CLAIMS

1 . An electro-optic modulator comprising:

a waveguide, the waveguide comprising aluminium nitride, configured to carry optical light along a longitudinal length of the waveguide;

a first electrically conductive sub-wavelength grating on a first side of the waveguide, the first electrically conductive sub-wavelength grating comprising a plurality of fingers, the plurality of fingers comprising doped polysilicon having a refractive index larger than a refractive index of aluminium nitride comprised in the waveguide, extending substantially perpendicular to the longitudinal length of the waveguide; and

a second electrically conductive sub-wavelength grating on a second side of the waveguide opposite the first side, the second electrically conductive sub-wavelength grating comprising a plurality of fingers, the plurality of fingers comprising doped polysilicon having the refractive index larger than the refractive index of aluminium nitride comprised in the waveguide, extending substantially perpendicular to the longitudinal length of the waveguide;

wherein the electro-optic modulator comprises a first silicon oxide layer comprising silicon oxide between the plurality of fingers of the first electrically conductive sub-wavelength grating such that an effective refractive index of the first electrically conductive sub-wavelength grating is less than the refractive index of aluminium nitride comprised in the waveguide;

wherein the electro-optic modulator comprises a second silicon oxide layer comprising silicon oxide between the plurality of fingers of the second electrically conductive sub-wavelength grating such that an effective refractive index of the second electrically conductive sub-wavelength grating is less than the refractive index of aluminium nitride comprised in the waveguide; and

wherein the electro-optic modulator is configured to modulate the optical light upon application of a potential difference between the first electrically conductive sub-wavelength grating and the second electrically conductive sub-wavelength grating based on Pockels effect.

2. The electro-optic modulator according to claim 1,

wherein the first electrically conductive sub-wavelength grating is over a substrate, the waveguide is over the first sub-wavelength grating, and the second electrically conductive sub-wavelength grating is over the waveguide, such that first sub-wavelength grating, the waveguide and the second electrically conductive sub-wavelength grating form a vertical arrangement over the substrate.

3. The electro-optic modulator according to claim 1,

wherein a period between neighbouring fingers of the first electrically conductive sub-wavelength grating is less than a wavelength of the optical light; and

wherein a period between neighbouring fingers of the second electrically conductive sub-wavelength grating is less than the wavelength of the optical light.

4. The electro-optic modulator according to claim 1,

wherein the optical light comprises a wavelength selected from a range from 1330 nm to 1550 nm.

5. The electro-optic modulator according to claim 1,

wherein the electro-optic modulator is a push-pull Mach-Zehner interferometer (MZI) modulator or a ring modulator.

6. A method of forming an electro-optic modulator, the method comprising:

forming a waveguide, the waveguide comprising aluminium nitride, configured to carry optical light along a longitudinal length of the waveguide;

forming a first electrically conductive sub-wavelength grating on a first side of the waveguide, the first electrically conductive sub-wavelength grating comprising a plurality of fingers, the plurality of fingers comprising doped polysilicon having a

refractive index larger than a refractive index of aluminium nitride comprised in the waveguide, extending substantially perpendicular to the longitudinal length of the waveguide; and

forming a second electrically conductive sub-wavelength grating on a second side of the waveguide opposite the first side, the second electrically conductive sub-wavelength grating comprising a plurality of fingers, the plurality of fingers comprising doped polysilicon having the refractive index larger than the refractive index of aluminium nitride comprised in the waveguide, extending substantially perpendicular to the longitudinal length of the waveguide;

wherein the electro-optic modulator comprises a first silicon oxide layer comprising between the plurality of fingers of the first electrically conductive sub-wavelength grating such that an effective refractive index of the first electrically conductive sub-wavelength grating is less than the refractive index of aluminium nitride comprised in the waveguide;

wherein the electro-optic modulator comprises a second silicon oxide layer comprising between the plurality of fingers of the second electrically conductive sub-wavelength grating such that an effective refractive index of the second electrically conductive sub-wavelength grating is less than the refractive index of aluminium nitride comprised in the waveguide; and

wherein the electro-optic modulator is configured to modulate the optical light upon application of a potential difference between the first electrically conductive sub-wavelength grating and the second electrically conductive sub-wavelength grating based on Pockels effect.

7. The method according to claim 6,

wherein the first electrically conductive sub-wavelength grating is formed over a substrate;

wherein the waveguide is formed over the first electrically conductive sub-wavelength grating after forming the first electrically conductive sub-wavelength grating; and

wherein the second electrically conductive sub-wavelength grating is formed over the waveguide after forming the waveguide.

8. The method according to claim 6,

wherein forming the waveguide comprises depositing aluminium nitride (AlN) via chemical vapor deposition or physical vapor deposition.

9. The method according to claim 6,

wherein forming the first electrically conductive sub-wavelength grating and forming the second electrically conductive sub-wavelength grating comprise depositing polysilicon via chemical vapor deposition or physical vapor deposition, patterning the deposited polysilicon, and doping the patterned polysilicon via ion implantation.

10. The method according to claim 9, further comprising:

annealing after forming the second electrically conductive sub-wavelength grating.

11. The method according to claim 6, further comprising:

forming a first metal via to electrically connect to the first electrically conductive sub-wavelength grating and a second metal via to electrically connect to the second electrically conductive sub-wavelength grating after forming the first electrically conductive sub-wavelength grating and the second electrically conductive sub-wavelength grating.

12. The method according to claim 6,

wherein a period between neighbouring fingers of the first electrically conductive sub-wavelength grating is less than a wavelength of the optical light; and

wherein a period between neighbouring fingers of the second electrically conductive sub-wavelength grating is less than the wavelength of the optical light.

13. The method according to claim 6,

wherein the electro-optic modulator is a push-pull Mach-Zehner interferometer (MZI) modulator or a ring modulator.