nm and by changing the section lengths to L_1 = 4 μm, L_2 = 3.5 μm, L_3 = 0.8 μm, 3 dB operation of the device can be restored. Dielectric film thickness accuracy within a few nm can be readily achieved using standard fabrication processes, for example plasma enhanced chemical vapor deposition (PECVD) [25]. Although we have considered only one possible scenario, i.e., variation of waveguide spacing, the effects of other fabrication imperfections on the coupler performance, e.g., variation of waveguide width (w) or variations of both waveguide width (w) and gap (d_{coup}) can also be corrected in a similar manner. The proposed design, therefore, has the additional advantage to be able to compensate for fabrication imperfections and thus is more robust in terms of fabrication tolerance.

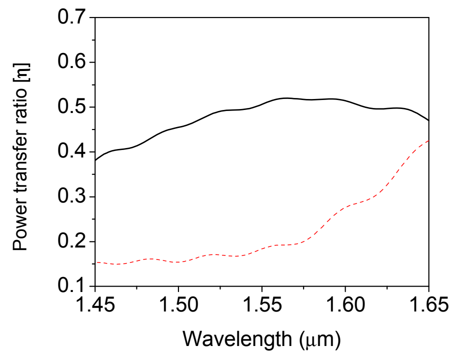

Fig. 5. Power transfer ratio of the broadband coupler when gap width is increased by 30 nm from final design (dashed line) and after the adjustment of metal section length and spacer thickness (solid line).

5. Conclusion

We have proposed a broadband directional coupler for silicon on insulator platform using the recently proposed HPWG. The device is very short, has low insertion loss and is wavelength insensitive over more than a 150 nm bandwidth with less than 5% variation of power transfer ratio. Performance of the device compares favorably against previously reported devices. Both adiabatic couplers [5] and directional coupler using a Mach-Zehnder interferometer [7] can offer a broadband response but require length exceeding several hundred micrometers. In contrast the proposed HPWG based directional coupler, while has a wavelength independent response over 150 nm bandwidth with an imbalance less than 5% and a length of less than 10 μm. The design presented in this work therefore, can be an important component for future silicon based optical communications systems.

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