BROADBAND SUPERCONTINUUM GENERATION WITH LOW PEAK POWER IN A CIRCULAR LATTICE NITROBENZENE-CORE PHOTONIC CRYSTAL FIBER

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We highlight the advantage of varying the filling factor d_1/Λ in the first cladding ring of a nitrobenzene-core ($C_6H_5NO_2$-core) photonic crystal fiber (PCF) with a circular lattice in improving the fiber nonlinearity. Joint optimization of feature sets can be achieved to achieve flat dispersion, small effective mode area, and low loss while controlling structural parameters such as filling factor (d_1/Λ) and lattice constant (Λ). Two optimal PCFs were selected and studied in detail for broadband and low peak power supercontinuum generation. The first PCF with a lattice constant (Λ) of 1.0 μm and a filling factor of 0.65 has an all-normal dispersion in the wavelength range from 0.5 to 2.0 μm. When a 90 fs pulse centered at 1.3 μm is pumped into a 1 cm long fiber with a peak power of only 133 W, the supercontinuum spectrum produced extends from the visible to the near-infrared (0.72–1.722 μm) range. On the other hand, a second PCF with Λ of 2.0 μm and d_1/Λ of 0.3 has anomalous dispersion and has a zero dispersion wavelength at 1.547 μm. By using a 110 fs input pulse with a peak power of 273 W and a pump wavelength of 1.56 μm, broad SC generation with a spectral bandwidth of 0.795–3.748 μm was achieved for a 15 cm long sample. The proposed design could become a new class of microstructured optical fibers for the broadband supercontinuum generation.

Keywords: photonic crystal fiber (PCF), nitrobenzene-core ($C_6H_5NO_2$-core), circular lattice, supercontinuum generation, all-normal dispersion, anomalous dispersion.

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