What is claimed is:

1. A composition comprising a silica-based aerogel framework, reinforced with an open-cell macroporous framework (OCMF) material, and a fire-class additive that comprises an endothermic material; wherein the silica-based aerogel framework comprises at least one hydrophobic-bound silicon; and wherein the reinforced aerogel composition has the following properties:

i) liquid water uptake of 20 wt% or less;
ii) thermal conductivity of 30 mW/M*K or less according to ASTM C518 standard at a temperature of about 37.5 °C, in an ambient environment, at atmospheric pressure, and at a compression load of about 2 psi;
iii) heat of combustion of less than 717 cal/g according to EN ISO 1716 standard; and
iv) an onset of thermal decomposition of the fire-class additives in the composition is within 50°C of the onset of thermal decomposition of the rest of the composition without the fire-class additive.

2. The composition of claim 1, wherein the OCMF material comprises an organic OCMF material.

3. The composition of claim 1, wherein the OCMF material comprises a melamine based OCMF material.

4. The composition of claim 1, wherein the OCMF material comprises or is a sheet of OCMF material.

5. The composition of-claim 1, wherein the OCMF material is an organic foam.

6. The composition or reinforced OCMF composition of claim 1, wherein:

the OCMF material is neither a low-combustible material nor a non-combustible material; and

the composition as a whole is low-combustable or non-combustable.

7. The composition of claim 1, wherein:

the OCMF material is neither a low-flammable material nor a non-flammable material; and

the composition as a whole is either low-flammable or non-flammable.

8. The composition of claim 1, wherein the OCMF material comprises between 2 wt% and 10 wt% of the composition.

9. The composition of claim 1, wherein the hydrophobic silicon-bound content in the composition is between 2 wt% and 10 wt%.

10. The composition of claim 1, wherein the composition has a heat of combustion of from 625 cal/g to 700 cal/g according to EN ISO 1716 standard.

11. The composition of claim 1, wherein the reinforced aerogel composition has an onset of thermal decomposition of organic content from 350°C to 390°C or above.

12. The composition of claim 1, comprising a hydrophobic content of at least 5%, and wherein the total heat of endothermic decomposition of the fire-class additives in the composition is at least 30% of the exothermic heat of decomposition of the rest of the composition without the fire-class additive.

13. The composition of claim 1, comprising at least two fire-class additives with their respective onset of endothermic decomposition are at least 10°C apart.

14. The composition of claim 1, wherein the total heat of endothermic decomposition of the fire-class additives in the composition is no more than 80% of the exothermic heat of decomposition of the rest of the composition without the fire-class additive.

15. The composition of claim 1, wherein the flame time of the composition in accordance with ISO 1182 is about 30 seconds or less, about 25 seconds or less, about 20 seconds or less,

about 15 seconds or less, about 10 seconds or less, about 5 seconds or less, about 2 seconds or less, or in a range between any two of these values.

16. The composition of claim 1, wherein the mass loss of the composition in accordance with ISO 1182 is about 50% or less, about 40% or less, about 30% or less, about 28% or less, about 26% or less, about 24% or less, about 22% or less, about 20% or less, about 18% or less, about 16% or less, or in a range between any two of these values.

17. The composition of claim 1, wherein, the onset of endothermic decomposition of the fire-class additive is greater than 280°C, 300°C, 350°C, 400°C, 450°C, or 500°C.

18. The composition of claim 1, wherein the OCMF material is one of a urethane-based polymer foam or a reticulated foam.

19. The composition of claim 1, wherein the OCMF has a density of between 2 $kg/m^3$ and 25 $kg/m^3$ and the composition has a density between 0.15 and 0.40 $g/cm^3$.

20. The composition of any one of the above claims, wherein the thermal conductivity is from 8 mW/M*K to 25 mW/M*K.

21. The composition of any one of the above claims, wherein the heat of combustion is more than 400 cal/g.

22. The composition of any one of the above claims, wherein the liquid water uptake is from 1 wt % to 10 wt %.

23. A reinforced aerogel composition comprising a silica-based aerogel framework, reinforced with an open-cell macroporous framework (OCMF) material, and a fire-class additive that comprises an endothermic material; wherein the silica-based aerogel framework comprises at least one hydrophobic-bound silicon; and wherein the reinforced aerogel composition has the following properties:

i) liquid water uptake of 20 wt% or less;

ii) thermal conductivity of 30 mW/M*K or less according to ASTM C518 standard at a temperature of about 37.5 °C, in an ambient environment, at atmospheric pressure, and at a compression load of about 2 psi;

iii) has an onset of thermal decomposition of organic content is from 280°C to 500°C; and

iv) an onset of thermal decomposition of the fire-class additives in the composition is within 50°C of the onset of thermal decomposition of the rest of the composition without the fire-class additive.

24. A reinforced aerogel composition comprising a silica-based aerogel framework, reinforced with an open-cell macroporous framework (OCMF) material, and a fire-class additive that comprises an endothermic material; wherein the silica-based aerogel framework comprises at least one hydrophobic-bound silicon; and wherein the reinforced aerogel composition has the following properties:

i) liquid water uptake of 20 wt% or less;

ii) thermal conductivity of 30 mW/M*K or less according to ASTM C518 standard at a temperature of about 37.5 °C, in an ambient environment, at atmospheric pressure, and at a compression load of about 2 psi; and

iii) an onset of thermal decomposition of the fire-class additives in the composition is within 50°C of the onset of thermal decomposition of the rest of the composition without the fire-class additive.

25. A reinforced aerogel composition comprising a silica-based aerogel framework, reinforced with an open-cell macroporous framework (OCMF) material, and a fire-class additive that comprises an endothermic material; wherein the silica-based aerogel framework comprises at least one hydrophobic-bound silicon; and wherein the reinforced aerogel composition has the following properties:

i) liquid water uptake of 20 wt% or less;

ii) thermal conductivity of 30 mW/M*K or less according to ASTM C518 standard at a temperature of about 37.5 °C, in an ambient environment, at atmospheric pressure, and at a compression load of about 2 psi;

iii) a flame time of the composition in accordance with ISO 1182 is 10 seconds or less, or a furnace temperature rise of 40°C or less, or both; and

iv) an onset of thermal decomposition of the fire-class additives in the composition is within 50°C of the onset of thermal decomposition of the rest of the composition without the fire-class additive.