CLAIMS

1. An optical modulator comprising:

a substrate; and

a waveguiding arrangement on the substrate, the waveguiding arrangement comprising:

a surface plasmon waveguide; and

at least one graphene layer arranged to interact with light propagating in the waveguiding arrangement,

wherein the surface plasmon waveguide is designed such that the light interacting with the at least one graphene layer has a maximum intensity overlapping with the at least one graphene layer.

2. The optical modulator as claimed in claim 1, wherein the surface plasmon waveguide is designed to have a thickness of between about 250 nm and about 450 nm.

3. The optical modulator as claimed in claim 1 or 2, wherein the surface plasmon waveguide is designed to have a width of between about 15 μm and about 30 μm.

4. The optical modulator as claimed in any one of claims 1 to 3, wherein the surface plasmon waveguide comprises a dielectric waveguide.

5. The optical modulator as claimed in any one of claims 1 to 4, wherein the at least one graphene layer is arranged on top of the surface plasmon waveguide or is embedded within the surface plasmon waveguide.

6. The optical modulator as claimed in any one of claims 1 to 5, wherein the at least one graphene layer comprises two graphene layers arranged spaced apart from each other.

7. The optical modulator as claimed in any one of claims 1 to 6, wherein the substrate comprises a metal layer.

8. The optical modulator as claimed in any one of claims 1 to 7, further comprising an optical source optically coupled to the waveguiding arrangement.

9. The optical modulator as claimed in claim 8, wherein the optical source is monolithically integrated with the waveguiding arrangement.

10. The optical modulator as claimed in any one of claims 1 to 9, further comprising an optical out-coupler optically coupled to the waveguiding arrangement.

11. A method for forming an optical modulator, the method comprising:

forming a waveguiding arrangement on a substrate, comprising:

forming a surface plasmon waveguide; and

forming at least one graphene layer to interact with light propagating in the waveguiding arrangement,

wherein forming a surface plasmon waveguide comprises designing the surface plasmon waveguide such that the light interacting with the at least one graphene layer has a maximum intensity overlapping with the at least one graphene layer.

12. The method as claimed in claim 11, wherein designing the surface plasmon waveguide comprises designing a thickness of the surface plasmon waveguide to be between about 250 nm and about 450 nm.

13. The method as claimed in claim 11 or 12, wherein designing the surface plasmon waveguide comprises designing a width of the surface plasmon waveguide to be between about 15 μm and about 30 μm.

14. The method as claimed in any one of claims 11 to 13, wherein the surface plasmon waveguide comprises a dielectric waveguide.

15. The method as claimed in any one of claims 11 to 14, wherein forming at least one graphene layer comprises forming the at least one graphene layer on top of the surface plasmon waveguide or embedded within the surface plasmon waveguide.

16. The method as claimed in any one of claims 11 to 15, wherein forming at least one graphene layer comprises forming two graphene layers spaced apart from each other.

17. The method as claimed in any one of claims 11 to 16, further comprising optically coupling an optical source to the waveguiding arrangement.

18. The method as claimed in claim 17, further comprising forming the optical source monolithically integrated with the waveguiding arrangement.

19. A method for controlling an optical modulator, the method comprising:

supplying a light to a waveguiding arrangement of the optical modulator for propagation in the waveguiding arrangement, the waveguiding arrangement comprising a surface plasmon waveguide, and at least one graphene layer arranged to interact with the light, wherein the surface plasmon waveguide is designed such that the light interacting with the at least one graphene layer has a maximum intensity overlapping with the at least one graphene layer; and

applying an electrical signal to the at least one graphene layer.

20. The method as claimed in claim 19, further comprising varying a magnitude of the electrical signal.