Highly birefringent all-normal dispersion silica fiber with flat dispersion profile in the 1200–2100 nm wavelength range

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Highly birefringent, polarization-maintaining (PM) optical fibers with all-normal dispersion (ANDi) are in great demand nowadays as a potential use for supercontinuum generation [1], dispersion management of ultrafast mode-locked oscillators [2] or as stretchers for chirped pulse amplification (CPA) systems [3]. Such optical fiber, suitable for abovementioned applications should have a high polarization extinction ratio (PER, of at least -20 dB), low transmission losses, and a dispersion profile with plateau over a possibly broad spectral range, covering the emission spectra of most common fiber lasers: Erbium- (1520 – 1600 nm) and Thulium-doped (1700 – 2100 nm). The dispersion compensating fibers (DCFs) available on the market are either non-PM, or designed to provide negative dispersion only in a narrow wavelength range. A broad and flat dispersion profile can be obtained in microstructured fibers with cladding containing a structure of air-holes [1]. However, splicing of such fibers is complex, lossy and, hence, less applicable for all-fiber systems. Here, we present a new design of an all-solid, polarization-maintaining ANDi fiber with a flat dispersion profile over the range of 1200 – 2100 nm, easily spliceable to conventional PM-Panda fibers.

The optical fiber was fabricated in the Laboratory of Optical Fibers Technology, Maria Curie Skłodowska University in Lublin, Poland. The dispersion plateau in normal range is obtained by high GeO_2 doping level in the core reaching 32%mol. The cross-sections of the three prototype fibers are presented in Fig.1 a-c together with the dimensions of the fiber cores. The outer diameters of the fibers were equal respectively to 125 µm, 122 µm and 127 µm. The fiber does not contain any air-hole structure which makes it easier for fusion splicing. The splicing loss can be optimised to the level of 0.28 dB for one splice, using conventional arc-fusion splicers. The fibers maintain a PER better than -22 dB after splicing to a standard PM Panda-type fiber. The dispersion profiles measured using spectral interferometry method are presented in Fig. 1 (d). The result directly indicates that the dispersion is flat over a broad range of 1200-2100 nm which makes it perfectly suitable for various applications including CPA, dispersion-management of ultrafast Er- and Tm-doped fiber oscillators, and broad coherent SC generation.

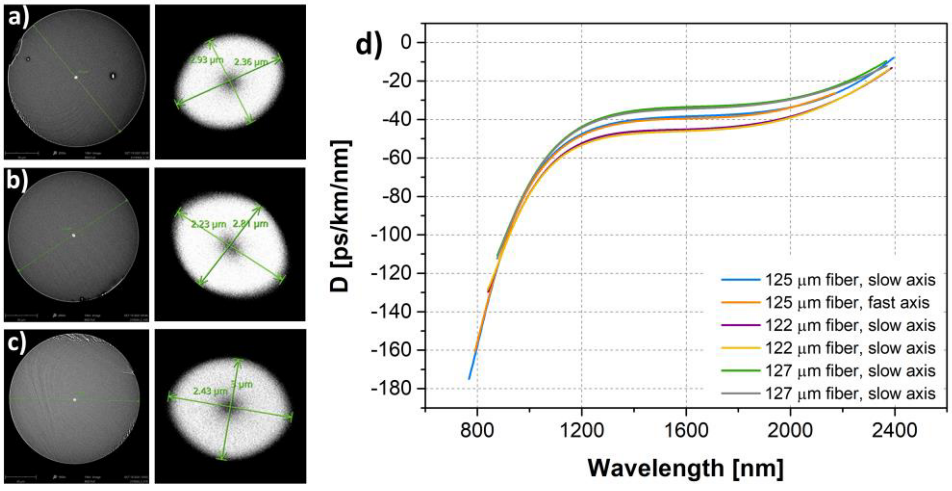

Fig. 1 The cross-sections of the prototype fibers and enlarged core regions obtained with SEM(a-c). The measured dispersion profiles for both polarization axis (d).

References

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