which avoids the laborious treatments of the substrate before being applied thereto, with effective grafting on numerous surfaces of different chemical origins. The applicant has also observed excellent control over the size of the domains at scales which may be substantially less than 20 nm. Lastly, the molecules, and more particularly the polymers or copolymers, of the invention allow excellent preparation of surfaces having a topography which may subsequently form the site of application of a block copolymer in accordance with a given orientation, while retaining the topography of the initial substrate.

Summary:

The present disclosure relates to a surface preparation method using molecules comprising at least one covalent bond which gives rise to free radicals when the molecule is activated thermally, by organic or inorganic reduction-oxidation, photochemically, by shear, by plasma, or else under the influence of ionizing radiation, said method comprising the following steps:

- contacting the molecules with the surface to be treated,
- activating the covalent bond which gives rise to free radicals thermally, by organic or inorganic reduction-oxidation, photochemically, by shear, by plasma, or else under the influence of ionizing radiation, to form a film with a thickness of less than 10 nm and preferably 5 nm on the surface,
- evaporating, when present, the solubilisation or dispersion solvent employed for contacting the molecules with the surface to be treated.

In an aspect, there is provided a method for preparing another surface on a surface to be treated, characterized by using molecules comprising at least one covalent bond which

gives rise to free radicals when the molecule is activated thermally, by organic or inorganic reduction-oxidation, photochemically, by shear, by plasma, or else under the influence of ionizing radiation, said method comprising the following steps:

(1) contacting the molecules with the surface to be treated,

(2) activating the covalent bond which gives rise to free radicals thermally, by organic or inorganic reduction-oxidation, photochemically, by shear, by plasma, or else under the influence of ionizing radiation, to form a film with a thickness of less than 10 nm on the surface, and

(3) evaporating, when present, the solubilisation or dispersion solvent employed for contacting the molecules with the surface to be treated.

In another aspect, there is provided the use of the method as defined above, for controlling the structuring of block copolymers, enhancing the printability of inks or paint, the wettability, the weathering or ageing resistance, the adhesion, the biocompatibility, the prevention of migration of inks, the prevention of deposits of proteins, of soiling or of moulds.

Detailed description

CLAIMS

1. A method for preparing another surface on a surface to be treated, characterized by using molecules comprising at least one covalent bond which gives rise to free radicals when the molecule is activated thermally, by organic or inorganic reduction-oxidation, photochemically, by shear, by plasma, or else under the influence of ionizing radiation, said method comprising the following steps:
(1) contacting the molecules with the surface to be treated,
(2) activating the covalent bond which gives rise to free radicals thermally, by organic or inorganic reduction-oxidation, photochemically, by shear, by plasma, or else under the influence of ionizing radiation, to form a film with a thickness of less than 10 nm on the surface, and
(3) evaporating, when present, the solubilisation or dispersion solvent employed for contacting the molecules with the surface to be treated.

2. The method according to claim 1, wherein the covalent bonds which give rise to free radicals have a bond energy of between 90 and 270 kJ/mol.

3. The method according to claim 1, wherein the covalent bonds which give rise to free radicals have a bond energy of between 100 and 170 kJ/mol.

4. The method according to claim 1, wherein the molecule is a polymer.

5. The method according to claim 1, wherein the molecule is a copolymer.

6. The method according to claim 5, wherein the copolymer is a random copolymer.

7. The method according to claim 5, wherein the copolymer is a gradient copolymer.

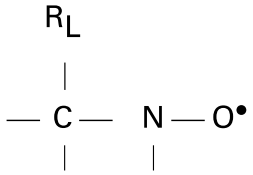
8. The method according to claim 6 or 7, wherein the copolymer has a molecular mass of more than 500 g/mol.

9. The method according to claim 6 or 7, wherein the copolymer has a molecular mass of between 1000 and 20 000 g/mol.

10. The method according to claim 6 or 7, wherein the copolymer is prepared by controlled radical polymerization.

11. The method according to claim 6 or 7, wherein the copolymer is prepared by nitroxide-controlled radical polymerization.

12. The method according to claim 11, wherein the nitroxides conform to the formula below:



(1)

in which the radical R_L has a molar mass of more than 15,0342.

13. The method according to claim 12, wherein the nitroxides is selected from:

- N-tert-butyl 1-phenyl-2-methylpropyl nitroxide,

- N-tert-butyl 1-(2-naphthyl)-2-methylpropyl nitroxide,
- N-tert-butyl 1-diethylphosphono-2,2-dimethylpropyl nitroxide,
- N-tert-butyl 1-dibenzylphosphono-2,2-dimethylpropyl nitroxide,
- N-phenyl 1-diethylphosphono-2,2-dimethylpropyl nitroxide,
- N-phenyl 1-diethylphosphono-1-methylethyl nitroxide,
- N-(1-phenyl-2-methylpropyl) 1-diethylphosphono-1-methylethyl nitroxide,
- 4-oxo-2,2,6,6-tetramethyl-1-piperidinyloxy, and
- 2,4,6-tri-tert-butylphenoxy.

14. The method according to claim 13, wherein the nitroxide is N-tert-butyl 1-diethylphosphono-2,2-dimethylpropyl nitroxide.

15. The method according to any one of claims 1 to 14, wherein the surface to be treated is mineral.

16. The method according to any one of claims 1 to 14, wherein the surface to be treated is metallic.

17. The method according to claim 15, wherein the surface to be treated is of silicon.

18. The method according to claim 16, wherein the surface to be treated is gold.

19. Use of the method according to any one of claims 1 to 14, for controlling the structuring of block copolymers, enhancing the printability of inks or paint, the wettability, the weathering or ageing resistance, the adhesion, the biocompatibility, the prevention of migration of inks, the prevention of deposits of proteins, of soiling or of moulds.