CLAIMS

1. A reaction vessel for producing functionalised Silica from silane and an oxide of at least one of Nitrogen, Sulphur and Carbon, comprising:

an enclosed mixing chamber for mixing silane gas and an oxide gas, the mixing chamber having a containment region arranged in the upper part of the mixing chamber for containing Hydrogen and monoxide reaction products produced from the reaction of the silane and oxide gases,

a delivery system for delivering the silane into the containment region via a silane inlet of the mixing chamber and for delivering the oxide to an oxide inlet of the mixing chamber wherein the inlet for the oxide is arranged below the Silane inlet such that the oxide gas must travel up via a lower part of the containment region through the contained Hydrogen and monoxide reaction products before it interacts with the Silane gas introduced further up the containment region, to facilitate mixing of the silane and oxide within the mixing chamber, for producing said functionalised silica; and

one or more outlets through which the reaction products are removed from the reaction vessel.

2. A reaction vessel according to claim 1, further comprising arranging at least one of the silane and oxide gas to be charged.

3. A reaction vessel according to claim 1 or 2, wherein at least the containment region of the reaction vessel is bell-shaped.

4. A reaction vessel according to claim 1 or 2, wherein at least the containment region of the reaction vessel is cylindrical.

5. A reaction vessel according to any one of claims 2 to 4, wherein the containment region is suspended in the reaction vessel and has a closed upper end and a lower end open into the reaction vessel.

6. A reaction vessel according to claim 5 wherein the containment region is enclosed by a wall.

7. A reaction vessel according to claim 5 or 6 wherein said one or more outlets are connected to the region of the reaction vessel outside of the containment region.

8. A reaction vessel according to any one of claims 1 to 7, wherein said at least one of the silane and oxide is arranged to be charged prior to being delivered to the mixing chamber.

9. A reaction vessel according to claim 8, wherein the delivery system includes a portion made of at least one of a triboelectrically sensitive material and a dielectric material, for charging at least one of the silane and the oxide.

10. A reaction vessel according to claim 9, wherein the delivery system includes at least one of: a delivery tube and a storage vessel for at least one of the silane and the oxide.

11. A reaction vessel according to any one of claims 1 to 10, wherein the delivery system includes conductive inlet pipes which pass through the mixing chamber for pre-charging said at least one of the silane and oxide gas using the charge imparted to the inlet pipes from the reaction in the mixing chamber.

12. A reaction vessel according to any one of claims 1 to 10, wherein the mixing chamber is arranged to cause at least one of the silane, the oxide and a mixture thereof to be charged through interaction with the mixing chamber.

13. A reaction vessel according to any of claims 1 to 12, wherein a portion of the reaction vessel is made from at least one of: a triboelectrically sensitive material and a dielectric material, for charging at least one of the silane and oxide.

14. A reaction vessel according to any of claims 1 to 13, wherein at least one inlet of said Silane inlet and said oxide inlet is arranged to deliver the silane or oxide to the mixing chamber in a turbulent flow.

15. A reaction vessel according to claim 14, wherein the reaction vessel is elongate having a longitudinal axis, and said at least one inlet is arranged to supply gas at an angle between 45 and 90 degrees relative to a longitudinal axis of the reaction vessel such that the inlet generally directs the gas towards the containment region of the reaction vessel.

16. A reaction vessel according to claim 14 or 15, wherein said at least one inlet is the inlet for said oxide.

17. A reaction vessel according to claim 16, wherein the silane is delivered into a delivery chamber of the reaction vessel through a tube parallel to the longitudinal axis of the reaction vessel such that the silane inlet is nearer the lower part of the delivery chamber and generally faces the bottom of the delivery chamber, such that the Silane fills the delivery chamber before emerging from the upper part of the delivery chamber into the containment region.

18. A reaction vessel according to claim 17, wherein:

the delivery means includes a cylinder that extends towards the inlet for silane, the cylinder having an opening to receive the inlet for silane into a confined space within the cylinder; and

wherein the cylinder is arranged to provide a flow path to the containment region.

19. A reaction vessel according to claim 17, wherein the inlet for silane is in the containment region of the reaction vessel and arranged at an angle parallel to the longitudinal axis of the reaction vessel such that the inlet for silane generally directs the silane towards the upper part of the containment region.

20. A reaction vessel according to any preceding claim, wherein the reaction vessel comprises a separation means for separating the gases and functionalised Silica produced.

21. A reaction vessel according to any preceding claim, wherein the delivery system is also arranged to deliver hydrogen and monoxide to the mixing chamber proximate to the reacting mixed gas for facilitating the production of functionalised Silica.

22. A reaction vessel according to any preceding claim, wherein the oxide is at least one of carbon dioxide, nitrogen dioxide and sulphur dioxide.

23. A method of producing functionalised Silica comprising the steps of:

supplying silane to a containment region arranged in the upper part of the mixing chamber for containing the Hydrogen and monoxide reaction products produced from the reaction of the silane and oxide gases;

supplying an oxide of at least one of Nitrogen, Sulphur and Carbon into said mixing chamber, wherein said oxide is delivered into said mixing chamber below the Silane such that the Oxide gas must travel up via a lower part of the containment region through the contained Hydrogen and monoxide reaction products before it interacts with the Silane gas introduced further up the containment region, for facilitating the production of functionalised nano-silica;

arranging for at least one of the silane and oxide to be charged; and

mixing the silane and oxide to produce a reacting mixed gas.

24. A method according to claim 23, wherein the silane is supplied to a region in the containment region that is proximate to the reacting mixed gas.

25. A method according to claim 23 or 24, wherein said at least one of the silane and oxide are arranged to be charged prior to being supplied to the containment region.

26. A method according to any of claims 23 to 25, wherein said at least one of the silane and oxide are arranged to be charged in the containment region.

27. A method according to any of claims 23 to 26, wherein at least one of the silane and oxide is supplied to the containment region so as to cause it to flow turbulently.

28. A method according to any of claims 23 to 27, further comprising the step of separating produced hydrogen, oxide and functionalised Silica from one another.

29. A method according to claim 28, wherein the produced hydrogen, oxide and functionalised Silica are separated using a batch process.