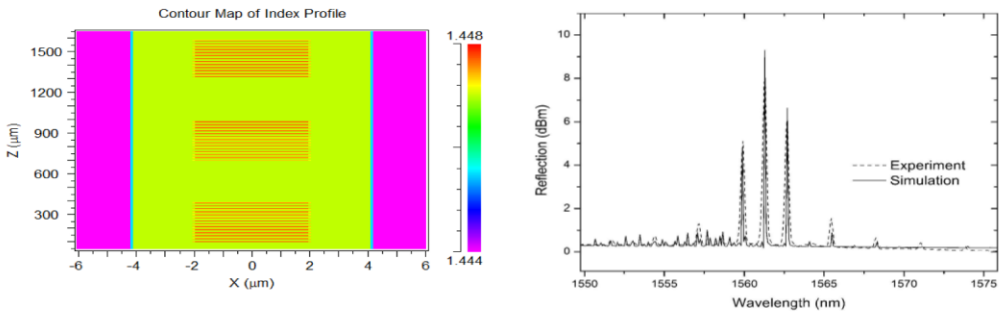

(a) (b)

Fig. 10. (a) Index profile of a superstructure fiber Bragg grating. (b) Experimental and theoretical reflection spectrum from the SFG.

As we observe from Fig. 10 (b) the experimental measurements and modeling show very strong agreement with regard to the resonances wavelength, reflectivity and peak separation of the resonances. Furthermore, side–band resonances around the central peak and the prediction of peaks with far lower power levels confirm that our modeling is very accurate over a wide range of wavelengths. Despite the agreement between experimental and simulated results there is a difference in the FWHM between spectra, nonetheless this is the first accurate modeling of superstructure gratings via this method, and further refinement is under way. Finally, when modeling these gratings we set the superstructure to be highly symmetric (near the center of fiber core), and we note the excellent agreement with the experimental results, which indicates that the inscribed superstructure is the very close to the fiber axis.

6. Conclusion

We have applied both FEM and bidirectional BPM to completely describe the transmission and reflection spectra of PbP femtosecond laser inscribed FBGs, predicting insertion loss and all dominant cladding and ghost modes that are strongly dependant on the FBG position in the core. We have proven that symmetry breaking is responsible for phase mismatching and the transmission spectrum can be affected even by a minute tilt between the grating and fiber axis. Moreover, superstructure gratings have been successfully modeled. Further investigation of superstructure characteristics will follow in the future. This analysis and approach can be used to improve and optimize the inscription of PbP fiber Bragg gratings that are simple or complex in nature.

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