Claims

1. A device for guiding and absorbing electromagnetic radiation, the device comprising:

absorbing means for absorbing the electromagnetic radiation ~~(130)~~, the absorbing means comprising a multilayer structure; and

a waveguide ~~(120)~~ coupled to the absorbing means for guiding the electromagnetic radiation to the absorbing means, the waveguide comprising the same multilayer structure as the absorbing means;~~,~~

wherein the ~~waveguide and the absorbing means are formed from a~~ multilayer structure comprises~~ing~~ a first cladding layer, a second cladding layer over the first cladding layer, and a quantum-well layer between the first and second cladding layers, the quantum-well layer being formed of a material having a different composition to the first and second cladding layers,

wherein the thickness and the composition of the quantum-well layer is optimised to provide an acceptable level of absorption of electromagnetic radiation in the waveguide while providing an appropriate band gap for absorption of the electromagnetic radiation in the absorbing means.

2. A device according to claim 1, further comprising a substrate ~~(110)~~, wherein the waveguide and the absorbing means are provided on the substrate and the absorbing means comprises at least one resonator, the or each of the at least one resonators being resonant at a predetermined wavelength of the electromagnetic radiation.

3. A device according to claim 2, wherein the acceptable level of absorption in the waveguide is a minimum level of absorption obtainable within a predetermined range of thicknesses and compositions of the quantum-well layer, such that the thickness and composition of the quantum-well is optimised to minimise absorption in the waveguide.

4. A device according to claim 2 or 3, wherein the thickness and the composition of the quantum well are configured to provide a desired quantum well band gap while maximising a quality Q factor of resonance of the resonators and keeping the strain within the active layer lower than a maximum suitable value.

5. A device according to claim 4, wherein the maximum suitable value is 1.5%.

6. The device according to any one of the preceding claims, wherein the quantum-well layer has a thickness that is substantially less than a thickness of the waveguide.

7. A device according to any one of the preceding claims, wherein the device is a spectrometer.

8. The device according to claim 7, wherein the quantum-well layer is configured to have a composition and thickness providing a band-gap that is less than or equal to a predetermined energy, the predetermined energy corresponding to a maximum wavelength λ_{max} of electromagnetic radiation that the spectrometer is configured to detect.

9. The device according to claim 8, wherein the resonators have a minimum free-spectral range FSR value corresponding to a wavelength interval $\Delta\lambda$ and the quantum well layer is configured to have a composition and thickness providing a ground state transition energy corresponding to the energy of radiation at a wavelength $\lambda_{max}+\Delta\lambda$.

10. A method of optimising a layer thickness and composition of a quantum-well layer for a device for guiding and absorbing electromagnetic radiation, the device comprising ~~a substrate (110);~~ absorption means ~~located (130) on the substrate~~ for absorbing the electromagnetic radiation, the absorbing means comprising a multilayer structure; a waveguide ~~(120)~~ comprising the same multilayer structure as the absorbing means ~~on the substrate~~, the waveguide being coupled to the absorption means for guiding the electromagnetic radiation to the absorption means, wherein the ~~waveguide and the absorbing means are formed from a~~multilayer structure comprises~~ing~~ a first cladding layer, a second cladding layer over the first cladding layer, and the quantum-well layer between the first and second cladding layers, the quantum-well layer being formed of a material having a different composition to the first and second cladding layers, the method comprising:

determining an appropriate ~~quantum well ground state transition energy~~band gap for the quantum-well layer for absorption of the electromagnetic radiation in the absorbing means; and

determining the thickness and the composition of the quantum well that are configured to provide the desired band gap~~ground state transition energy~~ and provide an acceptable level of absorption in the waveguide.

11. A method according to claim 10, wherein the device further comprises a substrate, the absorbing means and the waveguide being provided on the substrate and the absorbing means comprising at least one resonators, the or each of the at least one resonators being resonant at a predetermined wavelength of radiation and wherein determining the thickness and the composition comprises determining the thickness and the composition that are configured to provide the desired band gap~~ground state transition energy~~, while maximising a quality Q factor of resonance of the resonators and keeping the strain within the quantum-well layer lower than a predetermined acceptable limit.

12. A method according to claim 11, wherein determining the thickness and the composition of the quantum well comprises:

selecting an initial thickness and composition of the quantum-well layer from a predetermined range of thicknesses and compositions;

determining a bend loss in the at least one resonators based on the initial thickness and composition;

obtaining a value of the Q factor for the resonator, based on the bend loss;

determining whether the obtained value of the Q factor is a maximum available value of the Q factor within the predetermined range of thicknesses and compositions;

obtaining a value of strain in the quantum-well layer based on the selected thickness and composition;

determining whether the obtained value of the strain is below the predetermined acceptable limit; and

using the selected thickness and composition as the final thickness and composition of the quantum-well layer, if it is determined that the value of the Q