What is claimed is:

1. A ~~reinforced aerogel~~ composition comprising a silica-based aerogel framework, reinforced with an open-cell macroporous framework (OCMF) ~~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) heat of combustion of less than 717 cal/g according to EN ISO 1716 standard.

~~2. A reinforced aerogel composition comprising a silica-based aerogel framework, reinforced with an OCMF material with a density of between 2 kg/m^3 and 25 kg/m^3, and a fire-class additive; 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) heat of combustion of less than 717 cal/g according to EN ISO 1716 standard.~~

~~3. A reinforced aerogel composition comprising a silica-based aerogel framework, reinforced with an OCMF material with a density of 2 kg/m^3 and~~

~~25 kg/m^3, and a fire-class additive; 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 between 1 wt% and 10 wt%;~~

~~ii) thermal conductivity of more than 8 and less than 25 mW/M*K 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) heat of combustion of less than 717 cal/g and more than 400 cal/g according to EN ISO 1716 standard.~~

~~4. A reinforced OCMF composition reinforced with a silica-based aerogel composition and a fire-class additive; 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) heat of combustion of less than 717 cal/g according to EN ISO 1716 standard.~~

~~5. A reinforced OCMF composition reinforced with a silica-based aerogel composition and a fire-class additive; 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 of about 2 psi; and

iii) heat of combustion of less than 717 cal/g according to EN ISO 1716 standard.

6. A reinforced OCMF composition reinforced with a silica-based aerogel composition and a fire-class additive; 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 between 1 wt% and 10 wt%;

ii) thermal conductivity of more than 8 and less than 25 mW/M*K according to ASTM C518 standard at a temperature of about 37.5 °C, in an ambient environment, at atmospheric pressure, and at a compression of about 2 psi; and

iii) heat of combustion of less than 717 cal/g and more than 400 cal/g according to EN ISO 1716 standard.

7.2. The reinforced aerogel composition of claim 1any one of claim 1-3 or reinforced OCMF composition of any one of claims 4-6, wherein the OCMF material comprises or is an organic OCMF material.

8.3. The reinforced aerogel composition of any one of claim 1-3 or reinforced OCMF composition of any one of claims 4-7claim 1, wherein the OCMF material comprises or is a melamine based OCMF material.

~~9.~~4. The ~~reinforced aerogel~~ composition of ~~any one of claim 1-3 or reinforced OCMF composition of any one of claims 4-6~~claim 1, wherein the OCMF material comprises or is a sheet of OCMF material.

~~10.~~5. The ~~reinforced aerogel~~ composition of ~~any one of claim 1-3 or reinforced OCMF composition of any one of claims 4-9~~ claim 1, wherein the OCMF material is an organic foam.

~~11. The reinforced aerogel composition of any one of claim 1-3 or reinforced OCMF composition of any one of claims 4-6, wherein the OCMF material is a melamine based foam.~~

~~12.~~6. The ~~reinforced aerogel~~ composition or reinforced OCMF composition of ~~any one of claims 1-11~~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.

~~13.~~7. The ~~reinforced aerogel~~ composition of claim 1~~or reinforced OCMF composition of any one of claims 1-11~~, 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.

~~14.~~8. The ~~reinforced aerogel~~ composition ~~or reinforced OCMF composition of any one of claims 1-11~~claim 1, wherein the OCMF material comprises between 2 wt% and 10 wt% of the composition.

~~15.~~9. The ~~reinforced aerogel~~ composition ~~or reinforced OCMF composition of any one of claims 1-14~~claim 1, wherein the hydrophobic silicon-bound content in the composition is between 2 wt% and 10 wt%.

~~16. The reinforced aerogel composition or reinforced OCMF composition of any one of claims 1-14, wherein the hydrophobic silicon-bound content in the composition is between 2 wt% and 8 wt%.~~

~~17. The reinforced aerogel composition or reinforced OCMF composition of any one of claims 1-14, wherein the hydrophobic silicon-bound content in the composition is between 2 wt% and 6 wt%.~~

~~18.~~10. The ~~reinforced aerogel~~ composition ~~or reinforced OCMF composition of any one of claims 1-17~~claim 1, wherein the composition has a heat of combustion of from 625 cal/g to 700 cal/g ~~or less~~ according to EN ISO 1716 standard.

~~19. The reinforced aerogel composition or reinforced OCMF composition of any one of claims 1-17, wherein the composition has a heat of combustion of 675 cal/g or less according to EN ISO 1716 standard.~~

~~20. The reinforced aerogel composition or reinforced OCMF composition of any one of claims 1-17, wherein the composition has a heat of combustion of 650 cal/g or less according to EN ISO 1716 standard.~~

~~21. The reinforced aerogel composition or reinforced OCMF composition of any one of claims 1-17, wherein the composition has a heat of combustion of 625 cal/g or less according to EN ISO 1716 standard.~~

~~22. The reinforced aerogel composition or reinforced OCMF composition of any one of claims 1-21, wherein the composition has a thermal conductivity of 22 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.~~

~~23. The reinforced aerogel composition or reinforced OCMF composition of any one of claims 1-21, wherein the reinforced aerogel composition has a thermal conductivity of 20 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.~~

~~24. The reinforced aerogel composition or reinforced OCMF composition of any one of claims 1-21, wherein the reinforced aerogel composition has a thermal conductivity of 18 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.~~

~~25. The reinforced aerogel composition or reinforced OCMF composition of any one of claims 1-21, wherein the reinforced aerogel composition has a density between 0.15 and 0.40 g/cm^3.~~

~~26.~~11. The ~~reinforced aerogel~~ composition of claim 1~~or reinforced OCMF composition of any one of claims 1-21~~, wherein the reinforced aerogel composition has an onset of thermal decomposition of organic content ~~of~~ from 350°C to 390°C or above.

~~27. The reinforced aerogel composition or reinforced OCMF composition of any one of claims 1-21, wherein the reinforced aerogel composition has an onset of thermal decomposition of 360°C or above.~~

~~28. The reinforced aerogel composition or reinforced OCMF composition of any one of claims 1-21, wherein the reinforced aerogel composition has an onset of thermal decomposition of 370°C or above.~~

~~29. The reinforced aerogel composition or reinforced OCMF composition of any one of claims 1-21, wherein the reinforced aerogel composition has an onset of thermal decomposition of 380°C or above.~~

~~30. The reinforced aerogel composition or reinforced OCMF composition of any one of claims 1-21, wherein the reinforced aerogel composition has an onset of thermal decomposition of 390°C or above.~~

~~31. An organic OCMF reinforced aerogel composition comprising fire-class additives and hydrophobic organic content wherein, , the onset of endothermic 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.~~

~~32.~~12. The ~~An organic OCMF reinforced aerogel~~ composition of claim 1, ~~comprising fire-class additives and~~ 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~~,~~.

33.13. The ~~An organic OCMF reinforced aerogel~~ composition of claim 1, comprising at least two fire-class additives with their respective onset of endothermic decomposition are at least 10°C apart.

~~34. An organic OCMF reinforced aerogel composition comprising fire-class additives and hydrophobic content 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.~~

~~35. The reinforced aerogel composition or reinforced OCMF composition of any one of claims 1-11, wherein the hydrophobic content is at least 5%, , and 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,.~~

36.14. The ~~reinforced aerogel~~ composition ~~or reinforced OCMF composition of any one~~ of claim~~s~~ 1~~-11~~, wherein, ~~,~~ the onset of endothermic 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.

~~37. The reinforced aerogel composition or reinforced OCMF composition of any one of claims 1-11, with at least two fire-class additives wherein the two fire-class additives respective onset of endothermic decomposition are at least 10°C apart~~

~~38.~~15. The ~~reinforced aerogel~~ composition of claim 1, ~~or reinforced OCMF composition of any one of claims 1-11~~, 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.

~~39. The composition of any one of claims 1-38, wherein the furnace temperature rise of the composition in accordance with ISO 1182 is about 100 °C or less, about 90 °C or less, about 80 °C or less, about 70 °C or less, about 60 °C or less, about 50 °C or less, about 45 °C or less, about 40 °C or less, about 38 °C or less, about 36 °C or less, about 34 °C or less, about 32 °C or less, about 30 °C or less, about 28 °C or less, about 26 °C or less, about 24 °C or less, or in a range between any two of these values.~~

~~40.~~16. The composition of claim 1~~of any one of claims 1-39~~, 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.

~~41.~~17. The composition of claim 1~~any one of claims 1-40~~, 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.

~~42. The composition of any one of the above claims, wherein the composition is low-flammable.~~

~~43. The composition of any one of the above claims, wherein the composition is non-flammable.~~

~~44. The composition of any one of the above claims, wherein the composition is low-combustible.~~

~~45. The composition of any one of the above claims, wherein the composition is non-combustible.~~

~~46.~~18. The composition of claim 1~~any one of the above claims~~, 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.

~~47. The composition of any one of the above claims, wherein the onset of exothermic decomposition of organic content of the composition without the fire-class additive is greater than 280°C, 300°C, 350°C, 400°C, 450°C, or 500°C,.~~

~~48. The composition of any one of the above claims, wherein the OCMF material is a melamine-based foam.~~

~~49.~~19. The composition of claim 1~~any one of the above claims~~, wherein the OCMF material is one of a urethane-based polymer foam or a reticulated foam.

~~50. The composition of any one of the above claims, wherein the OCMF material is a reticulated foam.~~

20. The composition of claim 1, wherein the OCMF has a density of between 2 kg/m3 and 25 kg/m3 and the composition has a density between 0.15 and 0.40 g/cm3.

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

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

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

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

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; 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.

26. 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) 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.