CLAIMS

1. A method of forming a liquid dispersion of 2D material/graphitic nanoplatelets in water or an aqueous solution comprising the steps of

(1) creating a dispersing medium by mixing at least one grinding media, water and at least one wetting agent until the grinding media, water and wetting agent mixture is substantially homogenous, in which the at least one grinding media is water soluble or functionalised to be water soluble and comprises an aqueous solution of a modified aldehyde resin having at least one amine group;

(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 using a mechanical means

characterised in that the liquid dispersion comprises the 2D material/graphitic nanoplatelets, the at least one grinding media, the water, and the at least one wetting agent~~, and that the at least one grinding media is water soluble or functionalised to be water soluble~~,

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 nanoplatelets are comprised of graphite nanoplates with at least 10 layers of carbon atoms, the graphitic nanoplatelets 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 platelets 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 nanoplatelets are comprised of graphite nanoplates with at least 10 layers of carbon atoms, the graphitic nanoplatelets 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 platelets 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~~2~~. A method according to claim 1 ~~or 2~~ in which the 2D material/graphitic nanoplatelets comprises at least one 1D material.

~~4. A method according to any of claims 1 to 3 in which the at least one grinding media comprises a grinding resin, a polymer modified with strong anchoring groups, an aqueous solution of a modified aldehyde resin having at least one amine group, or a low molecular weight styrene/maleic anhydride copolymer~~

~~5~~3. A method according to any of claims 1 ~~to~~ or 2~~4~~ in which the at least one wetting agent comprises one of a polymeric wetting agent, an ionic wetting agent, a polymeric non-ionic dispersing and wetting agent, a cationic wetting agent, an amphoteric wetting agent, a Gemini wetting agent, a highly molecular resin-like wetting and dispersing agent or a mixture of two or more of these wetting agents~~-~~.

~~6. A method according to any of claims 1 to 5 in which the dispersing medium comprises the at least one grinding media and the water, and the step of creating the dispersing medium comprises~~
~~(i) mixing the at least one grinding media with the water until it is substantially homogenous.~~

~~7. A method according to claim 6 in which the method further comprises the steps of~~
~~(ii) adding the 2D material/graphitic nanoplatelets to the at least one grinding media and water mixture following completion of step (i), and~~
~~(iii) mechanically mixing the 2D material/graphitic nanoplatelets and the at least one grinding media and water mixture until the 2D material/graphitic nanoplatelets are substantially dispersed in the grinding media solution.~~

~~8~~4. A method according to any of the preceding claim~~s 6 or 7~~ in which ~~the dispersing medium further comprises~~ the at least one wetting agent ~~which~~ is stored in a liquid form~~, and the step of creating the dispersing medium comprises~~
~~(i) mixing the at least one grinding media, water and wetting agent until the grinding media, water and wetting agent mixture is substantially homogenous~~.

~~9~~5. A method according to of claim~~s~~ 1 to 3~~6 or 7~~ in which ~~the dispersing medium further comprises~~ the at least one wetting agent~~, the wetting agent~~ is stored as a solid, and the step of creating a dispersing medium comprises
(i) mixing the at least one grinding media, water and wetting agent until the wetting agent is dissolved and the grinding media, water and wetting agent mixture is substantially homogenous.

~~10~~6. A method according to any of claims 1 to ~~7~~ 3 in which the at least one wetting agent is added to the dispersing medium at substantially the same time as the 2D material/graphitic platelets.

~~11~~7. A method according to any of claims 1 to ~~10~~ 6 in which the step (3) of 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 is performed using one or more of a dissolver, a bead mill, or a three-roll mill.

~~12~~8. A liquid dispersion characterised in that the liquid dispersion comprises 2D material/graphitic nanoplatelets, at least one grinding media, water, and at least one wetting agent, and in which the at least one grinding media

is water soluble or functionalised to be water soluble and comprises an aqueous solution of a modified aldehyde resin having at least one amine group,

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 nanoplatelets are comprised of graphite nanoplates with at least 10 layers of carbon atoms, the graphitic nanoplatelets 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 platelets 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.

~~13. A liquid dispersion according to claim 12 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 nanoplatelets are comprised of graphite nanoplates with at least 10 layers of carbon atoms, the graphitic nanoplatelets 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.~~

~~14~~9. A liquid dispersion according to claim ~~12 or 13~~8 in which the 2D material/graphitic nanoplatelets comprises at least one 1D material.

~~15. A liquid dispersion according to any of claims 12 to 14 in which the at least one grinding media is comprised of media is a grinding resin, a polymer modified with strong anchoring groups, an aqueous solution of a modified aldehyde resin having at least one amine group, or a low molecular weight styrene/maleic anhydride copolymer .~~

~~16~~10. A liquid dispersion according to ~~any of~~ claims ~~12~~ 8 ~~to~~ or ~~15~~ 9 in which the wetting agent is comprised of one of a polymeric wetting agent, an ionic wetting agent, a polymeric non-ionic dispersing and wetting agent, a cationic wetting agent, an amphoteric wetting agent, a Gemini wetting agent, a highly molecular resin-like wetting and dispersing agent or a mixture of two or more of these wetting agents .

~~17~~11. A liquid dispersion according to any of claims ~~12~~ 8 to ~~16~~ 10 manufactured using a method according to any of claims 1 to ~~11~~7.

~~18~~12. A liquid coating composition comprising a liquid dispersion according to any of claims ~~12~~ 8 to ~~17~~11.