Claims

1. A composition of matter comprising at least one nanowire on a graphitic substrate, said at least one nanowire having been grown epitaxially on said substrate,

wherein said nanowire comprises at least one group III-V compound or at least one group II-VI compound or ~~comprises at least one~~ wherein said nanowire consists of non carbon group IV ~~element~~elements only.

2. A composition as claimed in claim 1 wherein said nanowire grows in the [111] or [0001] direction.

3. A composition as claimed in any preceding claim wherein the nanowire comprises a group III-V compound.

4. A composition as claimed in any preceding claim in which the nanowires comprise GaSb, GaP, GaAs or InAs.

5. A composition as claimed in any preceding claim wherein the graphitic substrate comprises graphene, graphane or graphene oxide, preferably wherein said graphene, graphane or graphene oxide comprises 10 or fewer layers.

6. A composition as claimed in any preceding claim wherein the graphitic substrate is a laminated substrate exfoliated from a Kish graphite, a highly ordered pyrolytic graphite (HOPG), CVD-grown graphene layers on Ni films, or CVD-grown graphene layers on Cu foils.

7. A composition as claimed in any preceding claim wherein the graphitic substrate is flexible and transparent

8. A composition as claimed in any preceding claim wherein the surface of substrate is modified with a plasma treatment with a gas of oxygen, hydrogen, NO_2, and their combinations.

9. A composition as claimed in any preceding claim wherein the surface of substrate is modified by chemical doping using a solution of $FeCl_3$, $AuCl_3$ or $GaCl_3$.

10. A composition as claimed in any preceding claim wherein said nanowire is no more than 200 nm in diameter and has a length of up to 5 microns.

11. A composition as claimed in any preceding claim wherein said substrate comprises a plurality of nanowires wherein said nanowires are substantially parallel.

12. A composition as claimed in any preceding claim wherein said nanowires are grown in the presence of a catalyst.

13. A process for preparing at least one nanowire grown epitaxially on a graphitic substrate comprising the steps of:

(I) providing group II-VI elements or group III-V elements or at least one non carbon group IV element to the surface of said graphitic substrate, preferably via a molecular beam; and

(II) epitaxially growing at least one nanowire from the surface of the graphitic substrate.

14. A process as claimed in claim 13 in which a catalyst is deposited on the substrate.

15. A process as claimed in claim ~~13 to~~ 14 wherein said catalyst is Au or the metal of the nanowire to be grown, e.g. Ga.

16. A process as claimed in claim ~~13~~ 14 to 15 where the substrate is coated with a hole-patterned mask, said catalyst being introduced on to the graphitic substrate surface exposed via the hole pattern.

17. A process as claimed in claim 16 where the hole-patterned mask comprises SiO_2 or Si_3N_4, e.g. deposited by e-beam evaporation, CVD, PE-CVD, or sputtering.

18. A process as claimed in claim 16 to 17 where the surface of the graphitic substrate exposed through the hole pattern is modified with a plasma treatment with a gas of oxygen, hydrogen, NO_2, and their combinations.

~~19. A nanowire made by a process as claimed in claim 13 to 18.~~

~~20~~19. A device comprising a composition as claimed in any one of claims 1 to 12, e.g. an optical or electronic device, e.g. a solar cell.

~~21~~20. Use of molecular beam epitaxy to grow a nanowire on a graphitic substrate~~.~~, wherein said nanowire comprises at least one group III-V compound or at least one group II-VI compound or wherein said nanowire comprises non carbon group IV elements only.