Claims

1. A device comprising:

a substrate ~~(110; 510)~~;

at least one resonator ~~(130; 530)~~ on the substrate, each resonator being resonant at a predetermined wavelength of electromagnetic radiation and configured to support a whispering gallery resonant mode in which electromagnetic radiation of the predetermined wavelength is concentrated in a region adjacent to the resonator circumference;

a waveguide ~~(120; 520)~~ on the substrate, coupled to the at least one resonator for guiding the electromagnetic radiation to the at least one resonator; and

a low refractive index region ~~(260; 560)~~ comprising an air gap between each resonator and the substrate, the low refractive index region having a lower refractive index than a material of the resonator; and

a support layer on the substrate, supporting the resonator and laterally adjacent to the air gap,

wherein the low refractive index region for each resonator has a width corresponding to a width of the region in which the electromagnetic radiation is concentrated.

2. The device of claim 1, wherein the low refractive index region for each resonator has a width substantially equal to the width of the region in which the electromagnetic radiation is concentrated.

~~3. The device of claim 1 or 2, wherein the low refractive index region is an air gap (260) between the resonator and the substrate.~~

~~4. The device of claim 3, further comprising:~~

~~a support layer (232) on the substrate, supporting the resonator and laterally adjacent to the air gap.~~

~~5~~3. The device of claim ~~4~~1 or 2, wherein the substrate and the support layer are both formed of Indium Phosphide InP.

~~6~~4. The device of claim ~~3, 4 or 5~~1, 2 or 3, further comprising:

an etch stop layer ~~(212)~~ on the substrate, between the substrate and the low refractive index region.

~~7. The device of claim 1 or 2, wherein the low-refractive index region comprises a dielectric layer (560) between the resonator and the substrate.~~

~~8~~5. The device of any one of the preceding claims, wherein the resonator includes a first cladding layer having a first band gap, an absorbing layer over the first cladding layer, and a second cladding layer having a second band gap and disposed over the absorbing layer,

wherein the absorbing layer has a lower band gap than the first and second band gaps, the band gap of the absorbing layer being selected so that electromagnetic radiation coupled into the resonator is absorbed in the absorbing layer, and

wherein the low refractive index region is disposed between the substrate and the first cladding layer and adjacent to the first cladding layer.

~~9~~6. The device of any one of the preceding claims, wherein the low refractive index region is annular.

~~10~~7. The device of any one of the preceding claims, wherein the device is a spectrometer for detecting a plurality of predetermined wavelengths of electromagnetic radiation, and

wherein the device comprises a plurality of resonators each configured to be resonant at a different one of the plurality of predetermined wavelengths.

~~11~~8. The device of any one of the preceding claims, wherein the waveguide is disposed laterally adjacent to the at least one resonator and is side-coupled to the at least one resonator.

~~12~~9. The device of any one of the preceding claims, wherein the waveguide is connected to the at least one resonator.

~~13~~10. Use of a low-refractive index region between a resonator and a substrate to reduce losses from the resonator in a device comprising the substrate, the resonator