°C, or iii) heat of combustion between 265 cal/g and 450 cal/g.

13) A reinforced aerogel composition comprising a silica-based framework, at least one hydrophobic-bound silicon, and a reinforcement material; wherein the reinforced aerogel composition has the following properties: i) liquid water uptake of 40 wt% or less; and ii) onset of thermal decomposition of hydrophobic organic materials of 515 °C or higher.

14) The reinforced aerogel composition of claim 13, wherein the reinforced aerogel composition has the following property: iii) heat of combustion of 717 cal/g or less.

15) The reinforced aerogel composition of any one of claims 13-14, wherein the reinforced aerogel composition comprises a sheet of fiber reinforcement material.

16) The reinforced aerogel composition of any one of claims 13-15, wherein the reinforced aerogel composition has the following properties: i) liquid water uptake of 40 wt% or less; ii) onset of thermal decomposition of hydrophobic organic materials between 515°C and 635°C; iii) heat of combustion between 265 cal/g and 717 cal/g; and iv) thermal conductivity of between 15 mW/M*K and 40 mW/M*K.

17) The reinforced aerogel composition of any one of claims 13-16, wherein the reinforced aerogel composition has the following properties: ii) onset of thermal decomposition of hydrophobic organic materials between 525°C and 635°C; and iii) heat of combustion between 265 cal/g and 600 cal/g.

18) The reinforced aerogel composition of claim 17, wherein the reinforced aerogel composition has one or more of the following properties: ii) onset of thermal decomposition of hydrophobic organic materials between 550°C and 635°C; or iii) heat of combustion between 265 cal/g and 550 cal/g.

19) The reinforced aerogel composition of claim 17, wherein the reinforced aerogel composition has one or more of the following properties: ii) onset of thermal decomposition of hydrophobic organic materials between 575°C and 635°C; or iii) heat of combustion between 265 cal/g and 450 cal/g.

20) The reinforced aerogel composition of any one of claims 13-19, wherein the hydrophobic organic content in the reinforced aerogel composition is between about 2 wt% and about 12 wt%.