Summary

There is provided a method of forming a nano-patterned substrate comprising the step of forming a plurality of nanostructures on a dielectric substrate, wherein the nanostructures are dimensioned or spaced apart from each other by a scaling factor of the dielectric substrate with reference to a silicon substrate.

According to a first aspect, there is provided a method of forming a nano-patterned substrate comprising the step of forming a plurality of nanostructures on a dielectric substrate, wherein said nanostructures are dimensioned or spaced apart from each other by a scaling factor of said dielectric substrate with reference to a silicon substrate, wherein the scaling factor is a ratio of a refractive index of the silicon substrate to a refractive index of the dielectric substrate ($n_{si}/n_{dielectric}$), wherein n_{si} is the refractive index of the silicon substrate and $n_{dielectric}$ is the refractive index of the dielectric substrate.

There is provided a method of forming a nano-patterned substrate comprising the step of forming a plurality of nanostructures on a dielectric substrate, wherein said dielectric substrate comprises an anti-reflectance layer disposed on a base substrate.

According to a second aspect, there is provided a method of forming a nano-patterned substrate comprising the step of forming a plurality of nanostructures on a dielectric substrate, wherein said dielectric substrate comprises an anti-reflectance layer disposed on a base substrate, and wherein said nanostructures are dimensioned or spaced apart from each other by a scaling factor of said dielectric substrate with reference to a silicon substrate, wherein the scaling factor is a ratio of a refractive index of the silicon substrate to a refractive index of the dielectric substrate ($n_{si}/n_{dielectric}$), wherein n_{si} is the refractive index of the silicon substrate and $n_{dielectric}$ is the refractive index of the dielectric substrate.

There is provided a method of forming a nano-patterned substrate comprising the steps of forming a plurality of nanostructures on a dielectric substrate, wherein the dielectric substrate comprises an anti-reflectance layer disposed on a base substrate, wherein the nanostructures comprise a dielectric material, and wherein the nanostructures are dimensioned or spaced apart from each other by a scaling factor of the dielectric material with reference to a silicon substrate.

According to a third aspect, there is provided a method of forming a nano-patterned substrate comprising the steps of forming a plurality of nanostructures on a dielectric substrate, wherein the dielectric substrate comprises an anti-reflectance layer disposed on a base substrate, wherein the nanostructures comprise a dielectric material, and wherein the nanostructures are dimensioned or spaced apart from each other by a scaling factor of the dielectric material with reference to a silicon substrate, wherein the scaling factor is a ratio of a refractive index of the silicon substrate to a refractive index of the dielectric substrate ($n_{si}/n_{dielectric}$), wherein n_{si} is the refractive index of the silicon substrate and $n_{dielectric}$ is the refractive index of the dielectric substrate.

There is provided a nano-patterned substrate produced by the method as described herein.

Claims

1. A method of forming a nano-patterned substrate comprising the step of forming a plurality of nanostructures on a dielectric substrate,

wherein said nanostructures are dimensioned or spaced apart from each other by a scaling factor of said dielectric substrate with reference to a silicon substrate, wherein the scaling factor is a ratio of a refractive index of the silicon substrate to a refractive index of the dielectric substrate ($n_{si}/n_{dielectric}$), wherein n_{si} is the refractive index of the silicon substrate and $n_{dielectric}$ is the refractive index of the dielectric substrate.

2. The method according to claim 1, wherein the nanostructures are integrally formed on said dielectric substrate.

3. The method according to claim 1 or 2, wherein the surface of the dielectric substrate comprises a plurality of protrusions, recessions or dimples.

4. The method according to any one of claims 1 to 3, wherein the dimension and position of said nanostructures comprises lateral dimensions, vertical dimensions, inter-structure distance or any combinations thereof.

5. The method according to any one of claims 1 to 4, wherein the nanostructure has a geometrical shape selected from the group consisting of disks, tubes, wires, columns, cylinders, pyramidal, conical, rings, and rectangular prisms.

6. The method according to any one of claims 1 to 5, wherein the dielectric substrate is selected from the group consisting of diamond, glass, polyethylene (PE), poly-arylene ethers (PAE), parylene, Teflon, ceramics, mica, polycarbonate (PC), polymethylmethacrylate (PMMA), polyamides, polysiloxane, polypropylene (PP), polyvinyl chloride (PVC), polyethylene terephthalate (PET) or polydimethylsiloxane (PDMS), Titanium dioxide, Gallium Nitride, Titanium Nitride, Gallium Phosphide, and Germanium.

7. The method according to any one of claims 1 to 5, wherein the dielectric substrate comprises a metal or its salt thereof, wherein the metal is selected from the group consisting of Germanium, Titanium, Indium, Gallium, Tin, Lead, Antimony, Bismuth, Lithium, Rubidium, Barium, Zirconium, Tungsten, and Tantalum.

8. A method of forming a nano-patterned substrate comprising the step of forming a plurality of nanostructures on a dielectric substrate,

wherein said dielectric substrate comprises an anti-reflectance layer disposed on a base substrate, and

wherein said nanostructures are dimensioned or spaced apart from each other by a scaling factor of said dielectric substrate with reference to a silicon substrate, wherein the scaling factor is a ratio of a refractive index of the silicon substrate to a refractive index of the dielectric substrate ($n_{si}/n_{dielectric}$), wherein n_{si} is the refractive index of the silicon substrate and $n_{dielectric}$ is the refractive index of the dielectric substrate.

9. The method according to claim 8, wherein the nanostructures are integrally formed on said dielectric substrate.

10. The method according to claim 8 or 9, wherein the anti-reflectance layer has a refractive index determined by $\sqrt{n_{air}n_{sub}}$, wherein n_{air} is the refractive index of air and n_{sub} is the refractive index of the base substrate.

11. The method according to any one of claims 8 to 10, wherein the anti-reflectance layer is of a material selected from a salt.

12. The method according to any one of claims 8 to 11, wherein the anti-reflectance layer has a thickness of about 50 nm to about 100 nm.

13. The method according to any one of claims 8 to 12, wherein the surface of the dielectric substrate comprises a plurality of protrusions, recessions or dimples.

14. The method according to any one of claims 8 to 13, wherein the dimension and position of said nanostructures comprises lateral dimensions, vertical dimensions, inter-structure distance or any combinations thereof.

15. The method according to any one of claims 8 to 14, wherein the nanostructure has a geometrical shape selected from the group consisting of disks, tubes, wires, columns, cylinders, pyramidal, conical, rings, and rectangular prisms.

16. The method according to any one of claims 8 to 15, wherein the base substrate is a dielectric material, or silicon.

17. The method according to claim 16, wherein said dielectric substrate is selected from the group consisting of diamond, glass, polyethylene (PE), poly-arylene ethers (PAE), parylene, Teflon, ceramics, mica, polycarbonate (PC), polymethylmethacrylate (PMMA), polyamides, polysiloxane, polypropylene (PP), polyvinyl chloride (PVC), polyethylene terephthalate (PET) or polydimethylsiloxane (PDMS), Titanium dioxide, Gallium Nitride, Titanium Nitride, Gallium Phosphide, and Germanium.

18. The method according to claim 16, wherein the dielectric substrate comprises a metal or its salt thereof, wherein the metal is selected from the group consisting of Germanium, Titanium, Indium, Gallium, Tin, Lead, Antimony, Bismuth, Lithium, Rubidium, Barium, Zirconium, Tungsten, and Tantalum.

19. A method of forming a nano-patterned substrate comprising the steps of forming a plurality of nanostructures on a dielectric substrate,

wherein the dielectric substrate comprises an anti-reflectance layer disposed on a base substrate, wherein the nanostructures comprise a dielectric material, and

wherein the nanostructures are dimensioned or spaced apart from each other by a scaling factor of the dielectric material with reference to a silicon substrate, wherein the scaling factor is a ratio of a refractive index of the silicon substrate to a refractive index of the dielectric substrate ($n_{si}/n_{dielectric}$), wherein n_{si} is the refractive index of the silicon substrate and $n_{dielectric}$ is the refractive index of the dielectric substrate.