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The Effect of Mode Area and Refractive Index for Optical TE Mode Propagation in Hybrid LN/Si Electro-Optic Structure of Mach-Zehnder Modulator

Luma Z Mohammed[1], Makram A. Fakhri[2], A. K. Abass[3]
[1,2,3]*Laser and Optoelectronic department, University of Technology, 10066 Baghdad, Iraq.*
lumazuhair@gmail.com, mokaram_76@yahoo.com, 140017@uotechnology.edu.iq

Abstract— *We propose and analyse a silicon based hybrid modulator on the nano thin film of the lithium niobate or commonly known as silicon-on-insulator technology. The Mach–Zehnder stripe optical waveguide of electro-optical modulator operats at GHz frequencies with large bandwidth and low losses between electrical and optical frequencies.The design and simulation of Mach-Zehnder modulator is based on a hybrid integration platform of silicon and lithium niobate that satisfies a single mode condition. The Silicon stripe waveguide is of 0.6 μm thickness in a silicon on insulator (SOI) of width 15 um and 0.05 um thickness x-cut LiNbO3 thin film, all sets use the pulse laser deposition (PLD) method. The Optical electric field distributions and effective mode area in the optical-waveguides were studied and discussed in this designated waveguide.The relationship between the width of waveguides regions with effective mode index and effective mode area was investigated. At 0.6 um width of waveguide and 0.2 um thickness, the effective mode index 1.9802 was recorded while the effective mode area 0.144 um2 was monitored. This shows the decrement in both: the width and thickness of the waveguide with the effective mode index and effective mode area.*

Index Terms—*lithium niobate; effective mode index; effective mode area; thin film; TE Mode*

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