Claims:

1. A carbon allotrope-silica composite material comprising:
   - a silica microcapsule comprising:
   - a silica shell having a thickness of from ~~about~~ 50 nm to ~~about~~ 500 µm, and a plurality of pores,

   said shell forming a capsule having a diameter from ~~about~~ 0.2 µm to ~~about~~ 1500 µm, and having a density of ~~about~~ 0.001 g/cm^3 to ~~about~~ 1.0 g/cm^3,

   wherein said shell comprises from ~~about~~ 0% to ~~about~~ 70% Q3 configuration, and from ~~about~~ 30% to ~~about~~ 100% Q4 configuration, or

   wherein said shell comprises from ~~about~~ 0% to ~~about~~ 60% T2 configuration and from ~~about~~ 40% to ~~about~~ 100% T3 configuration, or

   wherein said shell comprises a combination of T and Q configurations thereof, and

   wherein an exterior surface of said capsule is covered by a functional group;
   - a carbon allotrope attached to said silica microcapsule, wherein said carbon allotrope is selected from the group consisting of a graphite, a graphene, a carbon nanofiber, a carbon nanotubes, a C60 fullerene, a C70 fullerene, a C76 fullerene, a C82 fullerene, a C84 fullerene, and a combination thereof.

2. The carbon allotrope-silica composite material of claim 1, wherein said thickness of said silica shell is from ~~about~~ 50 nm to ~~about~~ 240 µm.

3. The carbon allotrope-silica composite material of claim 1, wherein said diameter of said silica microcapsule is from ~~about~~ 0.2 µm to ~~about~~ 500 µm.

4. The carbon allotrope-silica composite material of claim 1, wherein said density of said silica microcapsule is from ~~about~~ 0.01 g/cm^3 to ~~about~~ 0.5 g/cm^3.

5. The carbon allotrope-silica composite material of any one of claims 1 - 2, wherein said carbon allotrope is attached covalently to said functional group of said silica microcapsule~~particle~~.

6. The carbon allotrope-silica composite material of any one of claims 1 - 2, wherein said carbon allotrope is attached non-covalently to the surface of said silica microcapsule~~particle~~.

7. The carbon allotrope-silica composite material of any one of claims 1 - 2, wherein said functional group of said silica microcapsule ~~particle~~ is a hydroxyl group, a carboxylic acid group, a thiol group, an amino group, a benzylamino group, a chloropropyl group, a disulfide group, an epoxy group, a methacrylate group, a vinyl group, and combinations thereof.

8. The carbon allotrope-silica composite material of any one of claims 1 - 7, wherein said carbon allotrope is functionalized or not functionalized.

9. The carbon allotrope-silica composite material of any one of claims 1 - 8, wherein said carbon allotrope comprises a functional group chosen from a nitrogen-containing functional group, an oxygen containing functional group, a sulfur-contaning functional group, a halogen-containing functional group and a combination thereof.

10. The carbon allotrope-silica composite material of claim 9, wherein said nitrogen-containing functional group is an amine group, a ketimine group, an aldimine group, an imide group, an azide group, an azo group, a cyanate group, an isocyanate group, a nitrate group, a nitrile group, a nitrite group, a nitroso group, a nitro group, a pyridyl group and a combination thereof.

11. The carbon allotrope-silica composite material of claim 9, wherein said sulfur-containing functional group is an sulfhydryl group, a sulfide group, a

disulfide group, a sulfinyl group, a sulfonyl group, a sulfo group, a thiocyanate group, carbonothioyl group, carbonothioyl group and a combination thereof.

12. The carbon allotrope-silica composite material of claim 9, wherein said oxygen-containing functional group is an hydroxyl group, a carbonyl group, an aldehyde group, a carboxylate group, a carboxyl group, an ester group, a methoxy group, a peroxy group, an ether group, a carbonate ester and a combination thereof.

13. The carbon allotrope-silica composite material of claim 9, wherein said halogen-containing functional group is a fluoro, a chloro, a bromo, an iodo and a combination thereof.

14. The carbon allotrope-silica composite material of any one of claims 1, and 6 - ~~15~~13, wherein said silica shell of said silica microcapsule comprises from ~~about~~ 40% Q3 configuration and ~~about~~ 60% Q4 configuration, or from ~~about~~ 100% Q4 configuration.

15. The carbon allotrope-silica composite material of any one of claims 1, and 6 - ~~16~~14, wherein said pores of said silica microcapsule have pore diameters from ~~about~~ 0.5 nm to ~~about~~ 100 nm.

16. The carbon allotrope-silica composite material of claim 1 to 15, wherein said functional group of said silica microcapsules is provided by an organosilane chosen from a trimethoxysilane, a triethoxysilane, a tripropoxysilane, 3-aminopropyltriethoxysilane, vinyltriacetoxy silane, a vinyltrimethoxysilane, 3-glycidoxypropyltrimethoxysilane, 3-methacryloxypropyltrimethoxysilane, 3-chloropropyltriethoxysilane, a bis-(triethoxysilylpropyl)tetrasulfane, a methyltriethoxysilane, a n-octyltriethoxysilane, and a phenyltrimethoxysilane and combinations thereof.

17. The carbon allotrope-silica composite material of any one of claims 1 to 16, wherein said carbon allotrope-silica composite material is loaded with a molecule.

18. The carbon allotrope-silica composite material of claim 17, wherein said molecule is a fluorescent molecule, a magnetic molecule, a catalyst molecule, a biological macromolecule, or a combination thereof.

19. The carbon allotrope-silica composite material of claim 18, wherein said magnetic molecule is a magnetic nanoparticle.

20. A process for the preparation of a carbon-allotrope silica composite material in solution comprising:

a) contacting an oxidized carbon allotrope with

- a silica microcapsule~~, or~~
- ~~a silica precursor in a polar solvent in the presence of a catalyst for a sol-gel reaction~~

for a time sufficient and at a temperature sufficient obtain a formed carbon-allotrope silica composite material in a liquid phase.

~~21. The process of claim 20, wherein said catalyst is an acidic or alkali catalyst.~~

~~22. The process of any one of claims 20-21, wherein said polar solvent is water, an alcohol, acetone, dimethylformamide (DMF), Dimethyl sulfoxide (DMSO) or a combination thereof.~~

~~23. The process of any one of claims 20-22, wherein said silica precursor is an alkoxysilane.~~

~~24. The process of claim 23, wherein said alkoxysilane is methoxysilane, an ethoxysilane, a propoxysilane, an isopropoxysilane, an aryloxysilane, tetramethoxysilane (TMOS), tetraethoxysilane (TEOS), tetrapropoxysilane (TPOS) or a functional trimethoxy, triethoxysilane, tripropoxysilane including aminopropylsilane, aminoethylaminopropylsilane, vinyltrimethoxysilane, 3-chloropropyltriethoxysilane, 3-glycidoxypropyltrimethoxysilane, methacryloyloxypropyltrimethoxysilane, phenyltriethoxysilane, phenyltrimethoxysilane, glycidoxypropoxyltrimethoxysilane, glycidoxypropyltriethoxysilane, mercaptopropyltriethoxysilane, mercaptopropyltrimethoxysilane, aminopropyltrimethoxysilane, 3-aminopropyltriethoxysilane, 3-(2-aminoethylamino)propyltrimethoxysilane, 3-[2-(2-aminoethylamino)ethylamino]propyltrimethoxysilane, [2(cyclohexenyl)ethyl]triethoxysilane, vinyltrimethoxysilane, vinyltriethoxysilane or a mixture of any two or more of the above.~~

~~25. The process of claim 21, wherein said acid catalyst is chosen from HCl, acetic acid, and sulfuric acid, or a combination thereof.~~

~~26. The process of claim 21, wherein said alkali catalyst is chosen from sodium hydroxide, potassium hydroxide and ammonia, or a combination thereof.~~

~~27~~21. The process of claim 20~~any one of claims 20-26~~, wherein said time sufficient is from ~~about~~ 15 minutes to ~~about~~ 48 hours.

~~28~~22. The process of any one of claims 20-~~27~~21, wherein said temperature sufficient is from ~~about~~ room temperature ~~(24ºC)~~ to ~~about~~ 100ºC.

~~29~~23. The process of any one of claims 20-~~28~~22, wherein said oxidized carbon allotrope is chosen from oxidized graphite, oxidized graphene, an oxidized carbon nanofiber, an oxidized carbon nanotubes, an oxidized C60 fullerene, an

oxidized C70 fullerene, an oxidized C76 fullerene, an oxidized C82 fullerene, an oxidized C84 fullerene, and a combination thereof.

~~30~~24. The process of any one of claims 20 to ~~29~~23, further comprising step b) after step a)

b) washing said formed carbon-allotrope silica composite material to remove ~~said acidic or alkali catalyst and~~ an ~~other~~ impurity, to obtain washed carbon-allotrope silica composite material.

~~31~~25. The process of claim ~~30~~24, further comprising step c) after step b):

c) separating said washed carbon-allotrope silica composite material from said liquid phase.

~~32~~26. The process of claim ~~31~~ 25 further comprising step d) after step c):

d) drying said washed carbon-allotrope silica composite material to obtain dried a carbon-allotrope silica composite material.

~~33~~27. The process of any one of claims 20 to ~~30~~26, wherein said silica microcapsule comprises:

- a silica shell having a thickness of from ~~about~~ 50 nm to ~~about~~ 500 µm, and a plurality of pores,

said shell forming a capsule having a diameter from ~~about~~ 0.2 µm to ~~about~~ 1500 µm, and having a density of ~~about~~ 0.001 g/cm^3 to ~~about~~ 1.0 g/cm^3,

wherein said shell comprises from ~~about~~ 0% to ~~about~~ 70% Q3 configuration, and from ~~about~~ 30% to ~~about~~ 100% Q4 configuration, or

wherein said shell comprises from ~~about~~ 0% to ~~about~~ 60% T2 configuration and from ~~about~~ 40% to ~~about~~ 100% T3 configuration, or

wherein said shell comprises a combination of T and Q configurations thereof, and

wherein an exterior surface of said capsule is covered by a functional group;

~~34~~28. The process of claim ~~33~~27, wherein said thickness of said silica microcapsule is from ~~about~~ 50 nm to ~~about~~ 240 µm.

~~35~~29. The process of claim 27~~33~~, wherein said diameter of said silica microcapsule is from ~~about~~ 0.2 µm to ~~about~~ 500 µm.

~~36~~30. The process of claim 27~~33~~, wherein said density of said silica microcapsule is from ~~about~~ 0.01 g/cm^3 to ~~about~~ 0.5 g/cm^3.

~~37~~31. The process of claim 27~~33~~, wherein said shell comprises from ~~about~~ 40% Q3 configuration and ~~about~~ 60% Q4 configuration, or from ~~about~~ 100% Q4 configuration.

~~38~~32. The process of claim 27~~33~~, wherein said pores have pore diameters from ~~about~~ 0.5 nm to ~~about~~ 100 nm.

~~39~~33. The process of any one of claims 27~~33~~-~~38~~32, wherein said functional group is a hydroxyl group, an amino group, a benzylamino group, a chloropropyl group, a disulfide group, an epoxy group, a mercapto group, a methacrylate group, a vinyl group, and combinations thereof.

~~40~~34. The process of claim ~~39~~33, wherein said functional group is provided by an organosilane chosen from a trimethoxysilane, a triethoxysilane, a tripropoxysilane, 3-aminopropyltriethoxysilane, vinyltriacetoxy silane, a vinyltrimethoxysilane, 3-glycidoxypropyltrimethoxysilane, 3-methacryloxypropyltrimethoxysilane, 3-chloropropyltriethoxysilane, a bis-(triethoxysilylpropyl)tetrasulfane, a methyltriethoxysilane, a n-octyltriethoxysilane, and a phenyltrimethoxysilane and combinations thereof.

~~41~~35. A process for the preparation of a carbon-allotrope silica composite material using a plasma deposition process, comprising:

a) contacting a silica microcapsule with a plasmagenic gas comprising a carbon precursor, or a carbon precursor in the presence of a nitrogen precursor, an oxygen precursor, or a sulfur precursor, or a combination thereof,

for a time sufficient, at a power sufficient, a concentration, and a pressure sufficient to deposit a carbon allotrope onto the surface of said silica microcapsule to form said carbon-allotrope silica composite material, wherein said carbon allotrope is selected from the group consisting of a graphite, a graphene, a carbon nanofiber, a carbon nanotubes, a C60 fullerene, a C70 fullerene, a C76 fullerene, a C82 fullerene, a C84 fullerene, and a combination thereof.

~~42~~36. The process of claim ~~41~~35, wherein said carbon precursor is chosen from a cyclic hydrocarbon, an aliphatic hydrocarbon, a branched hydrocarbon, a halogenated hydrocarbon, and mixtures thereof.

~~43~~37. The process of claim ~~42~~36, wherein said aliphatic hydrocarbon is methane.

~~44~~38. The process of claim ~~43~~37, wherein said carbon precursor is injected at a pressure of ~~about~~ ~~172,37~~13,33 kPa to ~~about~~ ~~517,11~~80 kPa.

~~45~~39. The process of any one of claim ~~41~~35-~~44~~38, wherein a flow rate of said plasmagenic gas is from ~~about~~ 0,1 slpm to ~~about~~ 1.5 slpm.

~~46~~40. The process of claim ~~45~~39, wherein said flow rate of said plasmagenic gas is from ~~about~~ 0,4 slpm to ~~about~~ 0,9 slpm.

~~47~~41. The process of any one of claims ~~41~~ 35 to ~~46~~40, further comprising injecting in said plasmagenic gas a sulfur-containing precursor, a nitrogen-containing precursor, an oxygen-containing precursor, a halogen-containing precursor, or a combination thereof.

~~48~~42. The process of claim ~~47~~41, wherein said sulfur-containing precursor is chosen from a sulfate, a persulfate, a sulfide, a sulfite, a sulfur oxide, a organosulfur compound, a thionyl compound, a thiosulfates, a thiocyanate, a isothiocyanate, a sulfuryl compound, a sulfonium compound, or a combination thereof.

~~49~~43. The process of claim ~~47~~41, wherein said nitrogen-containing precursor is chosen from nitrogen (gas N_2), ammonia, an amine, an amide, an imine, an ammonium compound, an azide, a cyanate, a cyanide, a hydrazine, a nitrate, a nitrite, a nitride, a nitrosyl compound, an isocyanate, a nitrogen halide, an organonitrogen compound, a thiocyanate, a thioureas, or a combination thereof.

~~50~~44. The process of claim ~~47~~41, wherein said oxygen-containing precursor is chosen from oxygen (gas O_2), a oxide, a peroxide, an alcohol, an ether, a ketone, an aldehyde, a carboxylic acid, an ether, an acid anhydride, an amides, or a combination thereof.

~~51~~45. The process of claim ~~47~~41, wherein said halogen-containing precursor is chosen from a bromide compound, a chlorine compound, a fluororine compound, an iodine compound, an halide, an interhalogen compound, or a combination thereof.

~~52~~46. The process of any one of claims ~~41~~35-~~49~~43, wherein said process comprises a sheath gas and said sheath gas is chosen from He, Ne, Ar, Xe, N_2, and a combination thereof.

~~53~~47. The process of claim ~~50~~46, wherein said sheath gas is Ar.

~~54~~48. The process of any one of claims ~~50 46~~ to ~~53~~47, wherein said sheath gas is injected at a pressure of from ~~about~~ 172,37 kPa to ~~about~~ 517,11 kPa.

~~55~~49. The process of claim ~~54~~48, wherein said sheath gas is injected at a pressure of from ~~about~~ 275,79 kPa to ~~about~~ 413,69 kPa.

~~56~~50. The process of any one of claims ~~41 35~~ to ~~55~~49, wherein a carrier gas comprises from ~~about~~ 1.7% to ~~about~~ 8% v/v carbon precursor vapor.

~~57~~51. The process of claim ~~56~~50, wherein said carrier gas comprises from ~~about~~ 4% to ~~about~~ 8% v/v carbon precursor vapor.

~~58~~52. The process of any one of claims ~~41 35~~ to ~~56~~50, wherein said power sufficient is from ~~about~~ 1 to ~~about~~ 50 kW.

~~59~~53. The process of claim ~~58~~52, wherein said power sufficient is from ~~about~~ 5 to ~~about~~ 20 kW.

~~60~~54. The process of any one of claims ~~41 35~~ to ~~59~~53, wherein said pressure sufficient is from ~~about~~ 13,33 kPa to ~~about~~ 61,33 kPa.

~~61~~55. The process of any one of claims ~~41 35~~ to ~~60~~54, wherein said time sufficient is from ~~about~~ 1 to ~~about~~ 60 minutes.

~~62~~56. A material comprising:

- a carbon allotrope-silica composite material according to any one of claims 1 to 19 ~~or~~,
- ~~a silica microcapsule comprising:~~

- ~~a silica shell having a thickness of from about 50 nm to about 500 µm, and a plurality of pores,~~

  ~~said shell forming a capsule having a diameter from about 0.2 µm to about 1500 µm, and having a density of about 0.001 g/cm^3 to about 1.0 g/cm^3,~~

  ~~wherein said shell comprises from about 0% to about 70% Q3 configuration, and from about 30% to about 100% Q4 configuration, or~~

  ~~wherein said shell comprises from about 0% to about 60% T2 configuration and from about 40% to about 100% T3 configuration, or~~

  ~~wherein said shell comprises a combination of T and Q configurations thereof, and~~

  ~~wherein an exterior surface of said capsule is covered by a functional group,~~

~~or a combination thereof,~~ and

- a cell, an enzyme, a viral particle, or a combination thereof.

~~63~~57. The material of claim ~~62~~56, wherein said material is for carrying a cell, an enzyme, a viral particle or a combination thereof.

~~64~~58. The material of claim ~~62~~56, wherein said cell is a prokaryotic cell or a eukaryotic cell.

~~65~~59. The material of claim ~~62~~56, wherein said prokaryotic cell is chosen from a bacterial cell, and an archaea cell.

~~66~~60. The material of claim ~~64~~58, wherein said eukaryotic cell is chosen from a fungal cell, a protozoan cell, an insect cell, a plant cell, and a mammalian cell.

~~67. The material of any one of claims 62 - 63, wherein said shell comprises from about 40% Q3 configuration and about 60% Q4 configuration, or from about 100% Q4 configuration.~~

~~68. The material of any one of claims 62 - 67, wherein said pores of said silica microcapsule have pore diameters from about 0.5 nm to about 100 nm.~~

~~69. The material of any one of claims 62 - 68, wherein said functional group is a hydroxyl group, an amino group, a benzylamino group, a chloropropyl group, a disulfide group, an epoxy group, a mercapto group, a methacrylate group, a vinyl group, and combinations thereof~~

~~70. The carrying material of claim 69, wherein said functional group is provided by an organosilane chosen from a trimethoxysilane, a triethoxysilane, a tripropoxysilane, 3-aminopropyltriethoxysilane, vinyltriacetoxy silane, a vinyltrimethoxysilane, 3-glycidoxypropyltrimethoxysilane, 3-methacryloxypropyltrimethoxysilane, 3-chloropropyltriethoxysilane, a bis-(triethoxysilylpropyl)tetrasulfane, a methyltriethoxysilane, a n-octyltriethoxysilane, and a phenyltrimethoxysilane and combinations thereof.~~

~~71~~61. A process for the preparation of a material comprising:

a) contacting

- a carbon allotrope-silica composite material of any one of claims 1 to 19 ~~or~~,
- ~~a silica microcapsule comprising:~~
    - ~~a silica shell having a thickness of from about 50 nm to about 500 µm, and a plurality of pores,~~

      ~~said shell forming a capsule having a diameter from about 0.2 µm to about 1500 µm, and having a density of about 0.001 g/cm^3 to about 1.0 g/cm^3,~~

      ~~wherein said shell comprises from about 0% to about 70% Q3 configuration, and from about 30% to about 100% Q4 configuration, or~~

~~wherein said shell comprises from about 0% to about 60% T2 configuration and from about 40% to about 100% T3 configuration, or~~

~~wherein said shell comprises a combination of T and Q configurations thereof, and~~

~~wherein an exterior surface of said capsule is covered by a functional group,~~

~~or a combination thereof,~~

with a cell, an enzyme, or a viral particle, and incubating for a time sufficient for binding of said cell, enzyme, or viral particle to said carbon allotrope-silica composite material, said silica microcapsule or said combination thereof.

~~72. The process of claim 71, wherein said shell comprises from about 40% Q3 configuration and about 60% Q4 configuration, or from about 100% Q4 configuration.~~

~~73. The process of any one of claims 71 - 72, wherein said pores of said silica microcapsule have pore diameters from about 0.5 nm to about 100 nm.~~

~~74. The process of any one of claims 71 - 73, wherein said functional group is a hydroxyl group, an amino group, a benzylamino group, a chloropropyl group, a disulfide group, an epoxy group, a mercapto group, a methacrylate group, a vinyl group, and combinations thereof~~

~~75. The process of claim 71, wherein said functional group is provided by an organosilane chosen from a trimethoxysilane, a triethoxysilane, a tripropoxysilane, 3-aminopropyltriethoxysilane, vinyltriacetoxy silane, a vinyltrimethoxysilane, 3-glycidoxypropyltrimethoxysilane, 3-methacryloxypropyltrimethoxysilane, 3-chloropropyltriethoxysilane, a bis-(triethoxysilylpropyl)tetrasulfane, a methyltriethoxysilane, a n-octyltriethoxysilane, and a phenyltrimethoxysilane and combinations thereof.~~

~~76~~62. The process of any one of claims ~~71~~ 61 - ~~75~~62, wherein said cell is chosen from a prokaryotic cell or a eukaryotic cell.

~~77~~63. The process of claim ~~76~~62, wherein said prokaryotic cell is chosen from a bacterial cell, and an archaea cell.

~~78~~64. The process of claim ~~76~~62, wherein said eukaryotic cell is chosen from a fungal cell, a protozoan cell, an insect cell, a plant cell, and a mammalian cell.

~~79~~65. The process of claim ~~77~~63, wherein said bacterial cell is chosen from the following phyla: an *Acidobacteria*, an *Actinobacteria*, an *Aquificae*, an *Bacteroidetes*, an *Caldiserica*, an *Chlamydiae*, an *Chlorobi*, an *Chloroflexi*, an *Chrysiogenetes*, an *Cyanobacteria*, an *Deferribacteres*, an *Deinococcus-Thermus*, an *Dictyoglomi*, an *Elusimicrobia*, an *Fibrobacteres*, an *Firmicutes*, an *Fusobacteria*, an *Gemmatimonadetes*, an *Lentisphaerae*, an *Nitrospira*, an *Planctomycetes*, an *Proteobacteria*, an *Spirochaetes*, an *Synergistetes*, an *Tenericutes*, an *Thermodesulfobacteria*, an *Thermotogae*, an *Verrucomicrobia*, or a combination thereof.

~~80~~66. The process of claim ~~77~~63, wherein said bacterial cell is chosen from the following genera: *Pseudomonas, Rhodopseudomonas, Acinetobacter, Mycobacterium, Corynebacterium, Arthrobacterium, Bacillius, Flavorbacterium, Nocardia, Achromobacterium, Alcaligenes, Vibrio, Azotobacter, Beijerinckia, Xanthomonas. Nitrosomonas, Nitrobacter, Methylosinus, Methylococcus, Actinomycetes* and *Methylobacter*.

~~81~~67. The process of claim ~~77~~63, wherein said archaeal cell is chosen from the following phyla: an Euryarchaeota, an Crenarchaeota, an Korarchaeota, an Nanoarchaeota, or a combination thereof.

~~82~~68. The process of claim ~~78~~64, wherein said fungal cell is chosen from phyla including a Blastocladiomycota, a Chytridiomycota, a Glomeromycota, a Microsporidia, a Neocallimastigomycota, an Ascomycota, a Basidiomycota, or a combination thereof.

~~83~~69. The process of claim ~~78~~64, wherein said fungal cell is chosen from the following genera : Saccaromyces, Pichia, Brettanomyces, Yarrowia, Candida, Schizosaccharomyces, Torulaspora, Zygosaccharomyces Aspergillus, Rhizopus, Trichoderma, Monascus, Penicillium, Fusarium, Geotrichum, Neurospora, Rhizomucor, and Tolupocladium.

~~84~~70. The process of claim ~~78~~63, wherein said protozoan cell is chosen from the following phyla : Percolozoa, Euglenozoa, Ciliophora, Mioza, Dinoza, Apicomplexa, Opalozoa, Mycetozoa, Radiozoa, Heliozoa, Rhizopoda, Neosarcodina, Reticulosa, Choanozoa, Myxosporida, Haplosporida, Paramyxia.

~~85~~71. The process of claim ~~78~~64, wherein said eukaryotic cell is from an algae.

~~86~~72. The process of claim ~~71~~61, wherein said enzymes is chosen from a oxidoreductase, a transferase, a hydrolase, a lyase, an isomerase, a ligase, a polymerase or a combination thereof.

~~87~~73. The process of any one of claims ~~71~~ 61 - ~~86~~72, wherein said process is carried in a biological reactor.

~~88~~74. The process of claim ~~87~~73, wherein said biological reactor is chosen from a fermentation batch reactor, an enzymatic batch reactor, a nitrification reactor, a digester reactor, a membrane bioreactor (MBR), a moving bed bioreactor (MBBR), a fluid bed reactor (FBR), a continuous stirred reactor (CSTR), a plug flow reactor (PFR) and a sequential batch reactor (SBR).

~~89~~75. The process of any one of claims ~~71~~ 61 - ~~88~~74, wherein said method is an anaerobic or an aerobic method.

~~90~~76. A method of cell growth comprising incubating a material according to any one of claims ~~62~~ 56 to ~~70~~60, in a sterile growth medium to obtain said cell.

~~91~~77. A method for performing an enzymatic reaction comprising incubating a material according to any one of claims ~~62~~ 56 to ~~70~~60~~, or 93~~, in a reaction medium.

~~92~~78. A method for performing a fermentation reaction comprising incubating a material according to any one of claims ~~62~~ 56 to ~~70~~60~~, or 93~~, in a fermentation reaction medium to obtain a fermentation product.

~~93~~79. The method of claims ~~90~~76, wherein said growth is a sporulation reaction to obtain spores.

~~94~~80. A method for decontamination of a contaminated fluid comprising incubating a material according to any one of claims ~~62~~ 56 to ~~70~~60~~, or 93~~, in said contaminated fluid.

~~95~~81. The method of any one of claims ~~90~~ 76 - ~~94~~80, wherein said method is carried in a biological reactor.

~~96~~82. The method of claim ~~95~~81, wherein said biological reactor is chosen from a fermentation batch reactor, an enzymatic batch reactor, a nitrification reactor, a digester reactor, a membrane bioreactor (MBR), a moving bed bioreactor (MBBR), a fluid bed reactor (FBR), a continuous stirred reactor (CSTR), a plug flow reactor (PFR) and a sequential batch reactor (SBR).

~~97~~83. A process for the preparation of a material comprising:

a) contacting

- a carbon allotrope-silica composite material of any one of claims 1 to ~~18~~ 19 ~~or,~~
- ~~a silica microcapsule comprising:~~
- ~~a silica shell having a thickness of from about 50 nm to about 500 µm, and a plurality of pores,~~
- ~~said shell forming a capsule having a diameter from about 0.2 µm to about 1500 µm, and having a density of about 0.001 g/cm^3 to about 1.0 g/cm^3,~~
- ~~wherein said shell comprises from about 0% to about 70% Q3 configuration, and from about 30% to about 100% Q4 configuration, or~~
- ~~wherein said shell comprises from about 0% to about 60% T2 configuration and from about 40% to about 100% T3 configuration, or~~
- ~~wherein said shell comprises a combination of T and Q configurations thereof, and~~
- ~~wherein an exterior surface of said capsule is covered by a functional group,~~
- ~~or a combination thereof,~~

with a molecule for adsorption of said molecule to said carbon allotrope-silica composite material, said silica microcapsule or said combination thereof.

~~98. The carbon allotrope-silica composite material of claim 97, wherein said thickness of said silica shell is from about 50 nm to about 240 µm.~~

~~99. The carbon allotrope-silica composite material of claim 97, wherein said diameter of said silica microcapsule is from about 0.2 µm to about 500 µm.~~

~~100. The carbon allotrope-silica composite material of claim 97, wherein said density of said silica microcapsule is from about 0.01 g/cm^3 to about 0.5 g/cm^3.~~

~~101. The process of claim 97, wherein said shell comprises from about 40% Q3 configuration and about 60% Q4 configuration, or from about 100% Q4 configuration.~~

~~102. The process of any one of claims 97 - 101, wherein said pores of said silica microcapsule have pore diameters from about 0.5 nm to about 100 nm.~~

~~103. The process of any one of claims 97 - 102, wherein said functional group is a hydroxyl group, an amino group, a benzylamino group, a chloropropyl group, a disulfide group, an epoxy group, a mercapto group, a methacrylate group, a vinyl group, and combinations thereof~~

~~104. The process of claim 103, wherein said functional group is provided by an organosilane chosen from a trimethoxysilane, a triethoxysilane, a tripropoxysilane, 3-aminopropyltriethoxysilane, vinyltriacetoxy silane, a vinyltrimethoxysilane, 3-glycidoxypropyltrimethoxysilane, 3-methacryloxypropyltrimethoxysilane, 3-chloropropyltriethoxysilane, a bis-(triethoxysilylpropyl)tetrasulfane, a methyltriethoxysilane, a n-octyltriethoxysilane, and a phenyltrimethoxysilane and combinations thereof.~~

~~105~~84. The process of ~~any one of claims 97 - 104~~claim 83, wherein said molecule is a fluorescent molecule, a magnetic ~~particle~~molecule, a catalyst molecule, a biological macromolecule, or a combination thereof.