

CLAIMS

- 1 A composition suitable for coating a metallic substrate that is susceptible to corrosion characterised in that the composition comprises a carrier medium and
5 graphene platelets in which the graphene platelets comprise between 0.002 wt% and 0.09 wt% of the coating, and the graphene platelets comprise one of or a mixture of two or more of graphene nanoplates, bilayer graphene nanoplates, few-layer graphene nanoplates, and / or graphite flakes in which the graphite flakes have one nanoscale dimension and 25 or less layers.
- 10 2 A composition according to claim 1 in which the graphene platelets comprise between 0.002 wt% and 0.004 wt% of the coating, between 0.0026 wt% and 0.04 wt% of the coating, between 0.0026 wt% and 0.0035 wt% of the coating, between 0.006 wt% and 0.009 wt% of the coating, around 0.003 wt% of the coating,
15 or around 0.03 wt% of the coating.
- 3 A composition according to claim 1 or 2 in which the packing density of the graphene platelets is sufficiently low that the majority of the graphene platelets are not in physical contact with any other graphene platelets.
- 20 4 A composition according to any of claims 1 to 3 in which the packing density of the graphene platelets is sufficiently low that the majority of the graphene platelets are not in electrical contact with any other graphene platelets
- 25 5 A composition according to any of claims 1 to 4 in which the graphene platelets have a particle size distribution with a D50 of less than 30 μm , less than 20 μm , or less than 15 μm .
- 30 6 A composition according to any of claims 1 to 5 in which more than 50% of the graphene platelets have an electrical conductivity greater than around 2.15×10^7 S/m at 20°C.

- 7 A composition according to claim any of claims 1 to 6 in which more than 50% of the graphene platelets have an electrical conductivity greater than around 3.5×10^7 S/m at 20°C.
- 5 8 A composition according to any of claims 1 to 7 in which at least 50 wt% of the graphene platelets comprise graphite flakes with one nanoscale dimension and 25 or less layers.
- 9 A composition according to any of claims 1 to 8 in which the carrier medium
10 is electrically non-conductive.
- 10 A composition according to any of claims 1 to 9 in which the carrier medium is selected from crosslinkable resins, non-crosslinkable resins, thermosetting acrylics, aminoplasts, urethanes, carbamates, polyesters, epoxies, silicones, polyureas,
15 silicates, polydimethyl siloxanes, and mixtures and combinations thereof.
- 11 A composition according to any of claims 1 to 10 in which the carrier medium is plastically deformable once it has set / cured.
- 20 12 A composition according to any of claims 1 to 11 in which the composition further comprises a solvent.
- 13 A composition according to any of claims 1 to 12 in which the composition further comprises a dispersant.
- 25 14 A coating system for a metallic substrate that is susceptible to corrosion for creation of a first coating on the metallic substrate, and, subsequently, a second coating over the first coating characterised in that the first coating comprises a composition according to any of claims 1 to 13, and the second coating is formed
30 from a second composition which comprises a carrier medium and 2D material/graphitic platelets in which the 2D material/graphitic platelets comprise more than 0.1 wt% of the second coating.

15 A coating system according to claim 14 in which the 2D material/graphitic platelets of the second composition one of or a mixture of two or more of graphene, graphene oxide, reduced graphene oxide nanoplates, hexagonal boron nitride, molybdenum disulphide, tungsten diselenide, silicene, germanene, Graphyne,
5 borophene, phosphorene, a 2D in-plane heterostructure of two or more of graphene, graphene oxide, reduced graphene oxide nanoplates, hexagonal boron nitride, molybdenum disulphide, tungsten diselenide, silicene, germanene, Graphyne, borophene, phosphorene, bilayer graphene, bilayer graphene oxide, bilayer reduced graphene oxide nanoplatelets, few-layer graphene, few-layer
10 graphene oxide, few-layer reduced graphene oxide nanoplatelets, graphite flakes in which the graphite flakes have one nanoscale dimension and 25 or less layers, layered hexagonal boron nitride (hBN), molybdenum disulphide (MoS_2), tungsten diselenide (WSe_2), silicene (Si), germanene (Ge), Graphyne (C), borophene (B), phosphorene (P), and or a 2D vertical heterostructure of two or more of the
15 aforesaid materials.

16 A coating system according to claim 14 or 15 in which the 2D material/graphitic platelets of the second coating comprise between 0.1 wt% and 20 wt% of the coating, between 0.1 wt% and 6.0 wt% of the coating, or between 0.1
20 wt% and 0.5 wt% of the coating.

17 A coating system according to any of claims 14 to 16 in which more than 50% of the 2D material/graphitic platelets of the second coating have an electrical conductivity which is less than the electrical conductivity of more than 50% of the
25 graphene platelets of the first coating.

18 A coating system according to any of claims 14 to 17 in which more than 50% of the 2D material/graphitic platelets of the second coating have an electrical conductivity of around or less than $2.0 \times 10^{-5} \text{ S/m}$ at 20°C .
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19 A method of treatment of a metallic substrate in which the substrate is coated with a composition according to any of claims 1 to 13.

20 A method of treatment of a metallic substrate in which the substrate is treated with the system according to any of claims 14 to 18.

21 A method of treatment according to claim 19 or 20 in which the substrate is
5 aluminium, an aluminium alloy, or a magnesium based alloy.