According to a second aspect of the present invention, there is provided a facility for treating a substrate having millimetre, micrometre and/or nanometre structures, for carrying out the above method, said facility comprising a fixing device for fixing the substrate, an application means for applying at least one protective material to the structures, wherein the at least one protective material can be dissolved in a solvent, characterized in that the structures are produced by an imprinting process.

According to a third aspect of the present invention, there is provided a product produced using the above method and/or the above facility, comprising a substrate with millimetre and/or micrometre and/or nanometre structures and at least one coating on the structures formed from at least one protective material, wherein the at least one protective material can be dissolved by a solvent, characterized in that the structures are produced by an imprinting process.

According to a fourth aspect of the present invention, there is provided a method for processing a substrate, the method including at least the steps of: delivering the substrate by a delivery unit, applying and/or arranging millimetre and/or micrometre and/or nanometre structures on the substrate, applying at least one protective material to the structures, in particular using the above method, wherein the at least one protective material can be dissolved in a solvent, receiving the substrate by a storage unit, characterized in that the structures are produced by an imprinting process.

According to a fifth aspect of the present invention, there is provided a facility for processing a substrate, including: a delivery unit for delivering the substrate, a processing unit for applying and/or arranging millimetre and/or micrometre and/or nanometre structures on the substrate, an application means for applying at least one protective material to the structures using the above method, wherein the at least one protective material can be dissolved in a solvent, a storage unit for receiving the substrate, characterized in that the structures are produced by an imprinting process.

All combinations of at least two features specified in the description, the claims and/or the drawings also fall within the scope of the invention. Where value ranges are specified, values lying within the specified limits are also disclosed as limit values and can be claimed in any combination.

In accordance with embodiments of the invention, a method for treating a substrate having millimetre and/or micrometre and/or nanometre structures is proposed, wherein at least one protective material is applied to the structures, wherein the at least one protective material can be dissolved in a solvent.

The process according to embodiments of the invention allows the protection of a structured surface, in particular provided by 3D structures. The structured surface has been produced in particular by an imprint process. However, production by hot stamping processes, photolithographic processes, etching processes, etc. are also conceivable.

One or more structures worthy of protection is/are disposed on the substrate surface of the substrate. For the sake of simplicity, reference will usually be made hereinafter to structures in the plural. These structures can be microchips, MEMs, cavities, LEDs, stores, but in particular embossed structures. The structures are coated by a protective material according to embodiments of the invention.

The concept according to embodiments of the invention consists of the use of a protective material-solvent combination. The protective material-solvent combination must be designed such that a solution of the protective material in the solvent is produced in an optimal manner in accordance with the principle “like mixes with like”. Here, the solvent is used as a cleaning agent in order to remove the protective material from a substrate surface after a predefined number of process steps.

The protective material protects the structures from all types of loads which occur on the substrate surface and/or the opposing, second

Claims

1. A method for treating a substrate (2, 2') having millimetre and/or micrometre and/or nanometre structures (3), wherein at least one protective material (4, 4') is applied to the structures (3), wherein the at least one protective material (4, 4') can be dissolved in a solvent, characterized in that the structures (3) are produced by an imprinting process.

2. The method according to claim 1, wherein the at least one protective material (4, 4') is arranged as at least one protective layer (4, 4') on the structures (3), wherein the at least one protective material (4, 4') fully covers the structures (3).

3. The method according to claim 1, wherein the at least one protective material (4, 4') is applied by centrifugal coating, spray coating, lamination and/or immersion.

4. The method according to claim 1, wherein the at least one protective material (4, 4') is chemically and/or physically modified after the application.

5. The method according to claim 4, wherein the modification comprises a curing, an increase in viscosity and/or an increase in elasticity of the at least one protective material (4, 4').

6. The method according to claim 1, wherein a second protective material (4') is applied to said protective material (4).

7. The method according to claim 6, wherein the second protective material (4') is different from the first applied protective material (4) (4).

8. The method according to claim 1, wherein a plurality of protective layers (4, 4') are arranged over the structures (3).

9. The method according to claim 8, wherein the plurality of protective layers (4, 4') comprise different protective materials (4, 4').

10. The method according to claim 1, wherein the at least one protective material (4, 4') comprises one of the following substances or a mixture of the following substances:
    - paraffins
    - polymers.

11. The method according to claim 10, wherein the paraffins comprise petrolatum.

12. The method according to claim 11, wherein the petrolatum comprises wax.

13. The method according to claim 12, wherein the wax comprises ceresin.

14. The method according to claim 10, wherein the polymer is selected from the group consisting of photoresists in general, poly(methyl methacrylates), poly(methyl glutarimides), phenol formaldehyde resins, epoxies, polyimides, polyamides, silanes, silicons, PDMS (protective film and removal material), PFPE or acrylates.

15. The method according to claim 14, wherein the phenol formaldehyde resins comprise Bakelite.

16. The method according to claim 14, wherein the epoxies comprise SU-8.

17. The method according to claim 1, wherein the at least one protective material (4, 4') comprises one of the following substances or a mixture of the following substances:
    - polyvinyl alcohol
    - polyethers
    - cellulose ethers
    - poly(2-ethyl-2-oxazolines)
    - alcohols
    - sugar
    - carboxylic acid compounds in plastics
    - benzotriazole.

18. The method according to claim 17, wherein the polyether comprises polyethylene glycol.

19. The method according to claim 17, wherein the alcohol comprises glycerol.

20. The method according to claim 19, wherein the glycerol comprises fats.

21. The method according to claim 20, wherein the fats comprises triacylglycerols.

22. The method according to claim 1, wherein the at least one protective material 4, 4' can be dissolved by one of the following solvents or by a solvent mixture of the following solvents:
- alkanes
- alkenes
- alkines
- aromatics
- carboxylic acid esters
- ethers
- tetramethylsilane
- tetrahydrogen chloride
- carbon disulfide
- benzene
- chloroform
- gases.

23. The method according to claim 22, wherein the aromatic comprises benzene.

24. The method according to claim 22, wherein the ether comprises diethylether.

25. The method according to claim 22, wherein the gas comprises carbon monoxide.

26. The method according to claim 1, wherein the at least one protective material 4, 4' can be dissolved by one of the following solvents or by a solvent mixture of the following solvents:
    - water
    - alcohols
    - ketones
    - amines,
    - lactones
    - lactams
    - nitriles
    - nitro compounds
    - tertiary carboxylic acid amides
    - urea derivatives
    - sulfoxides
    - sulfones
    - carbonate esters
    - acids
    - formic acid, acetic acid
    - bases
    - gases.

27. The method according to claim 26, wherein the alcohol comprises methanol or ethanol.

28. The method according to claim 26, wherein the ketone comprises acetone.

29. The method according to claim 26, wherein the amine comprises one of primary and secondary amines.

30. The method according to claim 26, wherein the sulfone comprises sulfolane.

31. The method according to claim 26, wherein the carbonate ester comprises dimethyl carbonate or ethylene carbonate.

32. The method according to claim 26, wherein the acid comprises mineral acid or organic acid.

33. The method according to claim 32, wherein the mineral acid comprises sulfuric acid or halogen hydracids.

34. The method according to claim 32, wherein the organic acid comprises carboxylic acid.

35. The method according to claim 34, wherein the carboxylic acid comprises formic acid or acetic acid.

36. The method according to claim 26, wherein the base comprises NaOH or KOH.

37. The method according to claim 26, wherein the gas comprises hydrogen, oxygen or nitrogen.

38. A facility for treating a substrate (2, 2') having millimetre, micrometre and/or nanometre structures (3), for carrying out a method according to any one of the preceding claims, said facility comprising
a) a fixing device (5, 6) for fixing the substrate (2, 2'),
b) an application means (7, 7') for applying at least one protective material (4, 4') to the structures (3), wherein the at least one protective material (4, 4') can be dissolved in a solvent, characterized in that the structures (3) are produced by an imprinting process.

39. The facility according to claim 38, wherein a nozzle device (7) having one or more nozzles and/or immersion bath (7') is used for applying at least one protective material (4, 4') to the structures (3).

40. A product (1, 1', 1'', 1'''), produced using a method and/or a facility according to any one of the preceding claims, comprising a substrate (2, 2') with millimetre and/or micrometre and/or nanometre structures (3) and at least one coating on the structures (3) formed from at least one protective material (4, 4'), wherein the at least one protective material (4, 4') can be dissolved by a solvent, characterized in that the structures (3) are produced by an imprinting process.

41. A method for processing a substrate (2, 2'), said method comprising at least the following steps:

a) delivering the substrate (2, 2') by a delivery unit (9),
b) applying and/or arranging millimetre and/or micrometre and/or nanometre structures (3) on the substrate (2, 2'),
c) applying at least one protective material (4, 4') to the structures (3) using a method according to any one of the preceding claims, wherein the at least one protective material (4, 4') can be dissolved in a solvent,
d) receiving the substrate (2, 2') by a storage unit (9'''), characterized in that the structures (3) are produced by an imprinting process.

42. The method according to claim 41, wherein the substrate comprises a film.

43. The method according to claim 41, wherein the millimetre and/or micrometre and/or nanometre structures (3) is applied and/or arranged on both sides of the substrate (2, 2'),

44. The method according to claim 41, wherein the at least one protective material (4, 4') is applied to the structures (3) on both sides of the substrate (2, 2'),

45. A facility (8, 8') for processing a substrate (2, 2') comprising:
a) a delivery unit (9) for delivering the substrate (2, 2'),
b) a processing unit (9', 9'') for applying and/or arranging millimetre and/or micrometre and/or nanometre structures (3) on the substrate (2, 2'),
c) an application means (7, 7') for applying at least one protective material (4, 4') to the structures (3) using a method according to any one of the preceding claims, wherein the at least one protective material (4, 4') can be dissolved in a solvent,
d) a storage unit (9''') for receiving the substrate (2, 2'), characterized in that the structures (3) are produced by an imprinting process.

46. The method according to claim 45, wherein the substrate comprises a film.