Self-compressed visible supercontinuum from 100 fs pulses using a hollow-core fiber

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We report the generation of visible supercontinuum from 100 fs Ti:Sapphire output in a single stage using a 2.57 m long hollow-core fiber in Ar. The impact of input energy and gas pressure on the output pulse are studied. This source exhibits self-compression, high transmission and good long-time stability.

The needs for broadband visible light sources for electronic spectroscopy has led to a renewed interest in supercontinuum (SC) generation using optical fibers. Multiple methods have been successfully applied to SC generation for electronic spectroscopy, such as photonic fibers, gas chamber filamentation, hollow-core fibers and mixes thereof[1-3]. We report the generation of broadband visible pulses in a single stage from 800 nm, 100 fs, <2 mJ regenerative amplifier output pulses (Coherent Inc) using a 2.57 m long stretched hollow-core fiber of 400 um inner core diameter (Few-Cycle Inc) [4].The impact of input energy and argon gas pressure on the output spectrum's stability and spectral phase are studied. The fiber exhibits around 75% over-all transmission, with up to 8% conversion to the λ<700 nm range accessible to our AOM pulse-shapers. The spectral phase of the output, characterized using an all-reflective TG-FROG, exhibits self-compression in the visible range. The results suggest that changes in gas pressure and power yield similar effects, thus one can compensate for the other to an extent. The fiber's output exhibits good long term stability over the course of multiple hours. We expect this source to be suitable for optical multidimensional spectroscopy.

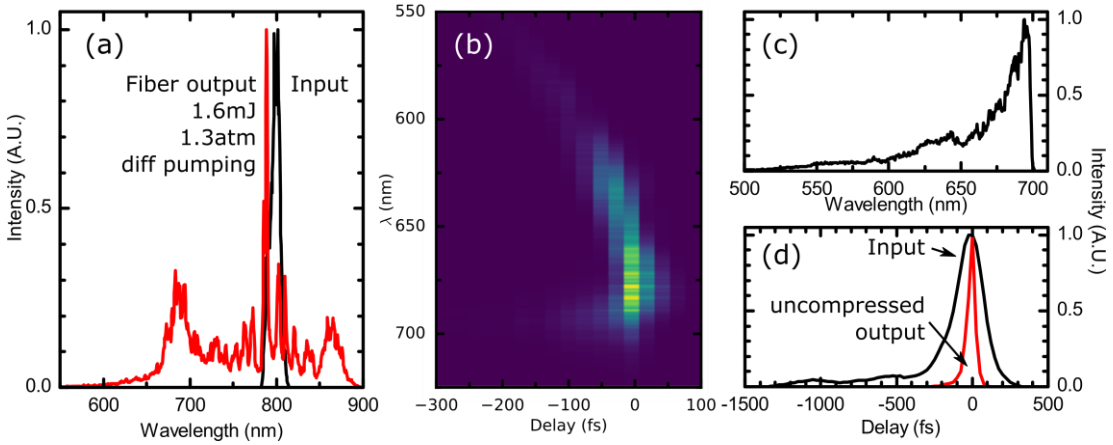

Fig. 1 Representative fiber output for 1.6mJ, 800nm input pulses using 1.3 atm Ar in differential pumping. (a) Spectrum of the output displaying broadening typical of self-phase modulation. (b) TG-FROG of the portion of the pulse with λ<700 nm (short-wave pass filter). (c) Spectrum of the pulse measured in (b). (d) TG-FROG traces integrated along spectral axis showing self-compression of the visible edge of the spectrum.

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[3] H. Zheng *et al.*, Appl. Opt. 53, 1909 (2014).
[4] V. Cardin *et al.*, Appl. Phys. Lett. 107, 181101 (2015).