CLAIMS

1. A method for forming a layered silicate/polymer composite, the composite comprising individual exfoliated silicate layers separated in a continuous polymer matrix, wherein the polymer is a hydrophobic polymer, the method comprising:

exfoliating sheet silicate in water to form a silicate suspension;

replacing the water in the silicate suspension by a first organic solvent to form a silicate/organic solvent suspension;

carrying out rotary evaporation on the silicate/organic solvent suspension to form a concentrated silicate/organic solvent suspension;

contacting the concentrated silicate/organic solvent suspension with a solution of a hydrophobic polymer precursor in a second organic solvent to form a silicate/polymer precursor suspension, the silicate layers randomly dispersed in the silicate/polymer precursor suspension, the polymer precursor containing hydroxyl or carboxylic acid groups;

coating the silicate/polymer precursor suspension on a substrate;

removing the first organic solvent and the second organic solvent;

curing the hydrophobic polymer precursor of the coating of the silicate/polymer precursor using ultraviolet radiation to initiate cross-linking of hydroxyl or carboxylic groups of the polymer precursor with the silicate layers; and

annealing the cured coating to form the layered silicate/polymer composite on the substrate, wherein the annealing forms chemical bonds between the silicate layers and the polymer matrix through cross-linking of the hydroxyl or carboxylic groups with the silicate layers;

wherein coating the silicate/polymer precursor suspension on the substrate comprises applying a shearing force to the suspension to orient the dispersed silicate sheets along a surface of the substrate, wherein the replacing the water by the first organic solvent is carried out by adding the first organic solvent to the silicate suspension in water, filtering the

resulting suspension and re-suspending the silicate in the first organic solvent;

wherein adding the first organic solvent, filtering and re-suspending is repeated once to carry out solvent exchange for a total of two times so that the silicate layers in the silicate/organic solvent suspension are not coagulated together.

2. The method of claim 1, wherein coating the silicate/polymer precursor suspension on a substrate comprises roll coating, bar coating, or blade coating.

3. The method of claim 1 or 2, wherein annealing comprises annealing at a temperature of between 100 and 200 °C.

4. The method of any one of claims 1 to 3, wherein the sheet silicate is selected from the group consisting of the serpentine group of phyllosilicates, the clay mineral group of phyllosilicates, the mica group of phyllosilicates, the chlorite group of phyllosilicates, and a mixture thereof.

5. The method of any one of claims 1 to 4, wherein the first organic solvent of the silicate/organic solvent suspension is miscible with the second organic solvent of the polymer precursor solution.

6. The method of any one of claims 1 to 5, wherein the organic solvent of the silicate/organic solvent suspension is acetone, 2-butanone, methyl ethyl ketone, or tetrahydrofuran.

7. The method of any one of claims 1 to 6, wherein the hydrophobic polymer precursor of the hydrophobic polymer precursor solution is selected from the group consisting of acrylates.

8. The method of any one of claims 1 to 7, wherein the water to exfoliate the silicate is acidified.

9. The method of claim 8, wherein the water is acidified with acetic acid.

10. The method of any one of claims 1 to 9, wherein the substrate comprises a plastic substrate.

11. The method of claim 10, wherein the substrate is polyethylene terephthalate or polycarbonate.

12. The method according to any one of claims 1 to 11, wherein carrying out rotary evaporation increases a concentration of silicate in the first organic solvent by any weight percentage value selected from a range from 3 weight percent to 10 weight percent.