LASER-INDUCED DAMAGE THRESHOLD (LIDT) MEASUREMENT REPORT

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

SAMPLE: 1

Request from	
Address	Altechna Coatings Savanorių 231 LT-02300 Vilnius Lithuania
Contact person	Ignas Bilkauskas
Purchase order	ALTC180531

Testing institute	
Address	UAB Lidaris Saulėtekio al. 10 10223 Vilnius Lithuania
Tester	Lina Vigricaite
Test date	2018-06-05
Sale order	SO882
Test ID	E17Z2E

Specimen	
Name	1
Type	HRsp>99,95%@ 1010-1050
Packaging	Plastic box

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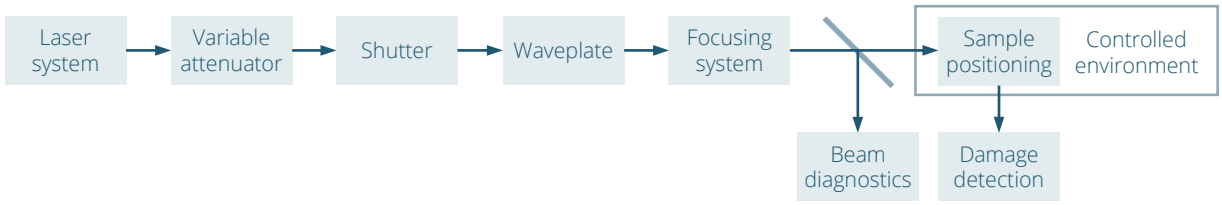
TEST EQUIPMENT

Test setup

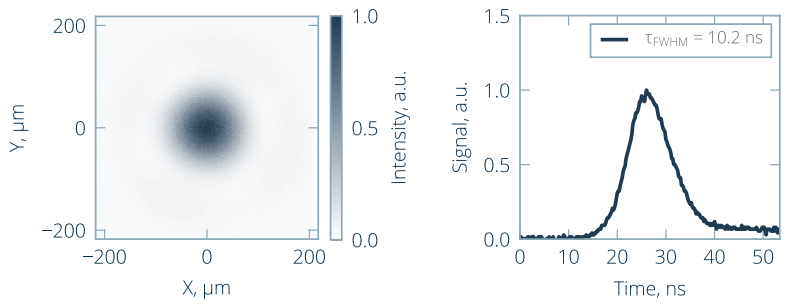


Laser and its parameters

Type	Q-switched, seeded Nd:YAG
Manufacturer	InnoLas Laser
Model	SpitLight Hybrid
Central wavelength	1064.0 nm
Angle of incidence	45.0 deg
Polarization state	Linear P
Pulse repetition frequency	100 Hz
Spatial beam profile in target plane	Near Gaussian
Beam diameter in target plane ($1/e^2$)	(200.8 ± 4.2) µm
Longitudinal pulse profile	Single longitudinal mode
Pulse duration (FWHM)	(10.2 ± 0.3) ns
Pulse to pulse energy stability (SD)	2.0 %

Energy/power meter

Manufacturer	Ophir
Model	PE50-DIF-C
Calibration due date	2019-09-01



(a) Beam profile (b) Pulse profile

Figure 1: Laser parameters used for measurements.

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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. [1]

LID of the sample is investigated by performing a standardized S-on-1 test procedure.[2]
LIDT value is determined by taking the average of the highest fluence value before which no damage was observed and the lowest fluence value at which damage was first observed.

Test sites

Number of sites	638
Arrangement of sites	Hexagonal
Minimum distance between sites	460 µm
Maximum pulses per site	1000

Damage detection

Online	Scattered light diode
Offline	Nomarski microscope

Test environment

Environment	Air
Cleanroom class (ISO 14644-1)	ISO8
Pressure	1 bar
Temperature	23 C
Humidity	29 %

Sample preparation

Storage before test	Normal laboratory conditions
Dust blow-off	Bulb blower
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)

TEST RESULTS

CHARACTERISTIC DAMAGE CURVE

Table 1: Estimated LIDTs for sample 1.

Test mode	Threshold
1-on-1	$29.9\ ^{+4.9}_{-4.5}$ J/cm^2
10-on-1	$29.9\ ^{+4.8}_{-4.5}$ J/cm^2
10^2-on-1	$29.9\ ^{+4.8}_{-4.5}$ J/cm^2
10^3-on-1	$14.9\ ^{+2.4}_{-2.3}$ J/cm^2

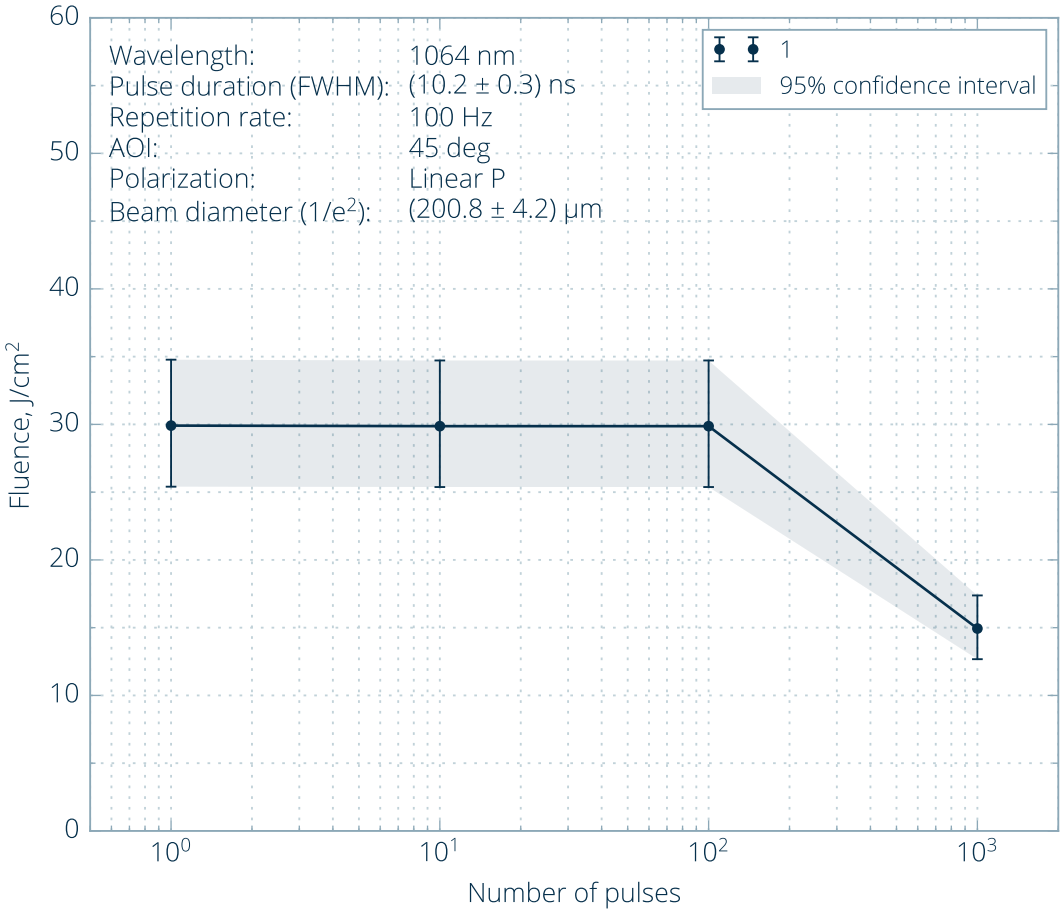
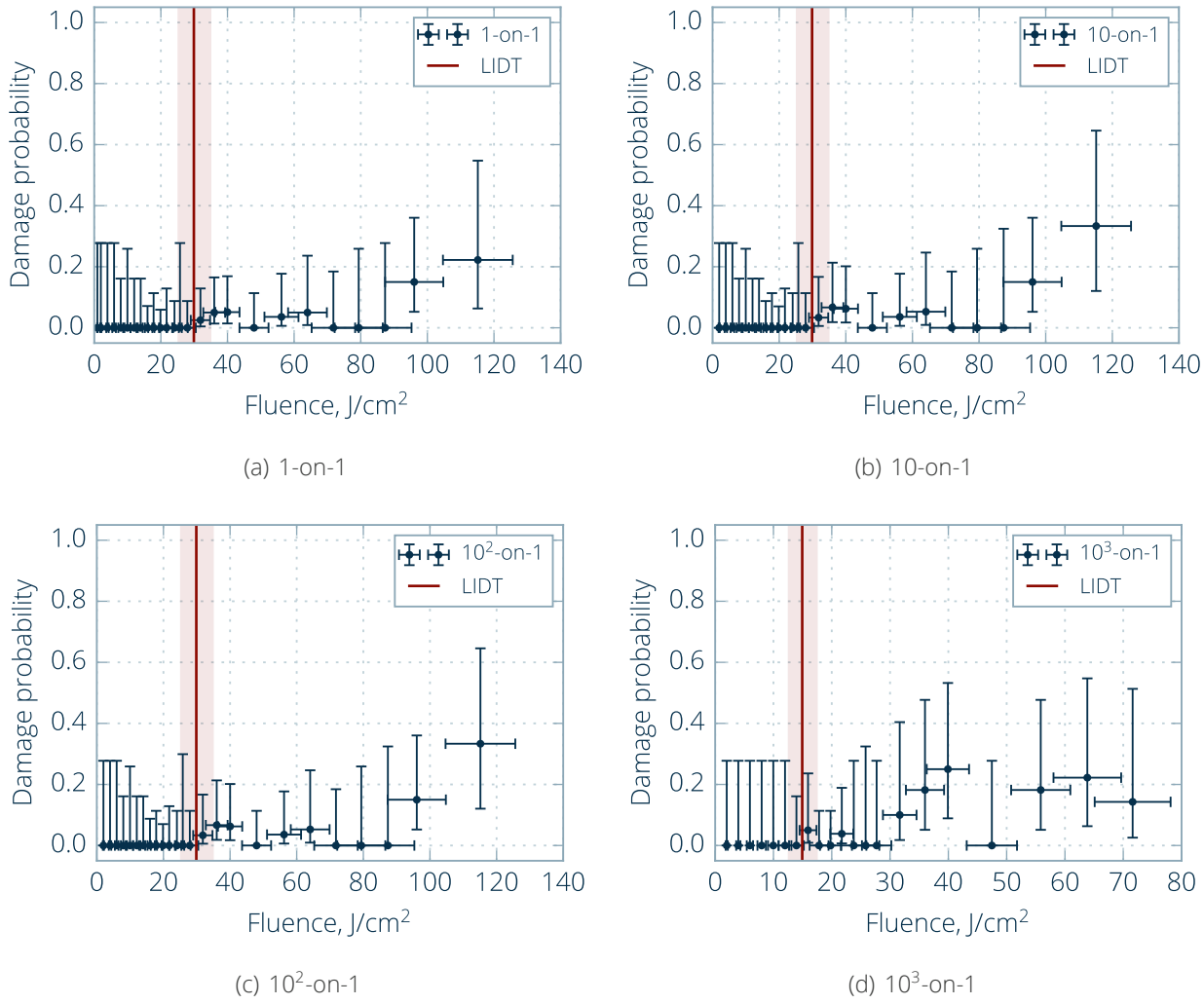


Figure 2: Characteristic damage curve.

DAMAGE PROBABILITY



(a) 1-on-1

(b) 10-on-1

(c) 10^2-on-1

(d) 10^3-on-1

Figure 3: Damage probability plots.

TYPICAL DAMAGE MORPHOLOGY

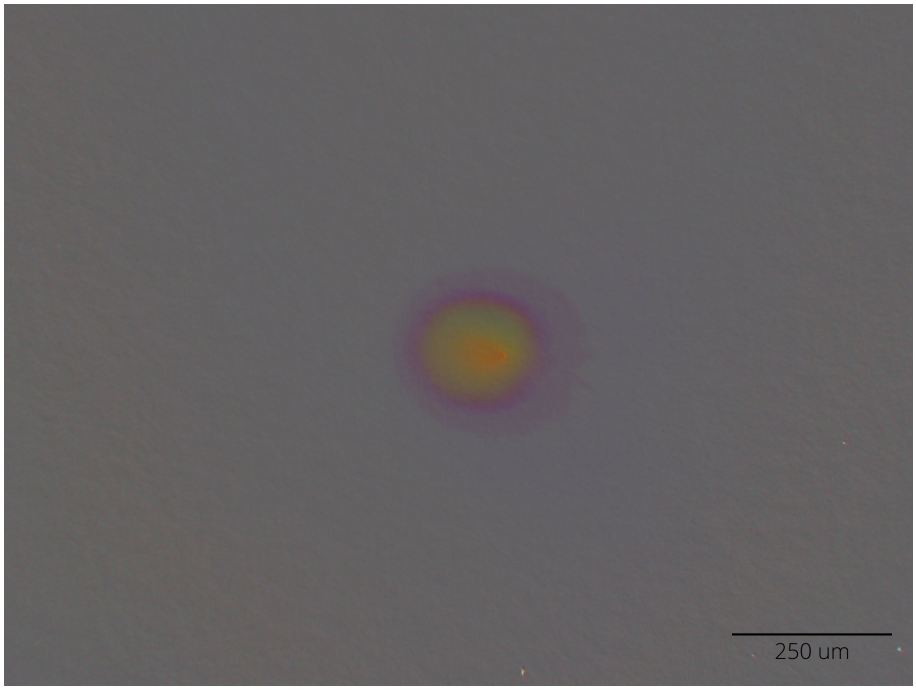


Figure 4: Typical damage morphology: fluence 37.1 J/cm^2, damage after 1 pulse(s).

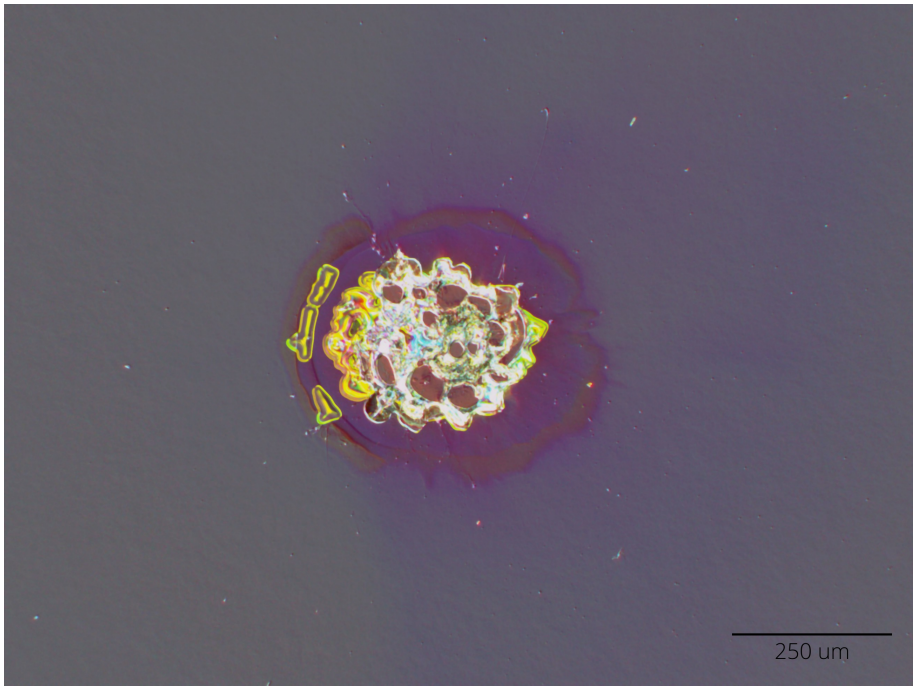


Figure 5: Typical damage morphology: fluence 98.3 J/cm^2, damage after 1 pulse(s).

TECHNICAL NOTE

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 6).

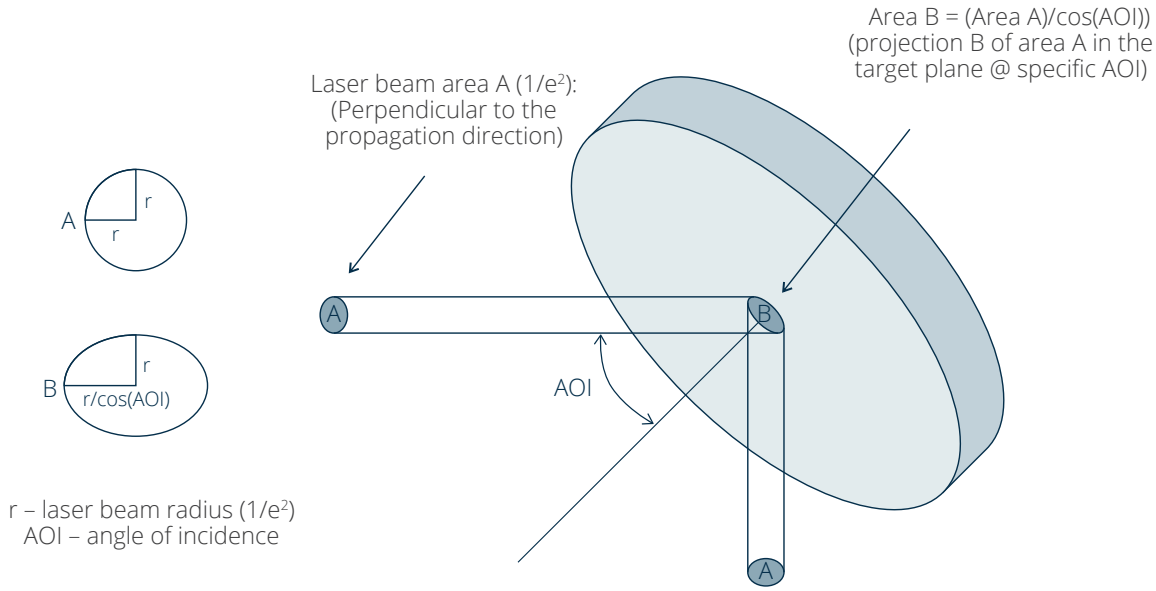


Figure 6: Oblique incidence.