

APP NOTE # -

MAY 23

SUPERCONTINUUM GENERATION IN NL-PM-1050-NEG

Introduction

Non-linear all-normal dispersion photonic crystal fibers are well suited for low noise spectral coherent supercontinuum generation [1,2]. The spectral broadening depends on the dispersion profile of the fiber and the widest spectrum is achieved by pumping around the maximum dispersion. The NL-PM-1050-NEG fiber is designed for super continuum generation by pumping with a 1050 nm femtosecond laser. It has a flat top dispersion profile with a maximum just below zero at 1050 nm [3].

This application note summarizes how to generate an octave spanning low noise coherent supercontinuum by use of the NL-PM-1050-NEG fiber. It is a highly nonlinear polarization maintaining photonic crystal fiber optimized for use with a 1050 nm range femtosecond laser. A sketch of the fiber end face is shown in Figure 1.

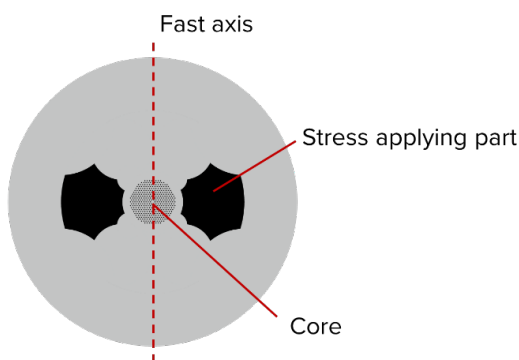


Fig 1. Schematic of the NL-PM-1050-NEG fiber end facet.

Figure 2 shows a schematic of the recommended setup for supercontinuum generation using the NL-PM-1050-NEG fiber. To align the polarization of the pump laser to the fast or slow axis of the fiber, a half wave plate was used. Coupling the femtosecond laser into the fiber was done by a mode matched XYZ adjustable lens. It is recommended to optimize the lens coupling at low power.

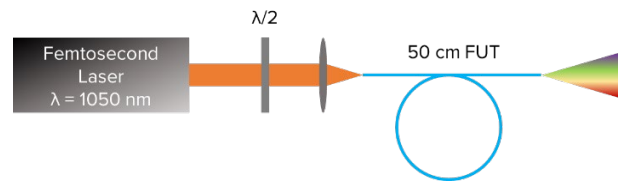


Fig 2. Schematic of experimental setup for SC generation using the NL-PM-1050-NEG fiber.

Figure 3 shows the spectral power density of the output NL-PM-1050-NEG fiber when pumped with a 130 fs 1050 nm laser with 80 MHz repetition rate (Origami 10 HP). The output spectrum was collected with an integrating sphere.

The fiber damage threshold depends on the actual pulse parameters of the pump laser. Using a 130 fs laser with 80 MHz rep rate, the fiber can typically handle an average power of more than 1 W. In order to improve the damage threshold, minimize back reflection and to avoid contamination in the cladding holes, it is recommended to collapse the fiber end face. This will also allow a more stable and easier coupling.

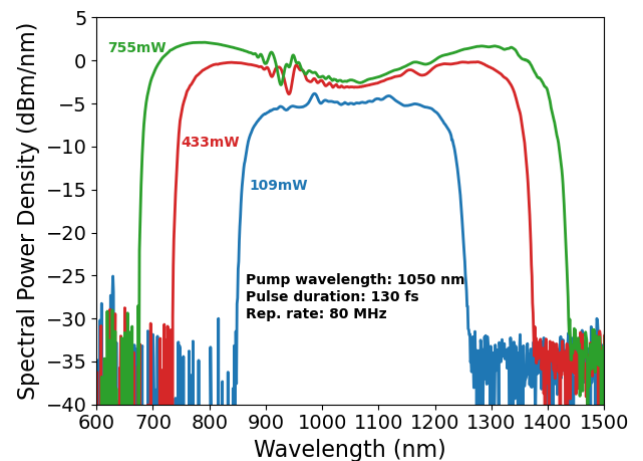


Fig 3. Measured spectral power density at output of the NL-PM-1050 NEG for input average power of 109 mW to 755 mW and input beam polarized along the fast axis. It is demonstrated that an octave spanning spectrum can be generated. Laser pulse parameters correspond to pulse energies in the 1 - 10 nJ range and input peak powers between 10 and 60 kW.

References

1. E. Genier, et al. "Ultra-flat, low-noise, and linearly polarized fiber supercontinuum source covering 670–1390 nm", Opt. Lett. 46, 1820-1823 (2021)
2. Yuan Liu et al. "Suppressing Short-Term Polarization Noise and Related Spectral Decoherence in All-Normal Dispersion Fiber Supercontinuum Generation", J. Lightwave Technol. 33, 1814-1820 (2015)
3. NKT Photonics, "Non-linear fibers Datasheet", (2023)
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