GUIDING LIGHT IN SILICON : NEW MATERIALS AND BUILDING BLOCKS

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Waveguides are a very interesting component in nanophotonic integrated circuits. They are of course necessary for interconnects, but a lot of elements are also based on waveguides. This presentation will describe the study of new nanoSilicon waveguides and some others nanophotonics structures, more particularly the ring and disk resonators. We will study three various type of materials, one new in term of waveguide (SiOC) and two well-known for waveguides applications (Silicon On Insulator and SOI Slot waveguides).

For SiOC, the aim of the work is focused on the molecular design, synthesis and optical characterization of polymer-derived ceramics thin films. SiOC thin films with a different chemical structure are produced by sol-gel method using a mixture of triethoxysilane (T^H) and methyldiethoxysilane (D^H) with a T^H /D^H molar ratio of 1, 2 and 9. For comparison Si/SiO2 films were also produced by using only T^H. Thin films are deposited on SiO_2 and Si substrate by spin coating and pyrolysed in carbon furnace under Ar flow at temperatures in the range of 800°–1250°C. The samples were investigated by absorption and photoluminescence spectroscopy. Emission in the yellow band (550nm) was observed at room temperature from the sample T^H /D^H = 2 annealed from about 1100°C upon continuous-wave excitation at 365nm. We have demonstrated high luminescence in visible range for all sample and also 5% external quantum efficiency on these thin films.

For SOI and SOI slot waveguides, we present detailed measurements performed on guides coupled to ring resonators and disk resonators. For the slot waveguides, the samples are sandwich waveguides structures, in which the slot-layer is SiO_x, deposited either by low pressure chemical vapour deposition (LPCVD) or plasma enhanced CVD (PECVD) technique. Several structures were considered, regarding the influence of the ring/disk dimension, the gap between the ring and the waveguide (also referred to as coupling distance).