CLAIMS

1. An optical modulator comprising:

a substrate;

a waveguiding arrangement on the substrate; and

an optical light source on the substrate, the optical light source being optically coupled to and monolithically integrated with the waveguiding arrangement,

wherein the waveguiding arrangement comprises:

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 out-coupler optically coupled to the waveguiding arrangement.

9. 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; and

forming an optical light source on the substrate, the optical light source being formed optically coupled to and monolithically integrated with 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.

10. The method as claimed in claim 9, 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.

11. The method as claimed in claim 9 or 10, 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.

12. The method as claimed in any one of claims 9 to 11, wherein the surface plasmon waveguide comprises a dielectric waveguide.

13. The method as claimed in any one of claims 9 to 12, 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.

14. The method as claimed in any one of claims 9 to 13, wherein forming at least one graphene layer comprises forming two graphene layers spaced apart from each other.

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

supplying a light using an optical light source to a waveguiding arrangement of the optical modulator for propagation in the waveguiding arrangement, the optical light source and the waveguiding arrangement being formed on a substrate of the optical modulator, wherein the optical light source is optically coupled to and monolithically integrated with the waveguiding arrangement, wherein the waveguiding arrangement comprises a surface plasmon waveguide, and at least one graphene layer arranged to interact with the light, and 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.

16. The method as claimed in claim 15, further comprising varying a magnitude of the electrical signal.