

## Crystalline Si-Based Tunable Fabry-Perot Filter for In-Plane Optical Integration

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In this paper, we present the crystalline Si-based tunable Fabry-Perot filter, which is able to be integrated for alignment with other optical devices on an in-plane substrate. The tunable Fabry-Perot filter is comprised of an air-gap resonator formed between two crystalline Si-reflecting mirrors fabricated by a silicon deep reactive ion etching (Si DRIE) process. The optical fibers can be horizontally aligned on the fabricated Fabry-Perot filter by exploiting an in-plane device structure. Tunability of the filter is achieved by changing the air-gap by actuating an electrostatic comb driver. The fabricated tunable Fabry-Perot filter showed high performance of the reflectance characteristics, such as a wide tuning range of over 80 nm and a high tuning sensitivity of 11.7 nm/V. When input voltage increases, a notch in the reflectance spectrum shifts to a longer wavelength and the wavelength tuning efficiency is 0.2 with respect to the displacement of a movable reflecting mirror. The response time for wavelength tuning was demonstrated to be less than 5 ms for both up and down tuning of 45 nm.