OPTOMAN

YOUR SIDEKICK FOR LASER OPTICS DEVELOPMENT

2020, Vilnius

Dispersive mirrors from OPTOMAN

This memo is intended to help gather necessary information which will be used to evaluate and design optimal and manufacturable dispersive mirrors. Provided data will be used as guidance only and shall by no means imply the manufacturer's commitment to reach certain parameters. OPTOMAN will evaluate received information as a whole, and will present individual solutions to specific client issues.

Features of OPTOMAN mirrors:

- Mirrors featuring predefined and flat GDD.
- Negative GDD down to –5000 fs^2
- Absolute reflectance of Rs>99.99% and Rp>99.99%.
- Measured LIDT of >0.3 J/cm^2 @ 1030nm, 50 fs, 150 kHz.
- Spectral range from 250 nm up to 5000 nm.

Tell OPTOMAN a bit about your laser system – We'd like to know the following information:

- Center wavelength and operational bandwidth.
- Pulse width.
- Pulse energy.
- Repetition rate.
- Beam shape and diameter (1/e^2).

Priorities

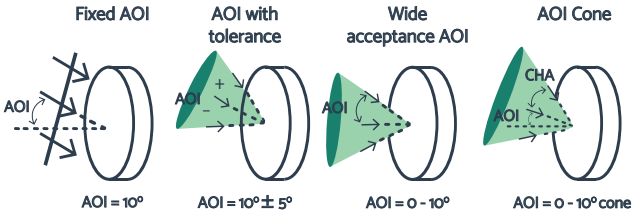
It is important to know which specifications are the most critical. **A typical example:**

#1 – LIDT. Maximum energy fluence on coated surface > 0.3 J/cm2.
#2 – GDD oscillations as low as possible.
#3 – GDD as low as possible. Preference -300 fs2.
#4 – Bandwidth optimization. Target – 100nm.

Pulse compression analysis:
OPTOMAN can do a pulse compression analysis and present you with a data analysis after a specific number of bounces.
Send OPTOMAN a message for more details.

Requirements for dispersive mirrors:

- Required reflectivity R, %.
- Group-delay dispersion (GDD) over an operation bandwidth and allowed oscillations (GDD tolerance) over operation bandwidth.
- Angle of incidence (AOI).



AOI = 0 - 10° means there is a wide acceptance angle and all spectral requirements must comply at all angles between 0° and 10°.

AOI = 10° + / -5° means 5° tolerance of AOI. AOI must be tuned for optimal spectral performance. Optimal performance will be somewhere between 5° and 15°.

AOI cone = 0 - 10° means that the incident beam is converging or diverging the with full angle width of 10°.

Tips

- For mirrors with high GDD values, it is recommended to tune the AOI of the mirror in your system to have the best performance.
- Spectral bandwidth can be calculated by knowing the pulse duration. You can use this calculator.
- Sometimes users cannot tell how much reflectivity the mirror must have. Typical options would be: R >99%; R>99.5% or R>99.9%

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GDD vs Bandwidth

It is important to note that bandwidth and GDD are closely connected. A high value of negative GDD results in a very narrow bandwidth. For a better understanding, see the graph below (Fig. 1).

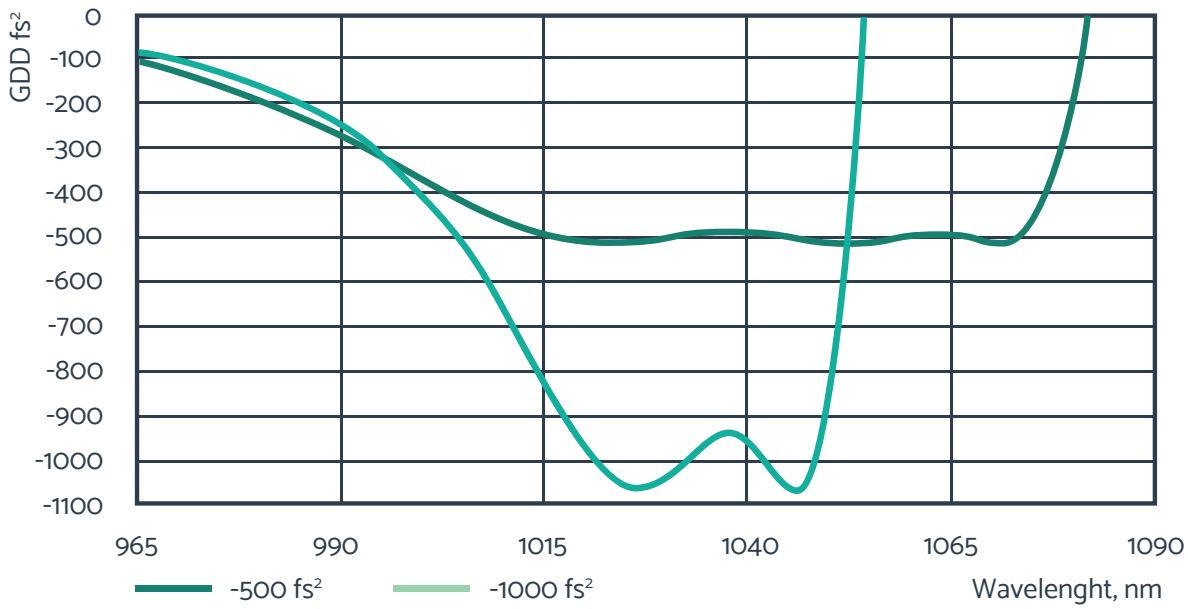

Fig. 1. GDD vs Wavelength for different chirped mirror designs. A more negative GDD value results in a narrower operational bandwidth.

Below graph indicates GDD dependence on operational bandwidth at a fixed coating thickness of 10 µm. Stars on the graph indicate experimentally produced designs

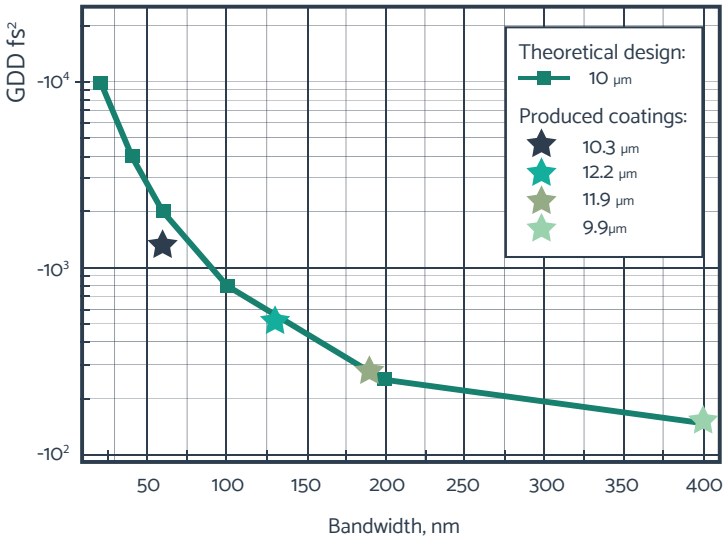

Fig. 2 [1] Relation between dispersive mirror operational bandwidth and average achievable GDD.

Source:
[1] PERVAK, V., et al. Empirical study of the group delay dispersion achievable with multilayer mirrors. *Optics express*, 2013, 21.15: 18311-18316.