ABSTRACT

The multi-cavity and multi-mode thermo-optic tuners based on silicon-on-insulator have been designed and simulated in this work. The microcavity inside the waveguide has 24 standing wave modes and a 7.302μm length with four mirrors at its ends. This work is purely theoretical, and the main objective is to study the temperature profile of the cavities and improve the thermal and tuning efficiencies of the multi-cavity thermo-optic tuners used in filtering and tuning applications. The finite element analysis, thermo-optic effect, and conduction of heat concepts are used in this work. Design and thermal simulations of multi-cavity Fabry-Perot resonators are performed using SolidWorks. First, the single-cavity up to seven-cavity resonators are designed and simulated and observed that the single-cavity resonator is the most efficient among them with a thermal efficiency of 16.07K/mW. The air gaps of multiple widths are introduced in the structure of the Fabry-Perot resonators and noticed that the thermal and tuning efficiencies of the resonators improved. The maximum thermal efficiency is 24.925 K/mW noticed for the single-cavity resonator with an air gap of 8.20μm. The heater design is modified in these structures and maximum efficiency among all structures is improved to 32K/mW. The Fabry-Perot resonator with a modified heater and an air gap of 8.20μm is the most efficient model concluded in this work. At the end, empirical formulae are presented to optimize the thermal efficiency of the N-cavity resonator.