CLAIMS

1. A method of forming a liquid dispersion of 2D material/graphitic nanoplatelets comprising the steps of:

(1) creating a dispersing medium by mixing at least one grinding media and at least one non-aqueous solvent until the grinding media and non-aqueous solvent mixture is substantially homogenous, wherein the at least one grinding media comprises an aldehyde resin;

(2) mixing the 2D material/graphitic nanoplatelets into the dispersing medium; and

(3) subjecting the 2D material/graphitic nanoplatelets to sufficient shear forces and or crushing forces to reduce the particle size of the 2D material/graphitic nanoplatelets;

characterised in that the liquid dispersion comprises the 2D material/graphitic nanoplatelets, the at least one grinding media, and the at least one non-aqueous solvent

in which the 2D material/graphitic nanoplatelets are comprised of one or more of graphene nanoplatelets, graphitic nanoplatelets, and 2D material nanoplatelets and in which

the graphene nanoplatelets are comprised of one or more of graphene nanoplates, reduced graphene oxide nanoplates, bilayer graphene nanoplates, bilayer reduced graphene oxide nanoplates, trilayer graphene nanoplates, trilayer reduced graphene oxide nanoplates, few-layer graphene nanoplates, few-layer reduced graphene oxide nanoplates, and graphene nanoplates of 6 to 10 layers of carbon atoms, and the graphitic platelets are comprised of graphite nanoplates with at least 10 layers of carbon atoms, the graphitic platelets are comprised of one or more of graphite nanoplates with 10 to 20 layers of carbon atoms, graphite nanoplates with 10 to 14 layers of carbon atoms, graphite nanoplates with 10 to 35 layers of carbon atoms graphite nanoplates with 10 to 40 layers of carbon atoms, graphite nanoplates with 25 to 30 layers of carbon atoms, graphite nanoplates with 25 to 35 layers of carbon atoms, graphite nanoplates with 20 to 35 layers of carbon atoms, or graphite nanoplates with 20 to 40 layers of carbon atoms, and the 2D material nanoplatelets are comprised of one or more of hexagonal boron nitride (hBN), molybdenum disulphide (MoS_2), tungsten diselenide (WSe_2), silicene (Si),

germanene (Ge), Graphyne (C), borophene (B), phosphorene (P), or a 2D in-plane or vertical heterostructure of two or more of the aforesaid materials.

~~2. A method according to claim 1 in which the 2D material/graphitic nanoplatelets are comprised of one or more of graphene nanoplatelets, graphitic nanoplatelets, and 2D material nanoplatelets and in which the graphene nanoplatelets are comprised of one or more of graphene nanoplates, reduced graphene oxide nanoplates, bilayer graphene nanoplates, bilayer reduced graphene oxide nanoplates, trilayer graphene nanoplates, trilayer reduced graphene oxide nanoplates, few-layer graphene nanoplates, few-layer reduced graphene oxide nanoplates, and graphene nanoplates of 6 to 10 layers of carbon atoms, and the graphitic platelets are comprised of graphite nanoplates with at least 10 layers of carbon atoms, the graphitic platelets are comprised of one or more of graphite nanoplates with 10 to 20 layers of carbon atoms, graphite nanoplates with 10 to 14 layers of carbon atoms, graphite nanoplates with 10 to 35 layers of carbon atoms graphite nanoplates with 10 to 40 layers of carbon atoms, graphite nanoplates with 25 to 30 layers of carbon atoms, graphite nanoplates with 25 to 35 layers of carbon atoms, graphite nanoplates with 20 to 35 layers of carbon atoms, or graphite flak nanoplates es with 20 to 40 layers of carbon atoms, and the 2D material nanoplatelets are comprised of one or more of hexagonal boron nitride (hBN), molybdenum disulphide (MoS_2), tungsten diselenide (WSe_2), silicene (Si), germanene (Ge), Graphyne (C), borophene (B), phosphorene (P), or a 2D in-plane or vertical heterostructure of two or more of the aforesaid materials.~~

~~3. A method according to any of claims 1 or 2 in which the at least one grinding media is comprised of one or more of a grinding resin, a polymer modified with strong anchoring groups, an aldehyde resin, or a mixture of two or more of such media.~~

~~4~~2. A method according to ~~any of claims 1 to 3~~claim 1 in which the at least one non-aqueous solvent is comprised of one or more of an organic solvent, butyl acetate, xylene, ethyl acetate, methyl ethyl ketone, butanol, 2 butoxyethanol, other glycol ethers, acetone, dimethyl carbonate, methyl acetate, parachlorobenzotrifluoride, *tert*-butyl acetate, propylene carbonate and (1R)-7,8-Dioxabicyclo[3.2.1]octan-2-one, or a mixture of two or more of these solvents.

~~5. A method according to any of claims 1 to 4 in which the dispersing medium comprises the at least one grinding media and the at least one non-aqueous solvent, and the step of creating the dispersing medium comprises:~~
~~(i) dissolving the at least one grinding media in the at least one solvent, and~~
~~(ii) mixing the grinding media solution until it is substantially homogenous.~~

~~6. A method according to claim 5 in which the method further comprises the steps of (iii) adding the 2D material/graphitic nanoplatelets to the dispersing medium following completion of step (ii), and~~
~~(iv) mechanically mixing the 2D material/graphitic nanoplatelets and the dispersing medium until the 2D material/graphitic platelets are dispersed in the dispersing medium.~~

3~~7~~. A method according to ~~any of claims 1 to 6~~claim 1 or 2 in which the step (3) of subjecting the 2D material/graphitic nanoplatelets and dispersing medium mixture to shear forces and or crushing forces is performed using one or more of a dissolver, a bead mill, or a three-roll mill.

4~~8~~. A liquid dispersion comprising 2D material/graphitic nanoplatelets, at least one grinding media, and at least one non-aqueous solvent,

wherein the at least one grinding media comprises an aldehyde resin,

in which the 2D material/graphitic nanoplatelets are comprised of one or more of graphene nanoplatelets, graphitic nanoplatelets, and 2D material nanoplatelets, and in which

the graphene nanoplatelets are comprised of one or more of graphene nanoplates, reduced graphene oxide nanoplates, bilayer graphene nanoplates, bilayer reduced graphene oxide nanoplates, trilayer graphene nanoplates, trilayer reduced graphene oxide nanoplates, few-layer graphene nanoplates, few-layer reduced graphene oxide nanoplates, and graphene nanoplates of 6 to 10 layers of carbon atoms, and the graphitic platelets are comprised of graphite nanoplates with at least 10 layers of carbon atoms, the graphitic platelets are comprised of one or more of graphite nanoplates with 10 to 20 layers of carbon atoms, graphite nanoplates with 10 to 14 layers of carbon atoms, graphite nanoplates with 10 to 35 layers of carbon atoms graphite nanoplates with 10 to 40 layers of carbon atoms,

graphite nanoplates with 25 to 30 layers of carbon atoms, graphite nanoplates with 25 to 35 layers of carbon atoms, graphite nanoplates with 20 to 35 layers of carbon atoms, or graphite nanoplates with 20 to 40 layers of carbon atoms, and the 2D material nanoplatelets are comprised of one or more of hexagonal boron nitride (hBN), molybdenum disulphide (MoS_2), tungsten diselenide (WSe_2), silicene (Si), germanene (Ge), Graphyne (C), borophene (B), phosphorene (P), or a 2D in-plane or vertical heterostructure of two or more of the aforesaid materials.

~~9. A liquid dispersion according to claim 8 in which the 2D material/graphitic nanoplatelets are comprised of one or more of graphene nanoplatelets, graphitic nanoplatelets, and 2D material nanoplatelets and in which the graphene nanoplatelets are comprised of one or more of graphene nanoplates, reduced graphene oxide nanoplates, bilayer graphene nanoplates, bilayer reduced graphene oxide nanoplates, trilayer graphene nanoplates, trilayer reduced graphene oxide nanoplates, few-layer graphene nanoplates, few-layer reduced graphene oxide nanoplates, and graphene nanoplates of 6 to 10 layers of carbon atoms, and the graphitic platelets are comprised of graphite nanoplates with at least 10 layers of carbon atoms, the graphitic platelets are comprised of one or more of graphite nanoplates with 10 to 20 layers of carbon atoms, graphite nanoplates with 10 to 14 layers of carbon atoms, graphite nanoplates with 10 to 35 layers of carbon atoms graphite nanoplates with 10 to 40 layers of carbon atoms, graphite nanoplates with 25 to 30 layers of carbon atoms, graphite nanoplates with 25 to 35 layers of carbon atoms, graphite nanoplates with 20 to 35 layers of carbon atoms, or graphite nanoplates with 20 to 40 layers of carbon atoms, and the 2D material nanoplatelets are comprised of one or more of hexagonal boron nitride (hBN), molybdenum disulphide (MoS_2), tungsten diselenide (WSe_2), silicene (Si), germanene (Ge), Graphyne (C), borophene (B), phosphorene (P), or a 2D in-plane or vertical heterostructure of two or more of the aforesaid materials.~~

~~10. A liquid dispersion according to claims 8 or 9 in which the at least one grinding media is comprised of one or more of a grinding resin, a polymer modified with strong anchoring groups, an aldehyde resins, or a mixture of two or more of such media.~~

5~~11~~. A liquid dispersion according to ~~any of claims 8 to 10~~claim 4 in which the at least one non-aqueous solvent is comprised of one or more of an organic solvent, butyl acetate, xylene, ethyl acetate, methyl ethyl ketone, butanol, 2 butoxyethanol, other glycol ethers, acetone, dimethyl carbonate, methyl acetate, parachlorobenzotrifluoride, *tert*-butyl acetate, propylene carbonate and (1R)-7,8-Dioxabicyclo[3.2.1]octan-2-one, or a mixture of two or more of these solvents.

6~~12~~. A liquid dispersion according to ~~any of claims 8 to 11~~claim 4 or 5 manufactured using a method according to any of claims 1 to 3~~7~~.

7~~13~~. A liquid coating composition comprising a liquid dispersion according to any of claims 4~~8~~ to 6~~12~~.