UltraFast Innovations

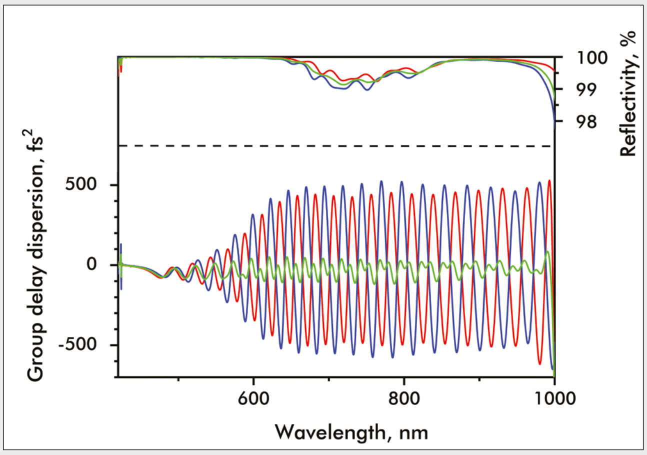
YOUR KEY to innovation and success

Ultra-broadband compression mirrors with double-angle technology (Design PC1332)

Our PC1332 mirrors are optimized for chirp compensation of visible/near-infrared spectra spanning more than an optical octave, for example an output of a hollow core fiber. Conventional broadband chirped mirror designs compensate group delay dispersion oscillations by combining two mirrors with complementary coatings. However, the approach suffers from the additivity of manufacturing variations in the two coating runs. Our PC1332 design instead compensates group delay dispersion oscillations by using identical mirrors from the same coating run at two different angles of incidence [1]. The technique not only minimizes the influence of manufacturing errors, but also provides flexibility for fine-tuning. In comparison to our forerunning PC70 design, the spectral coverage of the PC1332 is shifted to the blue, thus supporting generation of shorter pulses: 2.2 fs (PC1332) compared to 3 fs (PC70).

Key Product Features:

- Bandwidth: 450-1000 nm
- Reflectance: > 99 % per bounce
- Supported pulse duration: < 3 fs (with appropriate input spectrum)
- Angle of incidence: 5°, respectively 19°
- Substrates: 1” diameter, FS, surface flatness λ/10 at 633 nm
- Database link: http://www.ultrafast-innovations.com/product.php?name=PC1332



Group Delay Dispersion (left axis) and reflectivity (right axis) properties of a mirror pair. The respective dispersion per bounce for 5°(red) and 19° (blue) incidence angle, as well as the average per pair (green), is shown. The central wavelength of the pair is 725 nm.

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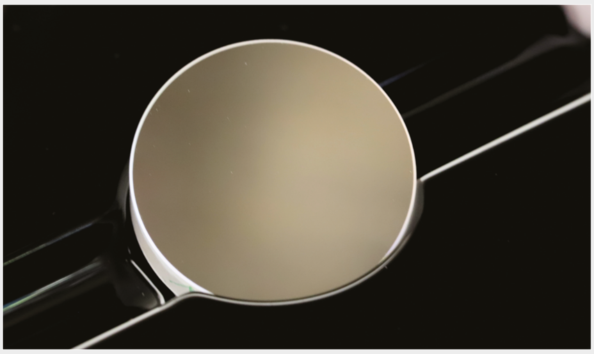
Compression Measurement:

A typical application for our PC1332 mirrors is the compression of a hollow core fiber output to the few-cycle regime. In the current example the output of an argon-filled hollow core fiber was compressed with PC1332 mirrors down to 2.2 fs, corresponding to 1.04-cycle pulses at 760 nm [2]. For GDD fine tuning a combination of BK7 wedges and a water cell was used, and the spectral phase was characterized with a D-scan. The measurement demonstrates simultaneous compression over the full spectral bandwidth. PC70 mirrors could only compress down to ≈ 3 fs.



Sample Measurement:

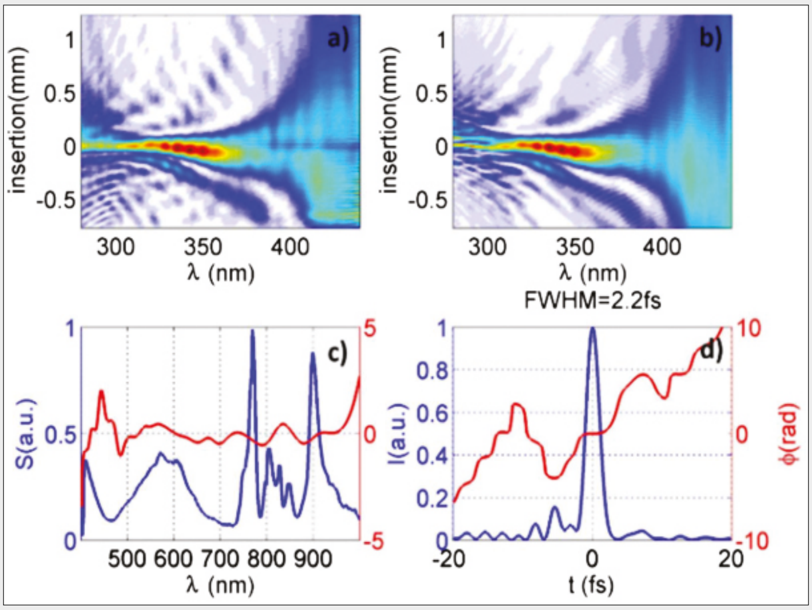
Femtolasers GmbH: FemtoPower Compact HE PRO CEP, 1 kHz repetition rate, 420 µJ, 24 fs

Continuum Generation in a Hollow Core Fiber:

Argon fill gas, 409 mbar pressure, 1 m length, 250 µm inner diameter

PC1332 mirror compressor:

14 reflections, GDD fine-tuning with BK7 wedges, TOD fine-tuning with a water cell, characterization with D-scan



Single-cycle hollow-core fiber (HCF) compressor: Measured (a) and retrieved (b) SHG D-scan traces. (c) Measured spectrum (blue) and retrieved spectral phase (red). (d) Reconstructed temporal profile for a post-compressed pulse in an Ar-filled HCF (p=409 mbar) with PC1332 spectral phase compensation, corresponding to 2.2 fs (1.04 cycles at 760 nm). Figure adapted from [2].

References:

[1] V. Pervak, I. Ahmad, M. K. Trubetskov, A. V. Tikhonravov, F. Krausz, Optics Express **17**(10), 7943-7951 (2009).

[2] F. Silva, B. Alonso, W. Holgado, R. Romero, J. S. Román, E. C. Jarque, H. Koop, V. Pervak, H. Crespo, and I. J. Sola, Optics Letters **43**(2), 337-340 (2018).