LIDARIS
LIDT Service

LASER-INDUCED DAMAGE THRESHOLD (LIDT) MEASUREMENT REPORT

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

SAMPLE: SAMPLE

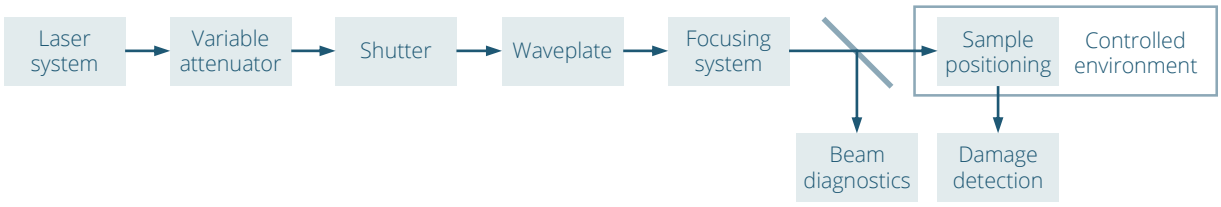
Request from	
Address	Company Address Line 1 Address Line 2 Country
Contact person	Name Surname
Inquiry ID	Inquiry ID: 0001
Purchase order	-

Testing institute	
Address	UAB Lidaris Saulėtekio al. 10 10223 Vilnius Lithuania
ester	Name Surname
Test date	01/01/2024
Sale order	SO0001
Test ID	-

Specimen	
Name	Sample
Type	AR Coating
Dimensions	Ø25.4 x 3.0 mm
Packaging	Plastic box

TEST EQUIPMENT

Test setup

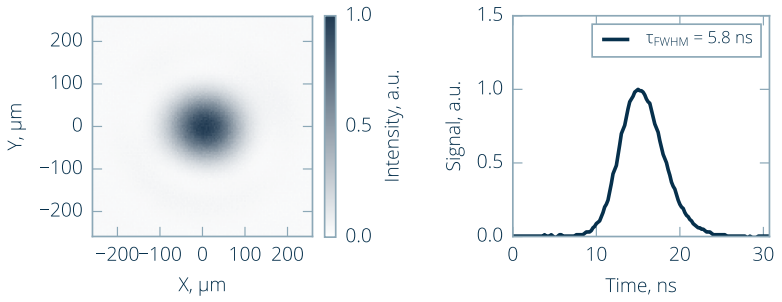


Laser and its parameters

Type	Q-switched, seeded Nd:YAG
Manufacturer	InnoLas Laser II
Model	SpitLight Hybrid
Central wavelength	532.0 nm
Angle of incidence	45.0 deg
Polarization state	Linear
Pulse repetition frequency	100 Hz
Spatial beam profile in target plane	TEM00
Beam diameter in target plane ($1/e^2$)	(216.8 ± 2.8) µm
Longitudinal pulse profile	Single longitudinal mode
Pulse duration (FWHM)	(5.8 ± 0.3) ns
Pulse to pulse energy stability (SD)	2.6 %

Energy/power meter

Manufacturer	Ophir
Model	PE50-DIF-C
Calibration due date	2024-06-01



(a) Beam profile (b) Pulse profile

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 1-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	219
Arrangement of sites	Hexagonal
Minimum distance between sites	900 µm
Maximum pulses per site	1

Analysis information

Online detection	Scattered light diode
Offline detection	Nomarski microscope
Software version	9418cf45

Test environment

Environment	Air
Cleanroom class (ISO 14644-1)	ISO7
Pressure	1 bar
Temperature	21.9 C
Humidity	53.9 %

Sample preparation

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

[1] ISO 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)

[2] ISO 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)

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

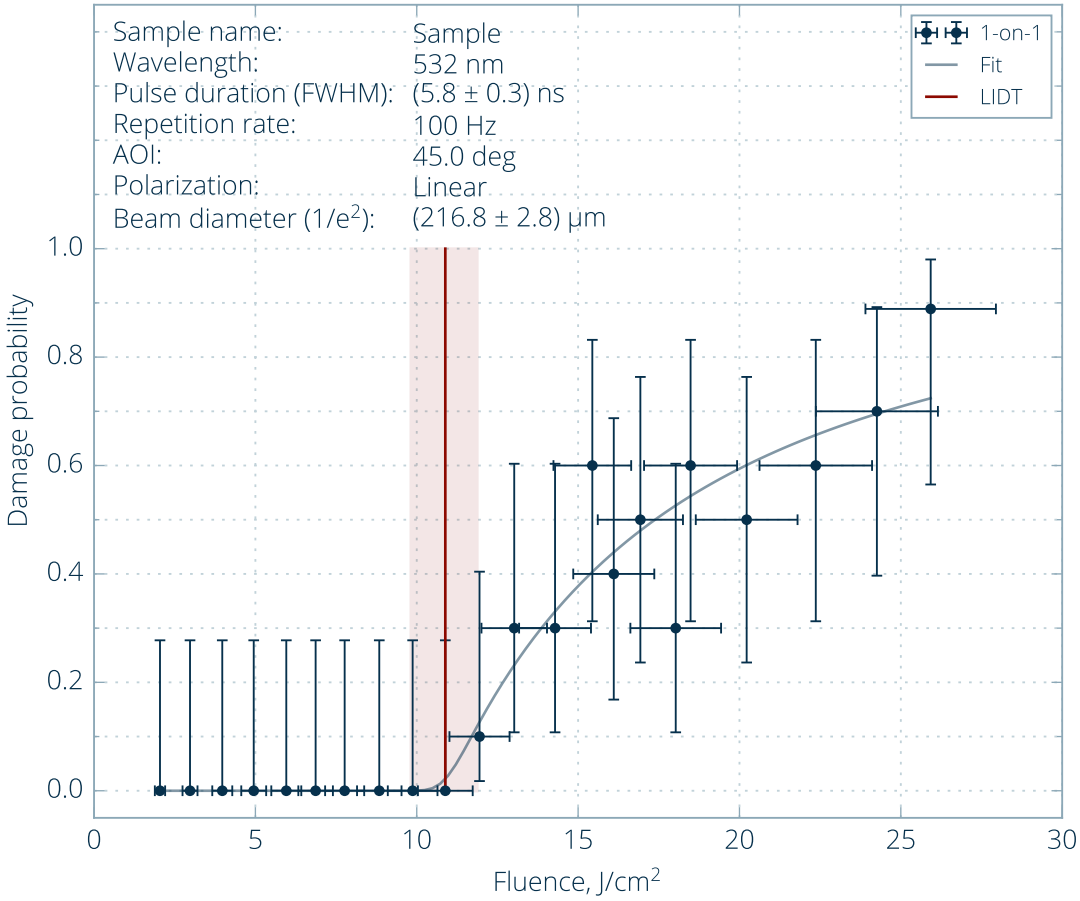
LIDT TEST RESULTS

LIDT VALUES

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

Test mode	Threshold (Offline detection - microscopy)
1-on-1	$10.88\ ^{+0.99}_{-1.12}$ J/cm^2

DAMAGE PROBABILITY



(a) 1-on-1

Figure 2. Damage probability plot.

TYPICAL DAMAGE MORPHOLOGY

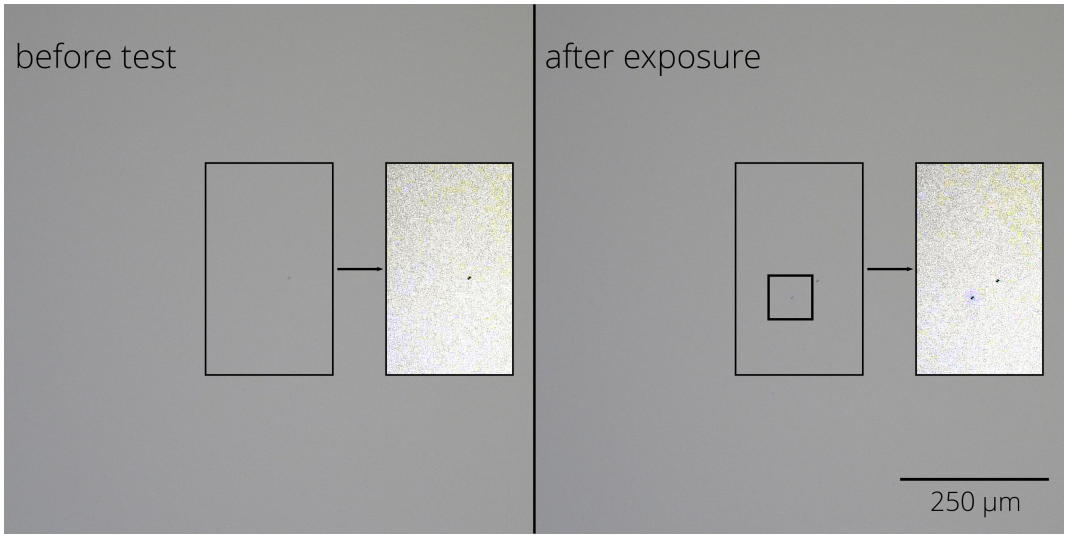


Figure 3. Typical damage morphology: fluence 12.5 J/cm^2, damage after 1 pulse(s). High contrast image.

Figure 4. Typical damage morphology: fluence 17.9 J/cm^2, damage after 1 pulse(s).

Figure 5. Typical damage morphology: fluence 21.9 J/cm^2, damage after 1 pulse(s).

Figure 6. Typical damage morphology: fluence 26.1 J/cm^2, damage after 1 pulse(s).

TECHNICAL NOTES

TECHNICAL NOTE 1: Oblique incidence

According to the ISO 21254-2:2011 standard, for spatial beam profiling perpendicular to the direction of beam propagation and angles of incidence differing from 0 degrees, the cosine of the angle of incidence is included in the calculation of the effective area, which leads to correct evaluation of laser fluence at different angles of incidence (Figure 7).

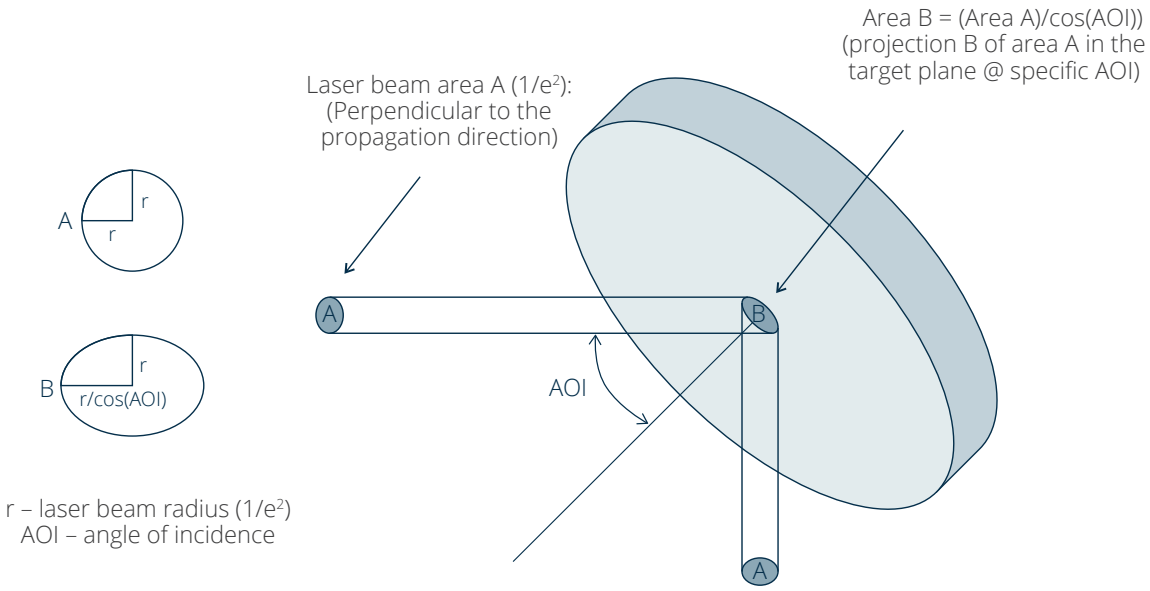


Figure 7. Oblique incidence.

TECHNICAL NOTE 2: Rear surface damage

Rear surface damage was observed exposing with more than 16 J/cm^2 fluence laser radiation.

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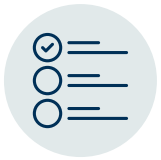

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