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Integrated silicon photonic chips for highly multiplexed early cancer biomarker detection

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An efficient and robust method for series connection of photonic crystal micro cavities that are coupled to photonic crystal waveguides in the slow light transmission regime was experimentally demonstrated. It was shown that group index taper engineering provides excellent optical impedance matching between the input and output strip waveguides and the photonic crystal waveguide, a nearly flat transmission over the entire guided mode spectrum and clear multi-resonance peaks corresponding to individual micro cavities that are connected in series. Series connected photonic crystal micro cavities are further multiplexed in parallel using cascaded multimode interference power splitters to generate a high density silicon nano photonic microarray comprising 64 photonic crystal micro cavity sensors, all of which are interrogated simultaneously at the same instant of time. The devices were fabricated on a SOI wafer with 250 nm silicon layer and 3 μ m buried oxide (BOX) layer. All components including PCWs, PC micro cavities, group index tapers and strip waveguides are patterned on SOI chip simultaneously. PCW devices with and without PC tapers were fabricated on the same chip. Light is coupled into and out of the devices using sub wavelength grating couplers via polarization maintaining single mode fiber on the input side and standard single mode fiber on the output side respectively. Optical spectrum analyzer (OSA) is used to analyze the transmitted light. All the transmission spectra of PC devices with and without PC tapers were normalized to the spectrum from a reference waveguide comprising two grating couplers and one single strip waveguide. All spectra are measured in water with the objective to implement biosensing.

Biography

Ray T Chen is a professor in the Department of Electrical and Computer Engineering at The University of Texas Austin, and holds the Cullen Trust for Higher Education Endowed Professorship in Engineering. From 1988 to 1992 Chen worked as a research scientist, manager, and director of the Department of Electro-Optic Engineering at the Physical Optics Corporation in Torrance, California. Chen served as the CTO, Founder, and Chairman of the Board of Radiant Research, Inc. from 2000 to 2001, where he raised 18 million dollars A-Round funding to commercialize polymer-based photonic devices involving over twenty patents, which were acquired by Finisar in 2002, a publicly traded company in the Silicon Valley (NASDAQ:FNSR). He also serves as the founder and Chairman of the Board of Omega Optics Inc. since its initiation in 2001. Omega Optics has received over five million dollars in research funding. His research work has been awarded over 100 research grants and contracts from such sponsors as DOD, NSF, DOE, EPA, NIH, NASA, the State of Texas, and private industry. Chen's group at UT Austin has reported its research findings in more than 650 published papers, including over 85 invited papers. He holds 20 issued patents. He has chaired or been a program-committee member for more than 100 domestic and international conferences. He has served as an editor, co-editor or coauthor for over twenty books and special issues.

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