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Supercontinuum Generation in Highly Birefringent Photonic Crystal Fibers

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Abstract content
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We have simulated the propagation of femtosecond laser pulses in highly birefringent photonic crystal fibers to understand the supercontinuum generation spectral broadening process. The dynamics involved were analysed through the variation of pulse properties and fiber parameters. Photonic crystal fibers possess elevated nonlinearity to the extent that laser pulses of low energy than was previously required, can now be used for the super coherent white light sources. This super coherent white light is crucial for use in optical coherence tomography, microscopy and spectroscopy applications whose relevance extend to materials processing and the medical fields. A variety of pulse energies were used in each setup where 100 fs pulses at 800 nm pump wavelength were launched into a 30 cm photonic crystal fiber with normal group velocity dispersion and single zero dispersion wavelength close to the pump. Several supercontinuum spectra of bandwidths extending to a span covering the visible range were observed for the different setup conditions. The effect of varying the pulse energy, pump wavelength, fiber dispersion and birefringence on the broadening of the spectrum were investigated and the dynamics analysed. The photonic crystal fiber birefringence had little effect on the spectral broadening and the obtained supercontinuum. Self phase modulation and Raman scattering were identified among the nonlinear effects responsible for the spectral broadening. It was also observed that higher energy input pulses with a pump power of 800mW resulted in a broader spectral continuum, spanning from 500nm to 1350 nm whilst a lower intensity spectrum with a bandwidth of 280nm was achieved with 300mW pump power.

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