CLAIMS

1. A method for setting the lubricity properties of a coating on a substrate surface, the method comprising the steps

(a) providing a gaseous reactant comprising an organosilicon precursor and optionally O_2 in the vicinity of the substrate surface; and

(b) generating a plasma from the gaseous reactant, thus forming a coating on the substrate surface by plasma enhanced chemical vapor deposition (PECVD), wherein the lubricity characteristics of the coating are set by setting the ratio of the O_2 to the organosilicon precursor in the gaseous reactant, and/or by setting the electric power used for generating the plasma.

2. A method for preparing a hydrophobic coating on a substrate, the method comprising the steps

(a) providing a gaseous reactant comprising an organosilicon precursor and optionally O_2 in the vicinity of the substrate surface; and

(b) generating a plasma from the gaseous reactant, thus forming a coating on the substrate surface by plasma enhanced chemical vapor deposition (PECVD), wherein the hydrophobic characteristics of the coating are set by setting the ratio of the O_2 to the organosilicon precursor in the gaseous reactant, and/or by setting the electric power used for generating the plasma.

3. The method of claim 1 or 2, which results in a coating which is characterized by a sum formula wherein the atomic ratio C : O is increased and/or the atomic ratio Si : O is decreased in comparison to the sum formula of the organosilicon precursor.

4. The method according to any of claims 1 to 3, wherein the O_2 is present in a volume-volume ratio to the gaseous reactant of from 0:1 to 5:1, optionally from 0:1 to 1:1, optionally from 0:1 to 0.5:1, optionally from 0:1 to 0.1:1, preferably wherein at least essentially no oxygen is present in the gaseous reactant.

5. The method according to any of the preceding claims, wherein the gaseous reactant comprises less than 1 vol% O_2, more particularly less than 0.5 vol% O_2, and most preferably is O_2-free.

6. The method according to any of the preceding claims, wherein the plasma is a non-hollow-cathode plasma.

7. The method according to any of the preceding claims

(i) wherein the plasma is generated with electrodes powered with sufficient power to form a coating on the substrate surface, preferably with electrodes supplied with an electric power of from 0.1 to 25 W, preferably from 1 to 22 W, more preferably from 3 to 17 W, even more preferably of from 5 to 14 W, most preferably of from 7 to 11 W, in particular of 8 W; and/or

(ii) wherein the ratio of the electrode power to the plasma volume is less than 10 W/ml, preferably is from 5 W/ml to 0.1 W/ml, more preferably is from 4 W/ml to 0.1 W/ml, most preferably from 2 W/ml to 0.2 W/ml.

8. A method for preparing a coating on a substrate surface, the method comprising the steps

(a) providing a gaseous reactant comprising an organosilicon precursor and optionally O2 in the vicinity of the substrate surface; and

(b) generating a non-hollow-cathode plasma from the gaseous reactant at reduced pressure, thus forming a coating on the substrate surface by plasma enhanced chemical vapor deposition (PECVD),

wherein the physical and chemical properties of the coating are set by setting the ratio of the O2 to the organosilicon precursor in the gaseous reactant, and/or by setting the electric power used for generating the plasma.

9. A method for preparing a barrier coating on a substrate, the method comprising the steps

(a) providing a gaseous reactant comprising an organosilicon precursor and O2 in the vicinity of the substrate surface; and

(b) generating a non-hollow-cathode plasma from the gaseous reactant at reduced pressure, thus forming a coating on the substrate surface by plasma enhanced chemical vapor deposition (PECVD),

wherein the barrier characteristics of the coating are set by setting the ratio of the O2 to the organosilicon precursor in the gaseous reactant, and/or by setting the electric power used for generating the plasma.

10. The method according to claim 9

(i) wherein the plasma is generated with electrodes powered with sufficient power to form a coating on the substrate surface, preferably with electrodes supplied with an electric power of from 8 to 500 W, preferably from 20 to 400 W, more preferably from 35 to 350 W, even more preferably of from 44 to 300 W, most preferably of from 44 to 70 W; and/or

(ii) the ratio of the electrode power to the plasma volume is equal or more than 5 W/ml, preferably is from 6 W/ml to 150 W/ml, more preferably is from 7 W/ml to 100 W/ml, most preferably from 7 W/ml to 20 W/ml.

11. The method according to claim 9 or 10, wherein the O_2 is present in a volume:volume ratio to the gaseous reactant of from 1 : 1 to 100 : 1 in relation to the silicon containing precursor, preferably in a ratio of from 5 : 1 to 30 : 1, more preferably in a ratio of from 10 : 1 to 20 : 1, even more preferably in a ratio of 15 : 1.

12. The method of any of the preceding claims, wherein the organosilicon precursor is selected from the group consisting of a linear siloxane, a monocyclic siloxane, a polycyclic siloxane, a polysesquioxane, a linear silazane, a monocyclic silazane, a polycyclic silazane, a polysilsesquiazane, an alkyl trimethoxysiloxane, and a combination of any two or more of these compounds, preferably is a linear or monocyclic siloxane.

13. The method of claim 1 or 2, wherein the organosilicon precursor is a monocyclic siloxane, preferably OMCTS.

14. The method of claim 2 or 9, wherein the organosilicon precursor is a linear siloxane, preferably HMDSO.

15. The method according to any of the preceding claims, wherein the substrate is a polymer selected from the group consisting of a polycarbonate, an olefin polymer, a cyclic olefin copolymer and a polyester, and preferably is a cyclic olefin copolymer, a polyethylene terephthalate or a polypropylene.

16. The method according to any of the preceding claims, wherein the plasma is generated with electrodes powered at a radiofrequency, preferably at a frequency of from 10 kHz to less than 300 MHz, more preferably of from 1 to 50 MHz, even more preferably of from 10 to 15 MHz, most preferably at 13.56 MHz.

17. A coating which is obtainable by the method according to any of the preceding claims.

18. The coating of claim 17, which is a lubricity and/or hydrophobic coating.

19. The coating of claim 18, wherein the atomic ratio of carbon to oxygen is increased in comparison to the organosilicon precursor, and/or wherein the atomic ratio of oxygen to silicon is decreased in comparison to the organosilicon precursor.

20. The coating according to any of claims 18 to 19, wherein the coating
(i) has a lower frictional resistance than the uncoated surface, wherein preferably the frictional resistance is reduced by at least 25 %, more preferably by at least 45%, even more preferably by at least 60% in comparison to the uncoated surface.

21. The coating according to any of claims 18 to 20, which

(i) has a lower wetting tension than the uncoated surface, preferably a wetting tension of from 20 to 72 dyne/cm, more preferably a wetting tension of from 30 to 60 dynes/cm, more preferably a wetting tension of from 30 to 40 dynes/cm, preferably 34 dyne/cm; and/or

(iv) is more hydrophobic than the uncoated surface.

22. A vessel coated on at least part of its interior surface with the coating according to any of claims 17 to 21, preferably a vessel which is

(i) a sample collection tube, in particular a blood collection tube; or

(ii) a vial; or

(iii) a syringe or a syringe part, in particular a syringe barrel or a syringe plunger; or

(iv) a pipe; or

(v) a cuvette.

23. The coated vessel according to claim 22, additionally comprising at least one layer of SiO_x, wherein x is from 1.5 to 2.9, wherein

(i) the coating is situated between the SiOx layer and the substrate surface or vice versa, or wherein

(ii) the coating is situated between two SiO_x layers or vice versa, or wherein

(iii) the layers of SiO_x and the coating are a graded composite of $Si_wO_xC_yH_z$ to SiO_x or vice versa.

24. The coated vessel according to any of claims 22 to 23 which contains a compound or composition in its lumen, preferably a biologically active compound or composition or a biological fluid, more preferably (i) citrate or a citrate containing composition, (ii) a medicament, in particular insulin or an insulin containing composition, or (iii) blood or blood cells.

25. The coated vessel according to any of claims 22 to 24, which is a syringe barrel made according to the method of claim 1 wherein the precursor is a siloxane, more preferably is a monocyclic siloxane, even more preferably is octamethylcyclotetrasiloxane, and wherein in step (a) substantially no O_2 gas is provided in the gaseous reactant, wherein the force for moving the plunger through said coated barrel is reduced by at least 25 %, more preferably by at least 45%, even more preferably by at least 60% in comparison to the uncoated syringe barrel.

26. Use of a coating having the sum formula $Si_wO_xC_yH_z$, wherein
w is 1,
x is 0.5 to 2.4,
y is 0.6 to 3, and
z is from 2 to 9
as
(i) a lubricity coating having a lower frictional resistance than the uncoated surface; and/or
(ii) a hydrophobic coating being more hydrophobic than the uncoated surface.

27. Use of the coated vessel according to any of claims 22 to 25 for protecting a compound or composition contained or received in said coated vessel against mechanical and/or chemical effects of the surface of the uncoated vessel material, preferably for preventing or reducing precipitation and/or clotting of a compound or a component of the composition in contact with the interior surface of the vessel.

28. The use of claim 27, wherein the compound or composition is
(i) a biologically active compound or composition, preferably a medicament, more preferably insulin or a composition comprising insulin wherein insulin precipitation is reduced or prevented; or
(ii) a biological fluid, preferably a bodily fluid, more preferably blood or a blood fraction wherein blood clotting is reduced or prevented.

CLAIMS

1. A method for preparing a coating on a substrate surface, the method comprising the steps

(a) providing a gaseous reactant comprising an organosilicon precursor and optionally O2 in the vicinity of the substrate surface; and

(b) generating a non-hollow-cathode plasma from the gaseous reactant at reduced pressure, thus forming a coating on the substrate surface by plasma enhanced chemical vapor deposition (PECVD),

wherein the physical and chemical properties of the coating are set by setting the ratio of the O2 to the organosilicon precursor in the gaseous reactant, and/or by setting the electric power used for generating the plasma.

2. A method for preparing a barrier coating on a substrate, the method comprising the steps

(a) providing a gaseous reactant comprising an organosilicon precursor and O2 in the vicinity of the substrate surface; and

(b) generating a non-hollow-cathode plasma from the gaseous reactant at reduced pressure, thus forming a coating on the substrate surface by plasma enhanced chemical vapor deposition (PECVD),

wherein the barrier characteristics of the coating are set by setting the ratio of the O2 to the organosilicon precursor in the gaseous reactant, and/or by setting the electric power used for generating the plasma.

3. The method according to claim 2

(i) wherein the plasma is generated with electrodes powered with sufficient power to form a coating on the substrate surface, preferably with electrodes supplied with an electric power of from 8 to 500 W, preferably from 20 to 400 W, more preferably from 35 to 350 W, even more preferably of from 44 to 300 W, most preferably of from 44 to 70 W; and/or

(ii) the ratio of the electrode power to the plasma volume is equal or more than 5 W/ml, preferably is from 6 W/ml to 150 W/ml, more preferably is from 7 W/ml to 100 W/ml, most preferably from 7 W/ml to 20 W/ml.

4 . The method according to claim 2 or 3, wherein the O2 is present in a volume:volume ratio to the gaseous reactant of from 1 :1 to 100 :1 in relation to the silicon containing precursor, preferably in a ratio of from 5 :1 to 30 :1 , more preferably in a ratio of from 10 :1 to 20 :1 , even more preferably in a ratio of 15 :1.

5. The method of any of the preceding claims, wherein the organosilicon precursor is selected from the group consisting of a linear siloxane, a monocyclic siloxane, a polycyclic siloxane, a polysesquioxane, a linear silazane, a monocyclic silazane, a polycyclic silazane, a polysilsesquiazane, an alkyl trimethoxysiloxane, and a combination of any two or more of these compounds, preferably is a linear or monocyclic siloxane.

6. The method of claim 2, wherein the organosilicon precursor is a linear siloxane, preferably HMDSO.