

SO0001



LASER-INDUCED DAMAGE THRESHOLD (LIDT) MEASUREMENT REPORT

S-ON-1 (ISO 21254-2)
TEST PROCEDURE

Sample: Sample

Request from

Address	Company
	Address Line 1
	Address Line 2
	Country
Contact person	Name Surname
Inquiry ID	Inquiry ID: 0001
Purchase order	-

Testing institute

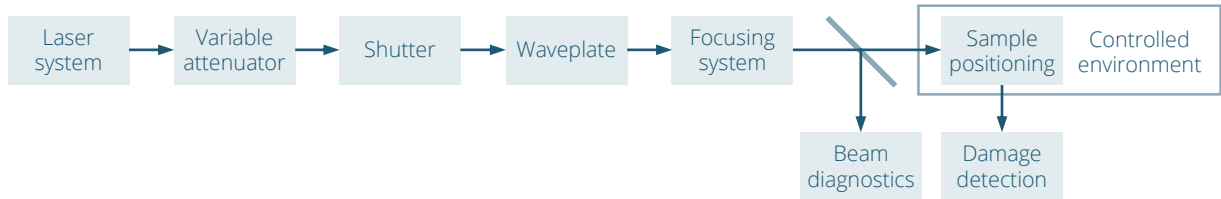
Address	UAB Lidaris
	Saulėtekio al. 10
	10223 Vilnius
	Lithuania
Tester	Name Surname
Test date	01/01/2021
Sale order	SO0001
Test ID	-

Specimen

Name	Sample
Type	AR Coating (1064nm)
Dimensions	Ø25.4 x 3.0 mm
Packaging	Plastic box

TEST EQUIPMENT

Test setup



Laser and its parameters

Type	Q-switched, seeded Nd:YAG
Manufacturer	InnoLas Laser
Model	SpitLight Hybrid
Central wavelength	1064.0 nm
Angle of incidence	0.0 deg
Polarization state	Linear
Pulse repetition frequency	20 Hz
Spatial beam profile in target plane	TEM00
Beam diameter in target plane (1/e ²)	(245.8 ± 2.5) μm
Longitudinal pulse profile	Single longitudinal mode
Pulse duration (FWHM)	(9.9 ± 0.5) ns
Pulse to pulse energy stability (SD)	1.4 %

Energy/power meter

Manufacturer	Ophir
Model	PE50-DIF-C
Calibration due date	2021-06-01

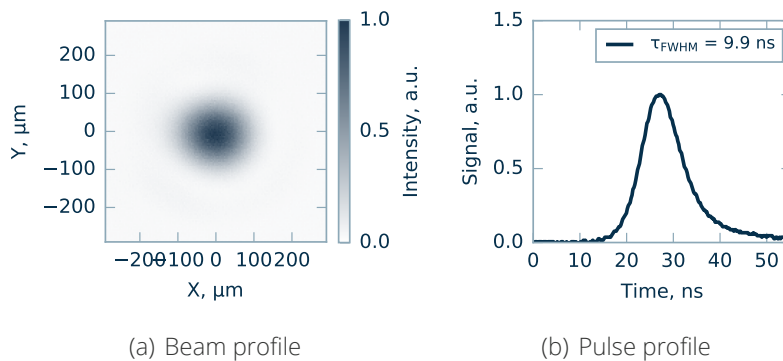


Figure 1. Laser parameters used for measurements.

TEST SPECIFICATION

Definitions and test description

Laser-induced damage (LID) is defined as any permanent laser radiation induced change in the characteristics of the surface/bulk of the specimen which can be observed by an inspection technique and at a sensitivity related to the intended operation of the product concerned. Laser-induced damage threshold (LIDT) is defined as the highest quantity of laser radiation incident upon the optical component for which the extrapolated probability of damage is zero.¹

LID of the sample is investigated by performing a standardized S-on-1 test procedure.² LIDT value is determined by fitting experimental damage probability data with a model derived for a Poisson damage process assuming degenerate defect ensemble.³

Test sites

Number of sites	420
Arrangement of sites	Hexagonal
Minimum distance between sites	900 µm
Maximum pulses per site	1000

Analysis information

Online detection	Scattered light diode
Offline detection	Nomarski microscope
Software version	d8e8d53 - b70360c

Test environment

Environment	Air
Cleanroom class (ISO 14644-1)	ISO7
Pressure	1 bar
Temperature	25.4 - 26.0 C
Humidity	28.4 - 31.8 %

Sample preparation

Storage before test	Normal laboratory conditions
Dust blow-off	None
Cleaning	Isopropanol

¹ISO 21254-1:2011: Lasers and laser-related equipment - Test methods for laser-induced damage threshold - Part 1: Definitions and general principles, International Organization for Standardization, Geneva, Switzerland (2011)

²ISO 21254-2:2011: Lasers and laser-related equipment - Test methods for laser-induced damage threshold - Part 2: Threshold determination, International Organization for Standardization, Geneva, Switzerland (2011)

³J. Porteus and S. Seitel, Absolute onset of optical surface damage using distributed defect ensembles, Applied Optics, 23(21), 3796-3805 (1984)

LIDT TEST RESULTS

LIDT VALUE

10 ³ -on-1	11.12 $\begin{smallmatrix} +0.94 \\ -1.64 \end{smallmatrix}$ J/cm ²
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CHARACTERISTIC DAMAGE CURVE

Table 1: Estimated LIDTs from fitting model for sample Sample.

Test mode	Threshold (Offline detection - microscopy)	Threshold (Online detection - scattering)
1-on-1	11.44 $\begin{smallmatrix} +0.98 \\ -1.96 \end{smallmatrix}$ J/cm ²	11.2 $\begin{smallmatrix} +2.0 \\ -2.2 \end{smallmatrix}$ J/cm ²
10-on-1	-	11.2 $\begin{smallmatrix} +1.2 \\ -2.2 \end{smallmatrix}$ J/cm ²
10 ² -on-1	-	11.2 $\begin{smallmatrix} +1.1 \\ -2.2 \end{smallmatrix}$ J/cm ²
10 ³ -on-1	11.12 $\begin{smallmatrix} +0.94 \\ -1.64 \end{smallmatrix}$ J/cm ²	11.2 $\begin{smallmatrix} +1.1 \\ -2.2 \end{smallmatrix}$ J/cm ²

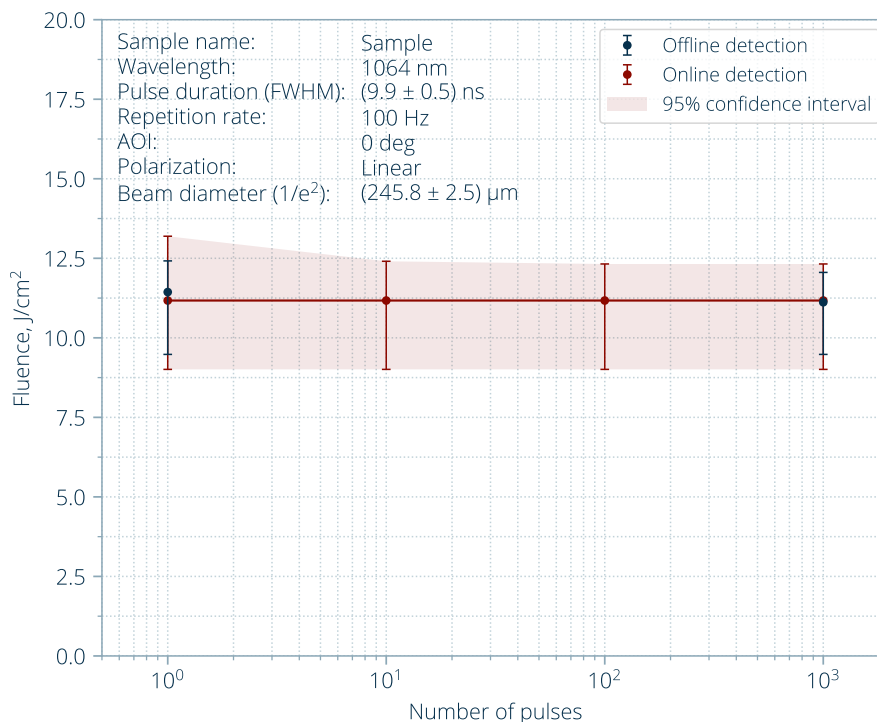


Figure 2. Characteristic damage curve.

DAMAGE PROBABILITY (OFFLINE DETECTION)

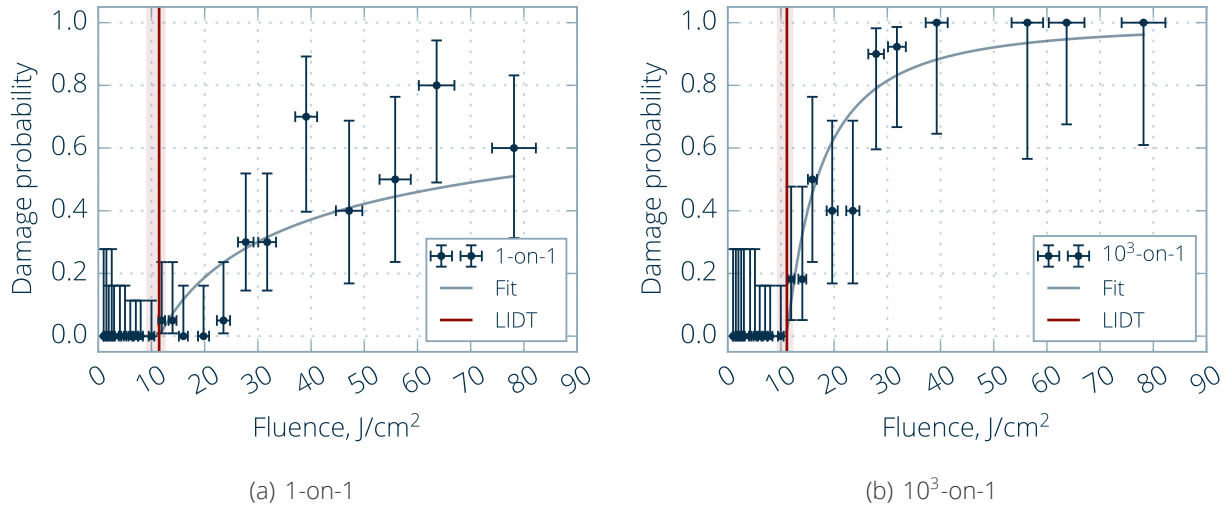


Figure 3. Damage probability plots.

TYPICAL DAMAGE MORPHOLOGY (OFFLINE DETECTION)

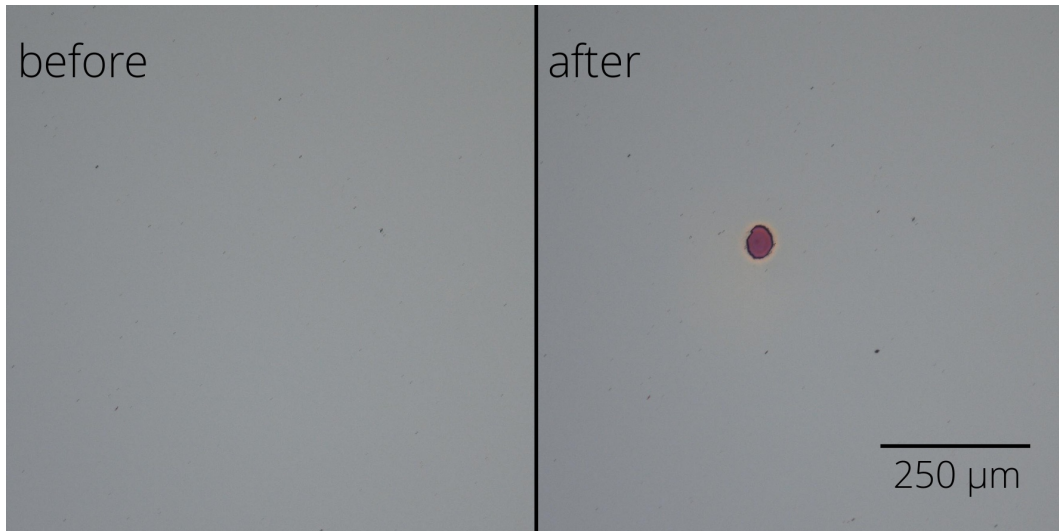


Figure 4. Typical damage morphology: fluence 11.9 J/cm², damage after 640 pulse(s).

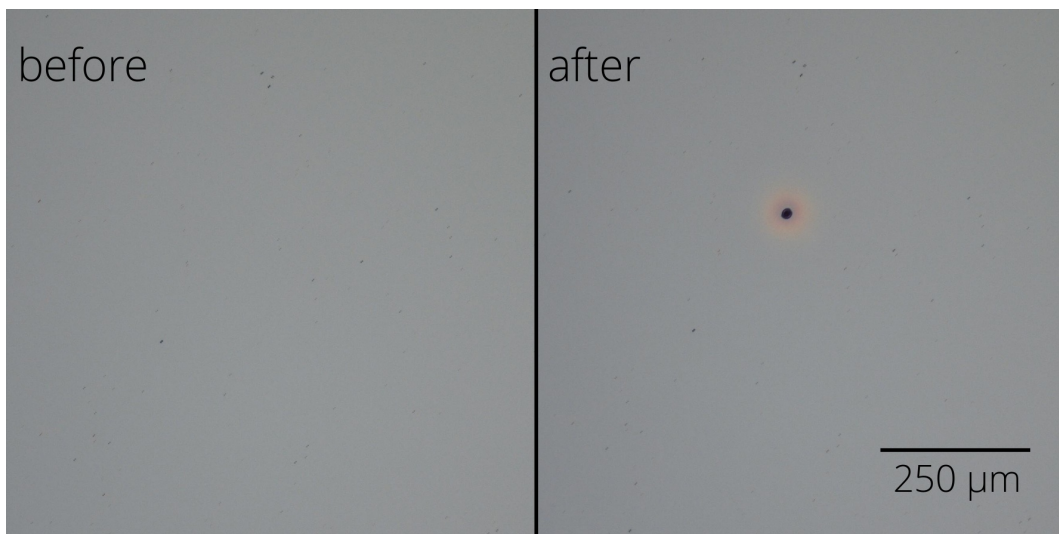
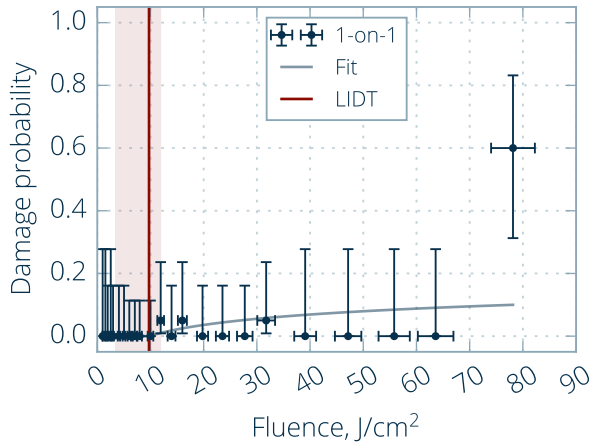
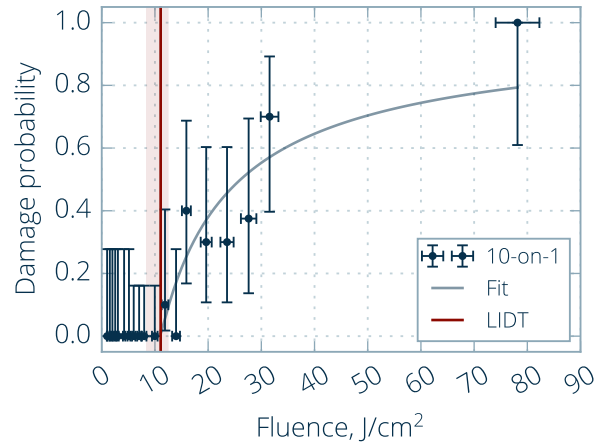


Figure 5. Typical damage morphology: fluence 23.6 J/cm², damage after 88 pulse(s).

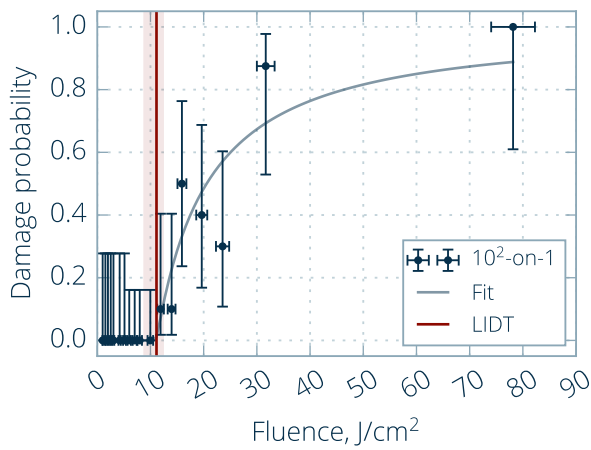
DAMAGE PROBABILITY (ONLINE DETECTION)



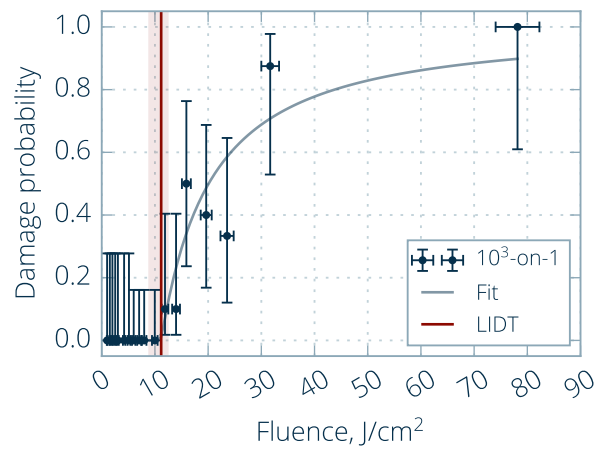
(a) 1-on-1



(b) 10-on-1



(c) 10²-on-1



(d) 10³-on-1

Figure 6. Damage probability plots.