structure is same as that of Fig. 11 but with silicon nitride ($\varepsilon_{spacer} = 4$) spacer layer in the bend region and silica spacer layer in the straight waveguide section. Transmission is significantly enhanced for both cover material i.e. air and silica.

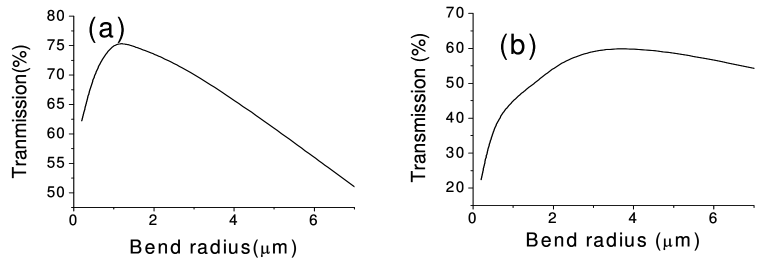

Fig. 13. Transmission through 90 degree bend for different bend radii for two different cover materials (a) air (b) silica. Spacer is silicon nitride in bend and silica in straight sections.

The effect of the silicon nitride spacer is further illustrated in Fig. 14. The structure is same as that shown in Fig. 12 but the spacer layer is now silicon nitride in the bend region. A standing wave is formed in the bend region because of index mismatch between bend and straight section but an improvement in transmission is evident.

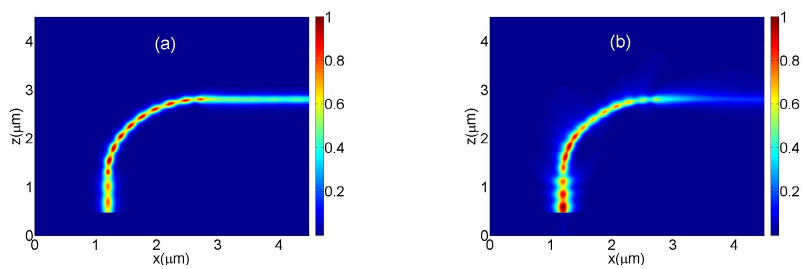

Fig. 14. E_y field intensity for a 90 degree bend with bend radius of 1.5 µm when cover medium is (a) air (b) silica. Spacer layer is silica nitride in bend and silica is straight sections.

For plasmonic waveguide bend, there is a trade off between propagation loss and radiation loss. Increase in mode confinement will result in reduced radiation loss. However, as the results of the parametric study in section 2 shows, increase in mode confinement also results in increased propagation loss. Transmission through bend reaches a maximum for an optimum bend radius. Waveguide dimensions, material properties and bend radius should be properly chosen to simultaneously achieve good confinement and high transmission through bends.

4. Conclusions

The properties of the hybrid mode guided by the waveguide consisting of a high dielectric medium adjacent to a metal plane with a thin low dielectric spacer are investigated. Power is concentrated in the low index spacer region for this waveguide. The hybrid waveguide is capable of guiding light efficiently through sub-micron bends. A design including the use of two different spacer materials in straight and bend sections is proposed to minimize bend loss. In addition to the capability of guiding light through tight bends, the hybrid guiding scheme offers a number of additional advantages. By suitable choice of materials it can be made compatible with silicon on insulator technology. It has high field intensity in the low index spacer layer and hence can be useful for sensing applications. More work is necessary to fully evaluate the potential of the hybrid wave guiding scheme for practical applications.

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