CLAIMS

What is claimed is:

1. A composite material comprising:

a substrate having a buoyancy;

an adsorbent for adsorbing organic compounds;

a photocatalyst for degradation of organic compounds; and

an enhancer for facilitating mass transfer between the adsorbent and the photocatalyst, increasing the selectivity of the composite material, increasing the chemical stability of the composite material, and/or improving the photocatalytic efficiency,

wherein the adsorbent, photocatalyst and enhancer are fusion bonded and immobilized on the substrate.

2. The composite material of Claim 1, wherein the substrate is a thermoplastic having a specific gravity less than 1.

3. The composite material of Claim 2, wherein the thermoplastic is polypropylene, polyethylene, polystyrene, nylon, or blends and alloys thereof.

4. The composite material of Claim 2, wherein the substrate is in the form of granules, fibers, sheets and other shapes of a size greater than the component materials.

5. The composite material of Claim 1, wherein the adsorbent concentrates organic compounds and facilitates the adsorbed organic compounds for mass transfer to the photocatalyst.

6. The composite material of Claim 5, wherein the adsorbent is chemically stable at temperatures ranging from below the melting point of the substrate to approximately 30°C above the melting point of the substrate.

7. The composite material of Claim 5, wherein the adsorbent is activated carbon, zeolite, any other synthetic or natural adsorbents, or a combination thereof.

8. The composite material of Claim 1, wherein the photocatalyst is titanium dioxide (TiO_2), zinc oxide (ZnO), cadmium sulfide (CdS), tungsten (VI) trioxide (WO_3), silicon carbide (SiC), metal oxides doped with inorganic elements, or any combination thereof.

9. The composite material of Claim ~~1~~ 8, wherein the photocatalyst has a diameter ranging from approximately 1nm to approximately 50,000nm.

10. The composite material of Claim 9, wherein the photocatalyst has a diameter ranging from approximately 10nm to approximately 100nm.

11. The composite material of Claim 1, wherein the enhancer improves mass transfer between the adsorbent and the photocatalyst, provides selectivity for removal and degradation of organic compounds, increases photocatalytic activity of the composite material, or increases the chemical stability of the composite material.

12. The composite material of Claim 1, wherein the ratio of the adsorbent to the photocatalyst is approximately 0.1 to approximately 10.

13. The composite material of Claim 12, wherein the ratio of the adsorbent to the photocatalyst is approximately 0.2 to approximately 6.

14. The composite material of Claim 1, wherein the amount of the enhancer is approximately 0.001% to approximately 5% of the amount of adsorbent in grams.

15. The composite material of Claim 14, wherein the amount of the enhancer is approximately 0.01% to approximately 0.2% of the amount of adsorbent in grams.

16. The composite material of Claim 1, wherein the amount of the enhancer is

approximately 0.001% to approximately 5% of the amount of photocatalyst in grams.

17. The composite material of Claim 16, wherein the amount of the enhancer is approximately 0.01% to approximately 0.2% of the amount of photocatalyst in grams.

18. The composite material of Claim 14, wherein the substrate is a thermoplastic, an alloy or a blend thereof having a specific gravity of approximately 0.8 to approximately 1.

19. The composite material of Claim 18, wherein the substrate is a thermoplastic, an alloy or a blend thereof having a specific gravity of approximately 0.9 to approximately 0.95.

20. A method of preparing a composite material, the method comprising:

mixing an adsorbent, a photocatalyst and an enhancer to form a mixture;

reacting, with stirring, the mixture at a temperature approximately 10°C below to approximately 30°C above the melting point of a substrate;

adding the substrate to the mixture;

allowing the mixture to immobilize by fusion bonding onto the substrate to form the composite material; and

separating the composite material from remaining mixture.

21. The method according to ~~claim 21~~ Claim 20, further comprising:

a) cooling the composite material;

b) washing the composite material; or

c) drying the composite material.

22. The method according to ~~claim 21~~Claim 20, wherein the mixture fused on the substrate covers the substrate surface completely.

23. The composite material of Claim 1, wherein the enhancer is a carbon nanotube, a precious metal salt, an inorganic substance such as SiO_2, or a functional

polymer, or any combination thereof.

24. The composite material of Claim 23, wherein the enhancer is a carbon nanotube.

25. A method of preparing a composite material, the method comprising:

mixing an adsorbent, a photocatalyst and an enhancer to obtain a mixture;

heating the substrate to approximately 10°C to 25°C above its melting point;

extruding the heated substrate through a mould;

cutting the substrate (*e.g.*, into granules, tubes, or fibers);

mixing the adsorbent, photocatalyst and enhancer mixture with the cut substrate with stirring to allow the mixture to bind onto the substrate to form the composite material;

cooling the mixture; and

separating the composite material from remaining mixture by a sieve.

26. A composite material prepared by a process comprising the steps of:

mixing an adsorbent, a photocatalyst and an enhancer to form a mixture;

reacting, with stirring, the mixture at a temperature approximately 10°C below to approximately 30°C above the melting point of a substrate;

adding the substrate to the mixture;

allowing the mixture to immobilize by fusion bonding onto the substrate to form the composite material; and

separating the composite material from remaining mixture.

27. The composite material of Claim 26, wherein the photocatalyst is TiO_2, the enhancer is carbon nanotubes, and the adsorbent is activated carbon.

28. The composite material of Claim 27, wherein the TiO_2 is mixed with carbon nanotubes and heated prior to adding the activated carbon, the resulting mixture is heated and maintained at a heated temperature before the substrate is added.

29. The composite material according to Claim 28, wherein the mixture fused on the substrate covers the substrate surface completely.

30. A composite material comprising:

a substrate having a buoyancy;

an adsorbent for adsorbing organic compounds; and

a photocatalyst for degradation of organic compounds;

wherein the adsorbent and photocatalyst are fusion bonded and immobilized on the substrate.