Claims

1. An aerogel composite comprising:
   - an aerogel;
   - a complex comprising carbon fibers (CF), carbon nanotubes (CNT), and a swelling clay; and
   - a nano-stabiliser.

2. The aerogel composite according to claim 1, wherein the composite comprises 50-70 parts of the aerogel by weight.

3. The aerogel composite according to claim 1 or 2, wherein the composite comprises 15-25 parts of the complex by weight.

4. The aerogel composite according to any preceding claims, wherein the composite comprises 1-4 parts of the nano-stabiliser by weight.

5. The aerogel composite according to any preceding claim, wherein the CF and CNT forms a CF/CNT hybrid.

6. The aerogel composite according to any preceding claim, wherein the composite has a thermal conductivity of 0.01-0.03 W/mK.

7. The aerogel composite according to any preceding claim, wherein the composite has a flexural strength of ≥ 0.25 MPa.

8. The aerogel composite according to any preceding claim, wherein the composite has a tensile strength of ≥ 1.20 MPa at 50% elongation.

9. A method of forming the aerogel composite according to any preceding claim, the method comprising:

(a) mixing an aerogel with a complex comprising carbon fibers (CF), carbon nanotubes (CNT), a swelling clay in a solvent, and a nano-stabiliser; and

(b) drying to form the aerogel composite.

10. The method according to claim 9, wherein the method further comprises forming the complex prior to the mixing in (a).

11. The method according to claim 10, wherein the forming the complex comprises:

- mixing CNT in a solution comprising an acid and a surfactant with CF;
- drying to form the CF/CNT hybrid;
- mixing the CF/CNT hybrid with the swelling clay in a solution comprising a dispersing agent; and
- drying to form the complex.

12. The method according to any of claims 9-11, further comprising heat treating the swelling clay prior to the mixing in (a).

13. The method according to any of claims 9-12, wherein the method further comprises calcinating the nano-stabliser prior to the mixing in (a).

14. The method according to claim 13, wherein the calcinating comprises sequentially calcinating at a first predetermined temperature for a first predetermined time, followed by a second predetermined temperature for a second predetermined time, followed by a third predetermined temperature for a third predetermined time.

15. The method according to claim 13 or 14, wherein the method further comprises ultrasonicating the nano-stabliser following the calcinating and prior to the mixing in (a).

16. The method according to any of claims 9-15, wherein the mixing in (a) further comprises mixing an interface modifier.