Development of a Broadband Non-zero Dispersion Flattened Fiber

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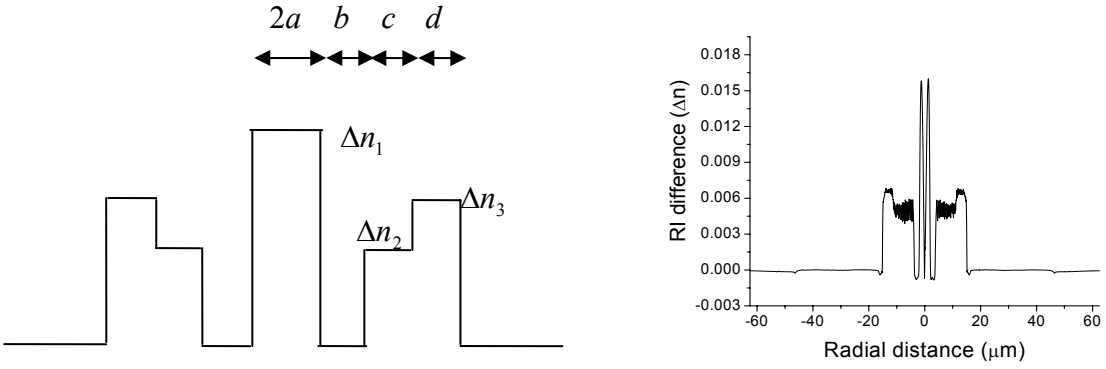
We present a newly developed dispersion flattened optical fiber having a 3-core refractive index profile for flat non-zero dispersion in the S, C. L and L+ band region. Measured dispersion showed flat properties from 1530 nm to 1625 nm and dispersion slope was estimated to be ~0.05 ps/km.nm^2 at 1550 nm. Theory predicted a near flat dispersion band from 1480 nm to 1800 nm.

A high bandwidth demand has been triggered in the optical communication due to the increased use of the internet all over the world. For every band of optical communication, care has to be taken for high bit rate transmission and wavelength division multiplexing (WDM) by decreasing dispersion or by having flat dispersion over the entire bands, allowing a small value of dispersion to avoid nonlinear issues like self-phase modulation etc. Earlier there were successful efforts to address these issues for C and L band (1.5μm -1.65 μm) [1-3]. However, the dispersion slope of large values (e.g. about 9 ps/km.nm^2) will cause problems in the long haul WDM optical fiber communication link due to accumulated dispersion. In the current communication, we report a newly fabricated optical fiber, which was optimized for flat dispersion in the entire S/S+, C, L and L+ bands, dispersion slope is far less (about 0.05 at 1.55 μm) as compared to the other fibers reported, giving a flat dispersion operation.

The MCVD technique was used to fabricate the alumino-germano-silicate optical fiber preform having a 3-core refractive index structure. The fiber was drawn with an outer diameter of 125 μm. The refractive index (RI) profile of the fiber was measured using the preform analyzer (NetTest P104) and the dispersion was measured using the EXPO-CD measurement system.

The proposed refractive index profile for the 3-core non-zero dispersion flattened fiber (NZDFF) is shown in Fig. 1(a) where a core has been surrounded by two consecutive outer cores and they are separated by the inner cladding layer. The experimentally fabricated optical fiber had the RI profile as shown in Fig. 1(b), which was fabricated using the optimum values of different parameters as listed in Table 1.



(a) (b)

Fig. 1. (a) Proposed RI profile structure of the 3-core NZDFF, and (b) Experimentally fabricated NZDFF.

Table 1: Design parameters of the 3-core NZDFF.

a	b	c	d	Δn_1	Δn_2	Δn_3
2.5	1.75	7.28	3.75	0.016	0.0036	0.0047

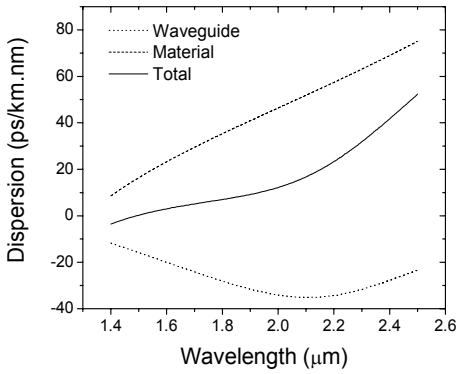
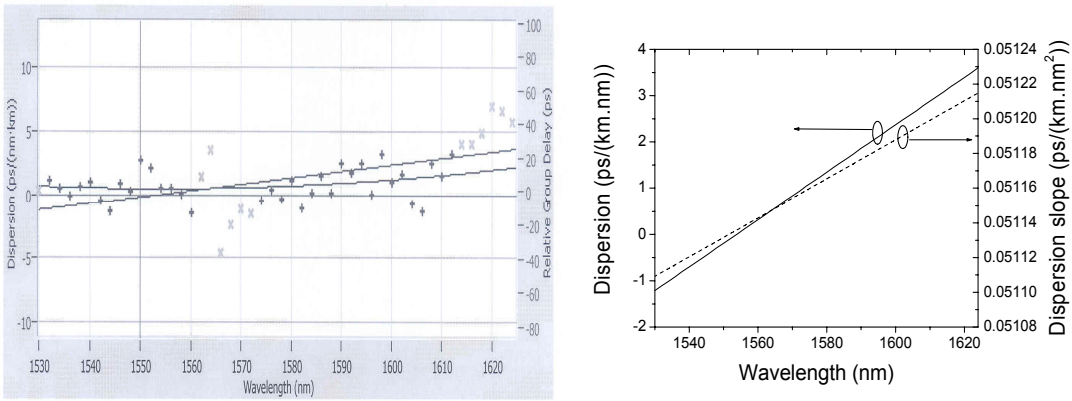


Fig. 2. Spectral variation of dispersion of the 3-core NZDFF.

The calculated spectral variation of dispersion for the proposed fiber is shown in Fig. 2 where the dispersion was found to be nearly flat in the range of 1400 nm to 1800 nm. The measured dispersion is displayed in Fig 3(a) and the dispersion slope was about 0.05 ps/km.nm^2 in entire C, L and L+ band ranges as illustrated in Fig. 3(b).



(a) (b)

Fig. 3. Spectral variations of (a) the measured dispersion, and (b) the dispersion slope of the 3-core NZDFF.

Acknowledgments

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References

[1] K. Ohsone, T. Nishio, and T. Yamazaki, Hitachi Cable Review 19 (2000) 45-48.

[2] T. Okuno, H. Hatayama, T. Sasaki, K. Soma, A. Moto, Y. Hirano, M. Onishi, and M. Shigematsu, Electronics Letters 40/12 (2004) 723 – 724.

[3] R. K. Varshney, A. K. Ghatak, and I. C. Goyal, Optical Engineering 46/4 (2007). 045001/1-045001/8.