Claims

1. A process for fabricating an ion-implanted layer in a substrate comprising: ablating a target material with incident radiation from a laser in the presence of the substrate and in the presence of a gas at a pressure within the range 72mTorr to 99mTorr, thereby implanting a quantity of the target material into the substrate to form said ion implanted layer such that the penetration depth of the implanted ions is at least 50nm.

2. A process according to any preceding claim wherein said ion implanted layer has a uniform distribution of the implanted ions from the surface of the substrate.

3. A process according to any preceding claim wherein said ion implanted layer has an implanted ion density of at least 10^{21} ions cm^{-3}, or at least 10^{23} ions cm^{-3}.

4. A process according to any preceding claim wherein the process is carried out at a partial pressure within the range 80mTorr to 90mTorr.

5. A process according to any preceding claim wherein the substrate is spaced from the target material by a distance in the range 0mm to 68.6mm.

6. A process according to any preceding claim wherein the substrate is spaced from the target material by a distance in the range 45mm to 68.6mm.

7. A process according to any preceding claim wherein the substrate is spaced from the target material by a distance in the range 71.4mm to 165mm.

8. A process according to any preceding claim wherein the target material is tellurium-based glass.

9. A process according to any preceding claim wherein the substrate is heated.

10. A substrate comprising an ion-implanted layer wherein the penetration depth of the implanted ions is at least 50nm and wherein the ion implanted layer has a uniform distribution of the implanted ions from the surface of the substrate and wherein the substrate is a glass selected from: silica, silicate, phosphate, tellurite, tellurite derivatives, germanate, bismuthate and solgel route glasses, or the substrate is an optical polymer.

11. A substrate according to claim 10 wherein the penetration depth of the implanted ions is at least 200nm.

12. A substrate according to claim 10 where the penetration depth of the implanted ions is at least 500nm.

13. A substrate according to any of claims 10 to 12 wherein the ion implanted layer has an implanted ion density of at least 10^{21} ions cm^{-3}, or at least 10^{23} ions cm^{-3}.

14. A substrate according to claim 10 wherein the substrate is an optical polymer selected from: Poly(methyl methacrylate), polyvinyl alcohol, polyether ether ketone, polyethylene terephthalate, polyimide, polypropylene, and polytetrafluoroethylene.

15. A substrate according to any one of claims 10 to 14 wherein the ion-implanted layer is either:
(i) on an outside face of the substrate; or
(ii) within the substrate.

16. A substrate according to any one of claims 10 to 15 wherein the ion-implanted layer either:
(i) encompasses substantially the whole area of the substrate; or
(ii) comprises one or more zones.

17. A substrate according to claim 16 wherein one or more of the zones overlap.

18. A substrate according to claim 16 or claim 17 wherein the zones comprise the same or different ions.

19. A substrate according to any one of claims 10 to 18 wherein the ion is a cation.

20. A substrate according to claim 19 wherein the cation is selected from the group Nd(3+), Yb(3+), Er(3+), Tm(3+), Pr(3+), Ho(3+), Sm(3+), Eu(3+), Tb(3+), Ce(3+) and La (3+).

21. A waveguide comprising a substrate according to any one of claims 10 to 20.

22. A biosensor comprising an optical substrate any of claims 10 to 20 or a waveguide according to Claim 21.

23. A method for the non-invasive measurement of a metabolite in an animal which comprises:
(i) applying the biosensor of claim 22 on or near said animal, for example

applying said sensor to the skin of the animal, said sensor comprising an optical substrate or waveguide;

(ii) irradiating said substrate or waveguide with a light source, for example, a laser, such that a portion of the light escapes into the animal;

(iii) measuring the photoluminescence lifetime of the escaped light; wherein the recovery lifetime is correlated with the level of the metabolite.