

A Loss Comparison of Flat-Fibre and Silica-on-Silicon Direct UV Written Waveguides using A Novel Bragg Grating Measurement Technique

S. Ambran, H.L. Rogers, A. S. Webb, J.C. Gates, C. Holmes, P. G. R. Smith, J. K. Sahu

Optoelectronics Research Centre

University of Southampton

Southampton, UK

sa4g09@orc.soton.ac.uk

We demonstrate a novel method for measuring propagation loss using UV written waveguides in two different planar geometrics flat-fibre [1] and silica-on-silicon [2]. The method allows simple and effective measurement without the need for physical cutback. The Direct Grating Writing (DGW) technique is used to produce Bragg gratings and waveguides simultaneously by locally changing the refractive index of a photosensitive core layer [2]. The core layers were doped with Germanium (Ge) and Boron (B) to increase the photosensitivity. The losses were measured by taking the ratio between the reflectivities in the forward and reverse directions of a series of Bragg gratings at different wavelengths distributed along the waveguide. The relationship of loss, L (dB/cm) is depicted in equation (1),

$$L = \frac{(P_1 - P_2) + (P_2' - P_1')}{4d} \quad (1)$$

where P and P' are the reflectivities in the forward and reverse directions respectively measured in dB and d is the separation of the gratings in cm. There were ten separate Bragg gratings in a 40 mm long sample. The losses for the flat-fibre and silica-on-silicon waveguides were found to be 0.12 dB/cm and 0.24 dB/cm respectively as depicted in Figure 1. The loss for the silica-on-silicon is twice that of the flat-fibre sample. This is due to the advantages of modified chemical vapour deposition (MCVD) fabrication of flat-fibre. Svalgaard and Kristensen reported that the loss for silica-on-silicon waveguides produced by plasma enhanced chemical vapour deposition (PECVD) was <0.2 dB/cm [3], which approximately agrees with the losses observed in the flame hydrolysis deposition (FHD) fabricated silica-on-silicon.

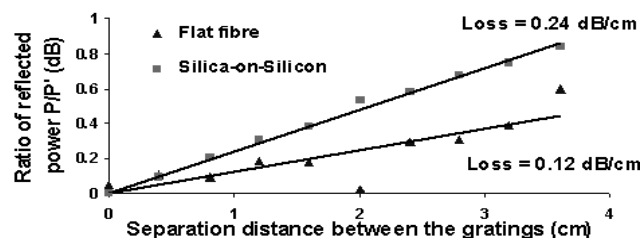


Figure 1: Propagation loss measured using pairs of Bragg gratings in flat-fibre and silica-on-silicon samples

[1] A.S. Webb, F.R. Mahamd Adikan, J.K. Sahu, R.J. Standish, C.B.E. Gawith, J.C. Gates, P.G.R. Smith and D.N. Payne. "MCVD planar substrates for UV-written waveguide devices" Elec. Lett, 43, No. 9, 2007.

[2] G.D. Emmerson, S.P. Watts, C.B.E. Gawith, V. Albanis, M. Ibsen, R.B. Williams, P.G. R. Smith. "Fabrication of directly UV-written channel waveguides with simultaneously defined integral Bragg gratings" Elec. Lett., 38, 1531-1532, 2002.

[3] M.Svalgaard and M. Kristensen. "Directly UV written silica-on-silicon planar waveguides with low loss" Elec. Lett.33 (10), 861-863, 1997.