CLAIMS

1. A process of manufacturing a segmented, reinforced dried gel composite sheet comprising the steps of:

   providing a segmented reinforcement sheet;

   combining the segmented reinforcement sheet with a gel precursor;

   gelling the gel precursor in the segmented reinforcement sheet to make a segmented reinforced gel composite sheet; and

   drying the segmented reinforced gel composite sheet to make a segmented, reinforced dried gel composite sheet.

2. The process of claim 1, wherein the segmented reinforcement sheet comprises a fiber.

3. The process of claim 1, wherein the segmented reinforcement sheet comprises an open cell foam.

4. The process of claim 1 further comprising applying an adhesive to at least one face of the segmented, reinforced dried gel composite sheet and attaching it to another planar material.

5. The process of claim 1, further comprising the steps of:

   providing the segmented, reinforced dried gel composite sheet of claim 1 with at least two major surfaces and multiple segmented cross-sectional surfaces;

   applying an adhesive to at least one surface of said segmented, reinforced dried gel composite sheet; and

   attaching said segmented, reinforced dried gel composite to another dried gel composite sheet.

6. The process of claim 1, wherein the segmented reinforcement sheet has a facing layer or a facing sheet attached to it.

7. The process of claim 6, wherein the facing layer comprises fibers.

8. The process of claim 2, wherein the segmented reinforcement sheet comprises a fiber reinforcement sheet comprising non-continuous fibers.

9. The process of claim 1, further comprising the step of incorporating additives into the gel precursor, selected from the group consisting of titanium dioxide, iron oxides, carbon black, graphite, aluminum hydroxide, phosphates, borates, metal silicates, metallocenes,

molybdates, stannates, carbonates, zinc oxides, aluminum oxides, antimony oxides, magnesiumzinc blends, magnesium-zinc-antimony blends, silicon carbide, molybdenum silicide, manganese oxides, iron titanium oxide, zirconium silicate, zirconium oxide, iron titanium oxide (ilmenite), chromium oxide and a combination thereof.

10. The process of claim 1, wherein the segmented reinforcement sheet comprises a fiber reinforcement sheet, and further comprising the step of adding at least a binder to the fibers of the fiber reinforcement sheet or using a fiber reinforcement sheet comprising at least one binder.

11. The process of claim 1, wherein at least a segment of the segmented reinforcement sheet is rigid.

12. The process of claim 1, wherein the gel precursor comprises a material selected from the group consisting of zirconia, yttria, hafnia, alumina, titania, ceria, silica, polyacrylates, polystyrenes, polyacrylonitriles, polyurethanes, polyimides, polyfurfural alcohol, phenol furfuryl alcohol, melamine formaldehydes, resorcinol formaldehydes, cresol formaldehyde, phenol formaldehyde, polyvinyl alcohol dialdehyde, polycyanurates, polyacrylamides, epoxies, agar, and agarose and combinations thereof.

13. The process of claim 1, wherein the segmented reinforcement sheet comprises a fiber reinforcement sheet comprising materials selected from the group consisting of mineral wool, glass wool, fiber glass, polyester, polyolefin terephthalates, poly(ethylene) naphthalate, polycarbonates, cellulose fiber, aliphatic polyamides, cotton based polyester-polyurethanes, Carbon based fibers, graphite, polyacrylonitrile (PAN), oxidized PAN, uncarbonized heat treated, fiberglass based material, E-glass, silica based fibers, quartz, Polyaramid fibers, polyolefins, polypropylene fibers, fluoropolymers, polytetrafluoroethylene (PTFE), Silicon carbide fibers, ceramic, Acrylic polymers, fibers of wool, silk, hemp, leather, suede, poly(p-phenylene-2,6-benzobisoxazole) (PBO), Liquid crystal material, Polyurethanes, polyamaides, Wood fibers, Boron, Aluminum, Iron, Stainless Steel fibers, polyether ether ketone (PEEK), polyether sulfone (PES), polyetherimide (PEI), polyether ketone (PEK), poly(p-phenylene sulfide) (PPS) and combinations thereof.

14. The process of claim 4, wherein the adhesive is selected from the group consisting of potassium water glass, sodium water glass, cement and alkali-activated aluminosilicates, polyethylene, polyoxydiphenylene-pyromellitimide, polyurethane, polyester, natural rubber, synthetic rubber, chlorosulfonated polyethylene synthetic rubber, plastic alloys, polytetrafluoroethylene (PTFE), polyvinyl halides, polyester, polychloroprene, acrylics, nitriles, ethylene propylene diene terpolymer (EPDM), polytrimethylene terephthalate, viton, vinyls, vinyl-acetate, ethylene-vinyl acetate, styrene, styreneacrylates styrene-butadienes, polyvinyl alcohol, polyvinylchloride, acrylamids, phenolics and combinations thereof.

15. The process of claim 1, wherein the thermal conductivity of the dried segmented, reinforced gel composite sheet is less than 25 mW/mK at ambient conditions.

16. The process of claim 1, wherein the rolling of the segmented, reinforced dried gel composite sheet is such that the gaps formed between the segments face away from the axis of the roll.

17. A segmented, reinforced dried gel composite sheet comprising a segmented reinforcement sheet, wherein the dried gel is continuous through at least one segment of the segmented reinforcement sheet and at least one gap exists between at least two adjoining segments with discontinuity in both the dried gel and the segmented reinforcement sheet.

18. The segmented, reinforced dried gel composite sheet of claim 17, wherein the segmented reinforcement sheet comprises a fiber.

19. The segmented, reinforced dried gel composite sheet of claim 17, wherein the segmented reinforcement sheet comprises an open cell foam.

20. The segmented, reinforced dried gel composite sheet of claim 17, further comprising fillers selected from the group consisting of titanium dioxide, iron oxides, carbon black, graphite, aluminum hydroxide, phosphates, borates, metal silicates, metallocenes, molybdates, stannates, carbonates, zinc oxides, aluminum oxides, antimony oxides, magnesium-zinc blends, magnesium-zinc-antimony blends, silicon carbide, molybdenum silicide, manganese oxides, iron titanium oxide, zirconium silicate, zirconium oxide, iron titanium oxide (ilmenite), chromium oxide and a combination thereof.

21. The segmented, reinforced dried gel composite sheet of claim 18, comprising a segmented fiber reinforcement sheet comprising at least a binder in the fiber.

22. The segmented, reinforced dried gel composite sheet of claim 17, wherein the segmented reinforcement sheet has a facing layer or a facing sheet attached to it.

23. The segmented, reinforced dried gel composite sheet of claim 22, wherein the facing layer comprises fibers.

24. The segmented, reinforced dried gel composite sheet of claim 17, wherein the segmented reinforcement sheet comprises a fiber reinforcement sheet comprising noncontinuous fibers.

25. The segmented, reinforced dried gel composite sheet of claim 17, further comprising additives selected from the group consisting of titanium dioxide, iron oxides, carbon black, graphite, aluminum hydroxide, phosphates, borates, metal silicates, metallocenes, molybdates, stannates, carbonates, zinc oxides, aluminum oxides, antimony oxides, magnesium-zinc blends, magnesium-zinc-antimony blends, silicon carbide, molybdenum silicide, manganese oxides, iron titanium oxide, zirconium silicate, zirconium oxide, iron titanium oxide (ilmenite), chromium oxide and a combination thereof.

26. The segmented, reinforced dried gel composite sheet of claim 17, wherein at least a segment of the segmented reinforcement sheet is rigid.

27. The segmented, reinforced dried gel composite sheet of claim 17, wherein the dried gel comprises a material selected from the group consisting of zirconia, yttria, hafnia, alumina, titania, ceria, silica, polyacrylates, polystyrenes, polyacrylonitriles, polyurethanes, polyimides, polyfurfural alcohol, phenol furfuryl alcohol, melamine formaldehydes, resorcinol formaldehydes, cresol formaldehyde, phenol formaldehyde, polyvinyl alcohol dialdehyde, polycyanurates, polyacrylamides, epoxies, agar, and agarose and combinations thereof.

28. The segmented, reinforced dried gel composite sheet of claim 17, wherein the segmented reinforcement sheet comprises a fiber reinforcement sheet comprising materials selected from the group consisting of mineral wool, glass wool, fiber glass, polyester, polyolefin terephthalates, poly(ethylene) naphthalate, polycarbonates, cellulose fiber, aliphatic polyamides, cotton based polyester-polyurethanes, Carbon based fibers, graphite, polyacrylonitrile (PAN), oxidized PAN, uncarbonized heat treated, fiberglass based material, E-glass, silica based fibers, quartz, Polyaramid fibers, polyolefins, polypropylene fibers, fluoropolymers, polytetrafluoroethylene (PTFE), Silicon carbide fibers, ceramic, Acrylic polymers, fibers of wool, silk, hemp, leather, suede, poly(p-phenylene-2,6-benzobisoxazole) (PBO), Liquid crystal material, Polyurethanes, polyamaides, Wood fibers, Boron, Aluminum, Iron, Stainless Steel fibers, polyether ether ketone (PEEK), polyether sulfone (PES), polyetherimide (PEI), polyether ketone (PEK), poly(p-phenylene sulfide) (PPS) and combinations thereof.

29. The segmented, reinforced dried gel composite sheet of claim 17, wherein the thermal conductivity of the segmented, reinforced gel composite sheet is less than 25 mW/mK at ambient conditions.

30. A panel comprising at least two layers of reinforced dried gel composites, wherein at least one layer comprises the segmented, reinforced dried gel composite sheet of one of claims 17 to 29.

31. The panel of claim 30, further comprising an adhesive is selected from the group consisting of potassium water glass, sodium water glass, cement and alkali-activated aluminosilicates, polyethylene, poly-oxydiphenylene-pyromellitimide, polyurethane, polyester, natural rubber, synthetic rubber, chlorosulfonated polyethylene synthetic rubber, plastic alloys, polytetrafluoroethylene (PTFE), polyvinyl halides, polyester, polychloroprene, acrylics, nitriles, ethylene propylene diene terpolymer (EPDM), polytrimethylene terephthalate, viton, vinyls, vinyl-acetate, ethylene-vinyl acetate, styrene, styreneacrylates styrene-butadienes, polyvinyl alcohol, polyvinylchloride, acrylamids, phenolics and combinations thereof.