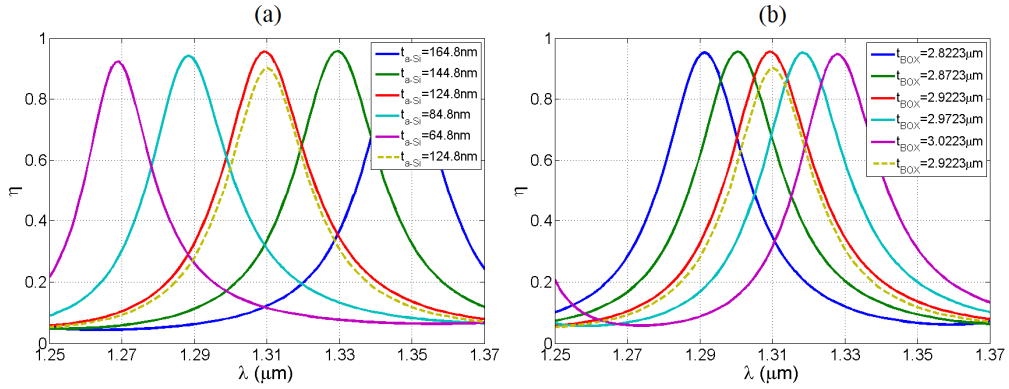

Fig. 7. The quantum efficiency plotted as a function of incoming laser wavelength with adjustment in (a) a-Si layer thickness and (b) BOX layer thickness. The solid lines are simulated via 2D FDTD method with Bloch boundary condition in the horizontal direction, and the dashed lines are simulated via full-structure 3D FDTD method.

4. Summary

A critically coupled Ge photodetector fabricated on SOI substrate under vertical illumination is proposed and studied. The analytical calculations are verified with numerical simulations, and it is shown that a > 90% quantum efficiency and > 50 GHz optical bandwidth operation at 1310 nm wavelength is accessible. Consequently, the corresponding EBP is enhanced by an order of magnitude compared to conventional Ge-on-Si photodetectors. The spectral FWHM of an optimum design is ~30 nm, and further improvement on the spectral response to feature a "flat-top" shape may be obtained by designing a dielectric mirror with anomalous dispersion [24]. This can be an attractive solution not only as a robust, stand-alone photodetector but also for application of wavelength-division multiplexing (WDM) in vertical illumination configuration.

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