Technology Profile Fact Sheet

Title: Method of fabricating an optical device using multiple sacrificial spacer layers

Aliases: Optically Controlled Laser, Gain Quenched Laser Logic, Mode Transition-Discrimination (MTD) photonic logic, High Reflectance Mirror, Coherent Light Generators having an Air Gap

Technical Challenge: The primary aim of this technology is the integration of semiconductor lasers to planar optical components such as waveguides, semiconductor optical amplifiers (SOAs), and detectors for Photonic Integrated Circuit (PIC) applications. Lasers such as semiconductor ridge lasers are useful as elements of PICs because these lasers emit light horizontally, so light can be processed by another element that is formed on the horizontal plane of the substrate of the PIC. When working with these types of PICs it is essential to control reflections from the interfaces between the lasers and the integrated photonic components.

Description: This application is for a method of fabricating multiple, integrated, buried-gap structures using standard microelectronics process tools. A method was previously patented (U.S. Patent No. 6,835,581) that allows for direct control of the reflections by deposition of specifically designed dielectric layers. Higher operating speed and lower power consumption is achievable when reflectance is increased. A great improvement on this prior patent is the selected removal of a specific section of the deposited dielectric layers. A key developed process is the use of sacrificial spacer layers (S2L) to create precise air gaps between coherent light generators and the waveguides that interconnect them, thereby delivering enhanced integrated laser performance. This process allows for increased or decreased reflectance at PIC interfaces.

This invention uses a simple wet chemical etch to remove the S2L. This is a method that is compatible with the fabrication of photonic integrated circuits. These buried gap structures are currently used as high reflectance mirrors for integrated, laser-based, photonic logic devices. The higher reflectance available from gap structures allows us to manufacture laser structures that were not previously practical to fabricate. The same process can be used for creation of low reflectance interfaces if required.

Demonstration Capability: Test devices have been fabricated which demonstrate the use of precise gaps using sacrificial spacer layers.

Potential Commercial Application(s): This method provides for the fabrication of integrated semiconductor lasers to be used in the optical telecommunication industry.

Patent Status: A patent application has been filed with the USPTO.

Reference Number: 1489