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GTI mirrors with low oscillations

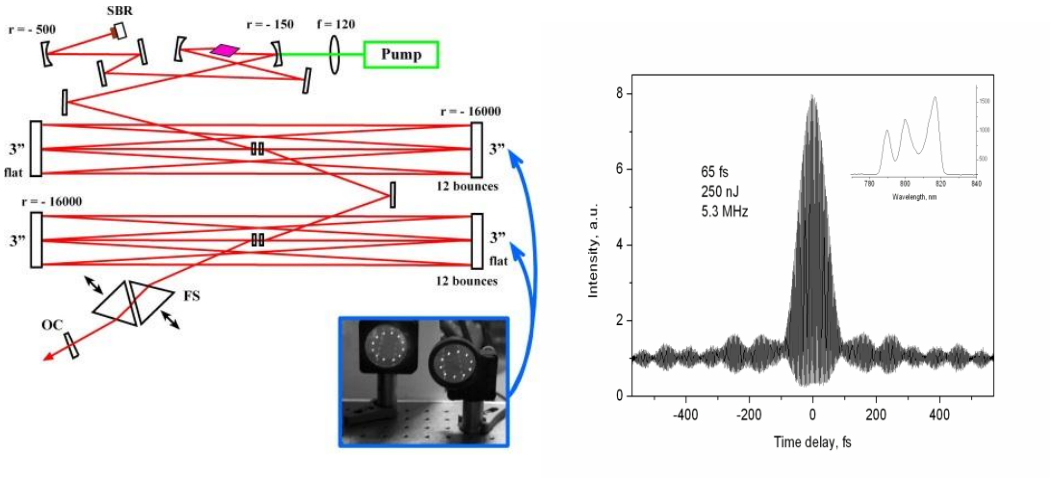

Fig. 1. Left: cavity configuration of the 5-MHz Ti:sapphire CPO. Insert: the beam spots on the DMs forming the delay line. All radii are given in mm. SBR: saturable Bragg reflector; FS: fused silica prisms for fine tuning intracavity GDD, OC: output coupler. Right: the autocorrelation trace of the generated pulses compressed by another set of (different) chirped mirrors external to the cavity (not shown). Inset: the generated spectrum.

We have used DM to construct a Ti.Sa CPO oscillator, the layout of which is shown in Figure 1. The laser generates 65-fs 0.25-μJ pulses at a repetition rate of 5 MHz [S. Naumov, A. Fernandez, R. Graf, P. Dombi, and A. Apolonski, "Approaching the microjoule frontier with femtosecond laser oscillators," New J. Phys. 7, 216 (2005).]. The autocorrelation trace and the spectrum of the generated pulses are shown in Fig. 1. The extension of the rectangular-shaped spectrum (inset in Fig. 1) is limited to the range of 780-820 nm by the saturable Bragg reflector incorporated in the laser. The resonator

contains two delay lines made up of DMs (CM1331), resulting in 120 bounces off these mirrors upon a single round trip in the cavity. In spite of the large number of mirror bounces, the accumulated phase error was kept at a moderate level as revealed by the low satellites in the interferometric autocorrelation. The chirped pulses originating from the oscillator were compressed by a set of high-dispersion DMs (HD15), allowing a more compact setup and improved pulse quality in comparison to extracavity GDD control with a prism compressor [S. Naumov, A. Fernandez, R. Graf, P. Dombi, and A. Apolonski, "Approaching the microjoule frontier with femtosecond laser oscillators," New J. Phys. 7, 216 (2005).]. Replacement of the previous DMs in the cavity delay lines with the low-ripple DMs resulted in a 10% increase in the output power of the laser. This increase in power along with the good quality of the autocorrelation provide evidence for the low loss and smooth dispersion of the mirrors, respectively. To show the robustness of both the approach and the reproducibility of the manufacturing process, DMs of this type and of similar bandwidth were designed, produced and also successfully tested in a 60-nJ Ti:Sa CPO operating at a repetition rate of 70 MHz [A. Fernandez, A. Verhoef, V. Pervak, G. Lermann, F. Krausz, A. Apolonski, "Generation of 60-nanojoule sub-40-femtosecond pulses at 70 megahertz repetition rate from a Ti:sapphire chirped pulse oscillator," Appl. Phys. B 87, 395-398 (2007).]

Reference:

V. Pervak, S. Naumov, F. Krausz, A. Apolonski. "Chirped mirrors with low dispersion ripple", Optics Express. **15**, 13768 (2007)

Recommended mirror designs:

HD15; CM1331