Laser-Induced Damage Threshold (LIDT) Measurement Report

ISO21254-2: S-on-1 Test Procedure

Sample: 20LDR15KG

LIDARIS
LIDT Service

Request from:

ALTECHNA Co.Ltd.
Mokslininku st. 6A
LT-08412 Vilnius

Contact person: Karolina Gudeliūnaitė

Testing institute:

Lidaris Ltd.
Saulėtekio al. 10,
LT-10223, Vilnius, Lithuania, EU

Tester/date: M. Sciuka / 2015-11-10

Specimen

Name of sample: 20LDR15KG

Type of specimen: UVFS
S1: (Tp avg. > 98%, Tp min >96%, Rs > 99.9%) @ 1010-1050, AOI = 55.4 ± 1.5 deg
S2: Uncoated

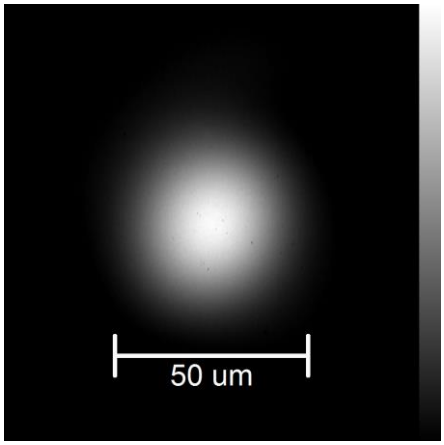
Storage, cleaning: Wrapped in paper for optics, plastic bag

Test specification

First harmonic of pulsed "Pharos" laser (λ=1030 nm, linear polarization, pulse duration 11.1 ps.), λ/2 plate combined with additional polarizer attenuator, online scattered light based damage detection, offline inspection of damage morphology with Nomarski microscopy.

Laser parameters used for testing

Wavelength:	1030 nm
Angle of incidence:	55.4 deg.
Pulse spectral width (WFHM):	28 nm
Polarization state:	linear P and S
Pulse repetition frequency:	10 kHz
Spatial beam profile in target plane:	TEM_{00}
Longitudinal beam profile:	Gaussian: Kerr lens mode locked
Beam diameter in target plane $_{(1/e^2)}$:	49.5 ± 0.1 μm (average from 64 pulses)
Pulse duration:	11.1 ps



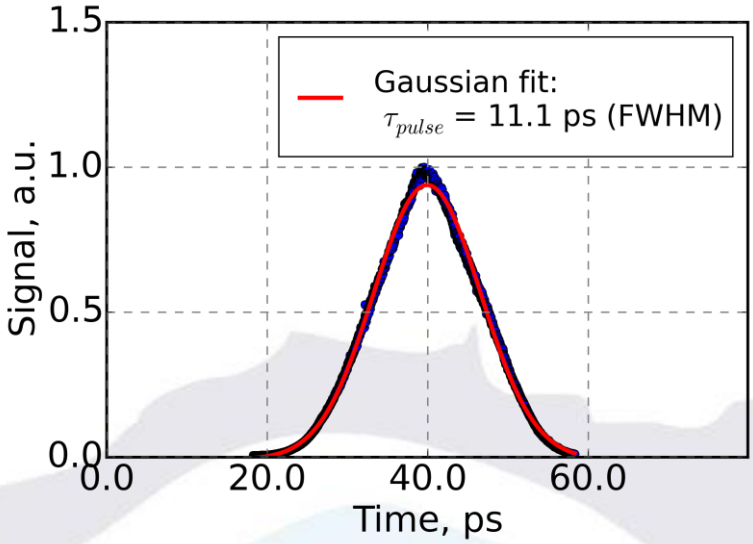


Fig. 1. Spatial beam profile in target plane (left) and pulse autocorrelation curve (right)

Test procedure: **S-on-1 test**

Number of irradiated sites:	403 (P pol.), 490 (S pol.)
Arrangement of test sites:	Hexagon close packing: equally spaced
Minimum distance between sites:	300 μm
Damage detection:	Scattered light diode/Nomarski microscopy
Test environment:	Industrial environment
Storage of the specimen:	Original packaging, normal laboratory conditions
Cleaning:	Compressed air
Definition of LIDT:	LIDT is defined as a middle fluence point between highest zero and lowest nonzero damage probability points. (See Fig. 2 for details)

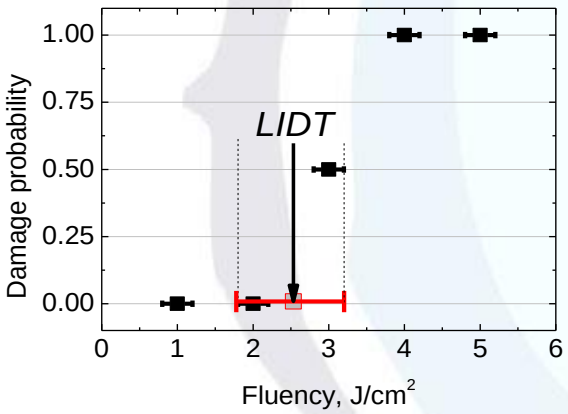


Fig. 2. Definition of LIDT estimated in case of deterministic (ps) damage probability data.

LIDARIS Ltd.
Address: Saulėtekio Al., 10 LT-10223 Vilnius, Lithuania, EU
Company code: 302813532
VAT registration: LT100007025612
Bank account (IBAN): LT30 7300 0101 3207 8596
Bank: Swedbank AB
Phone: +370 609 09233
Email: info@lidaris.com
Skype: lidt-service
www.lidaris.com

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Test result:

Table1. LIDT Results of sample 20LDR15KG

Test mode	Threshold, J/cm^2	
	P polarization	S polarization
1-on-1	4.75 ± 0.08	10.30 ± 0.18
10000-on-1	4.28 ± 0.11	8.34 ± 0.16

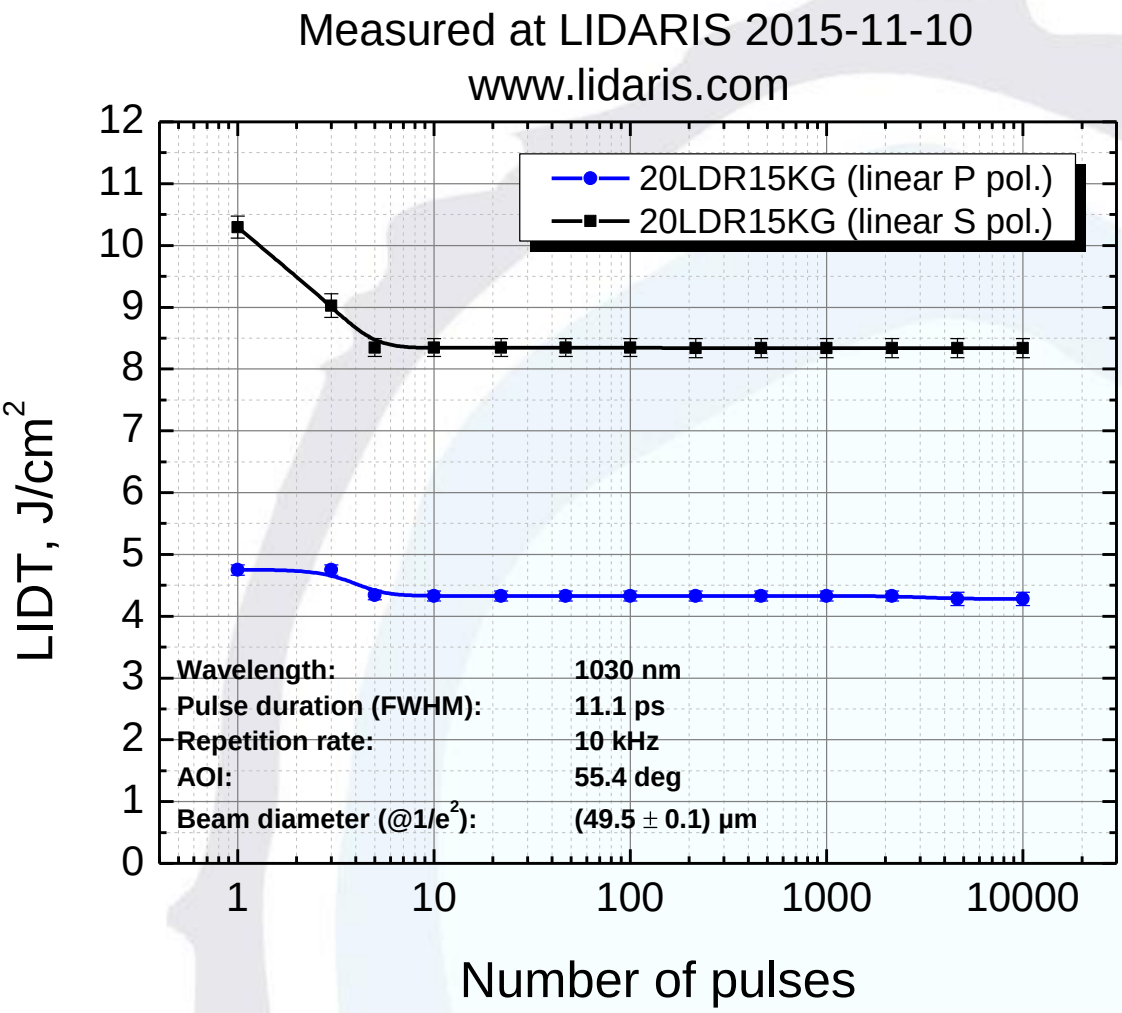

Fig. 3. Characteristic damage curve.

Typical damage morphology:

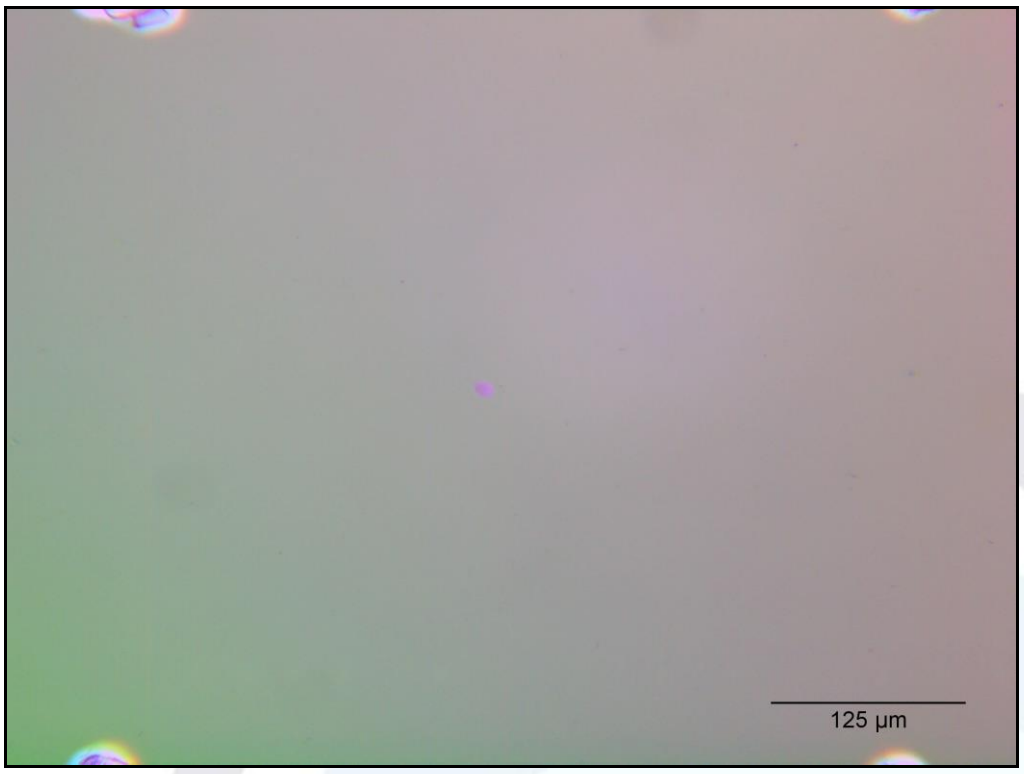

Fig. 4. Typical front surface damage morphology for P polarization (Fluence 5.17 J/cm^2, damage after 1 pulse)

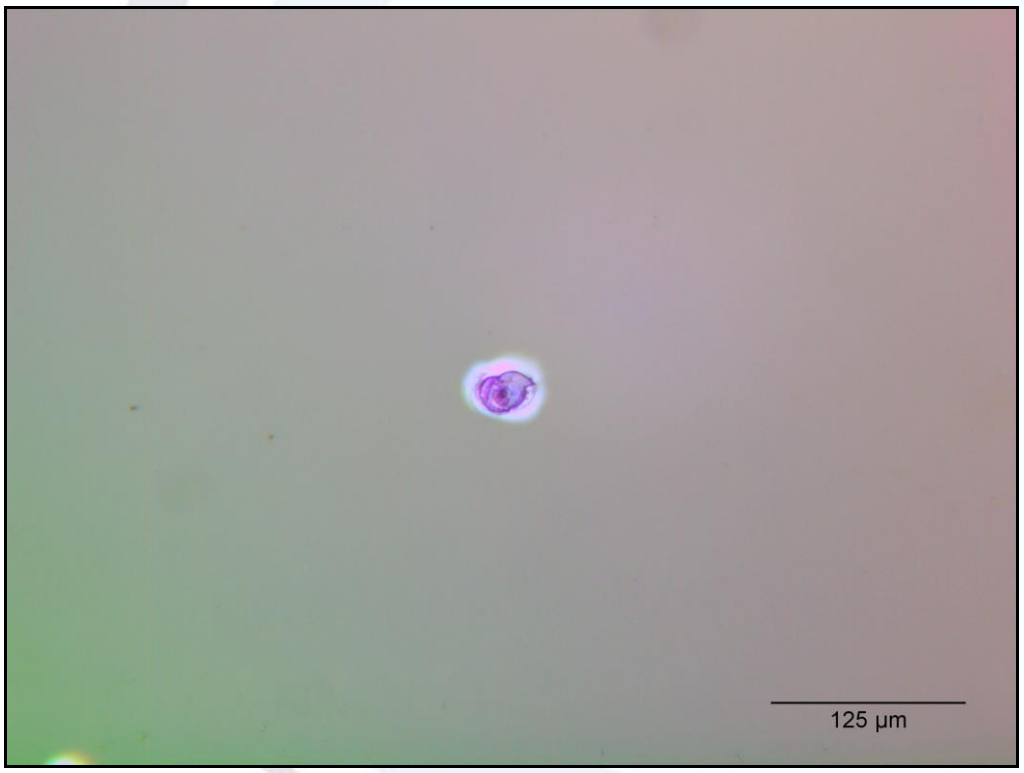

Fig. 5. Typical front surface damage morphology for P polarization (Fluence 4.32 J/cm^2, damage after 4262 pulses)

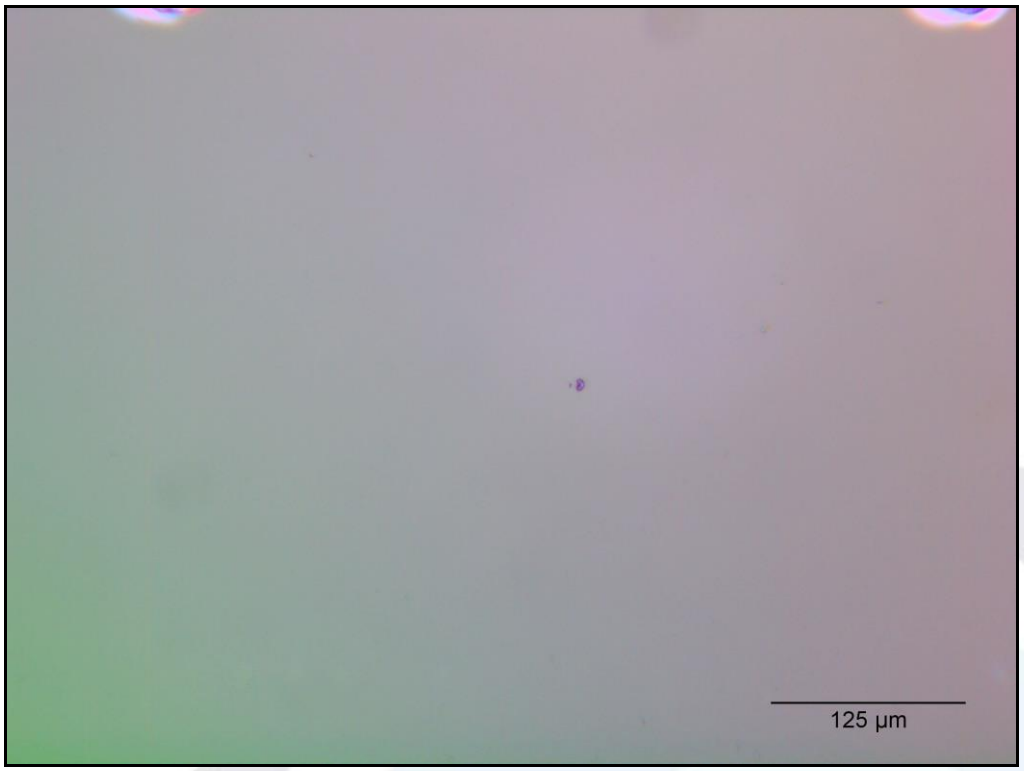

Fig. 6. Typical front surface damage morphology for S polarization (Fluence 12.62 J/cm^2, damage after 1 pulse)

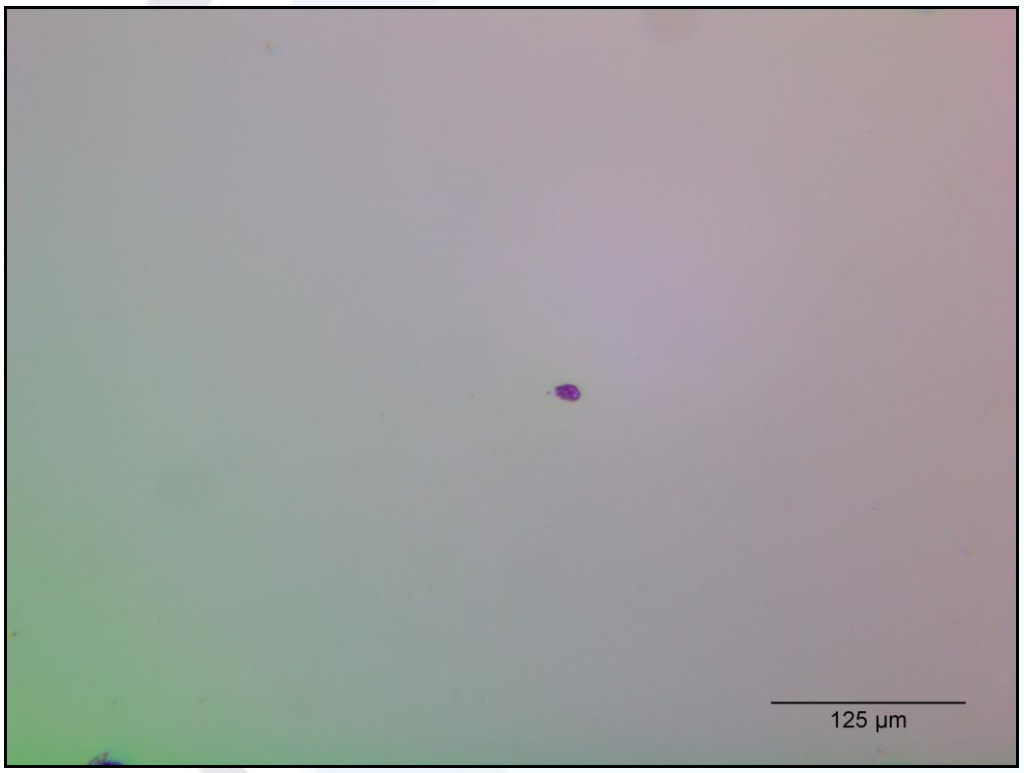

Fig. 7. Typical front surface damage morphology for S polarization (Fluence 8.36 J/cm^2, damage after 5 pulses)

Technical note:

According to the ISO 21254-2 norm 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 has to be included in the calculation of the effective area. Therefore the beam diameter increase due to the angle of incidence (AOI) is taken into account when calculating the laser fluency.

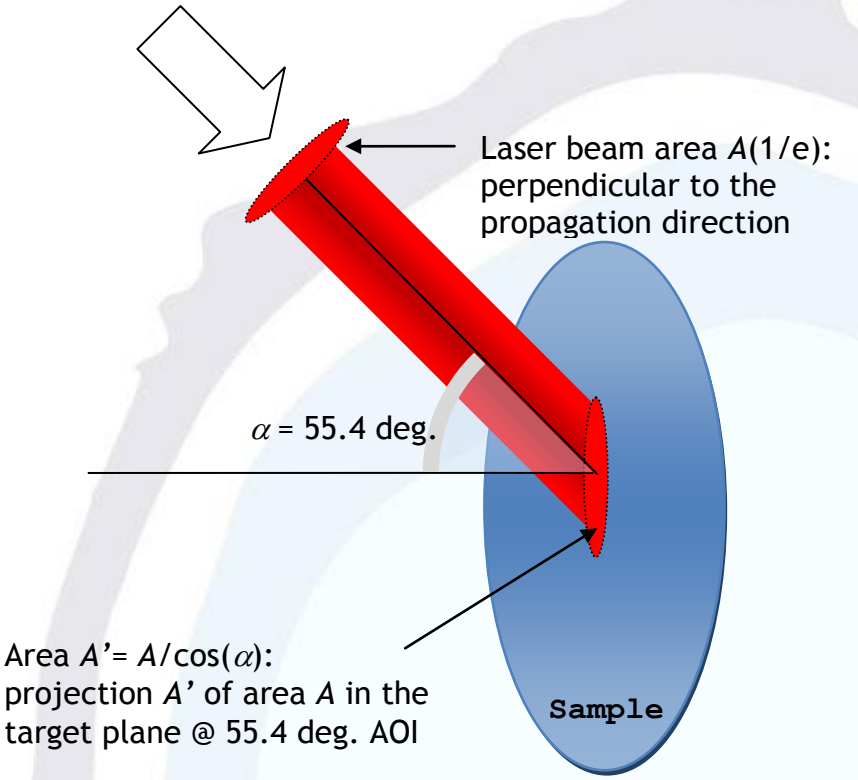

Fig. 8. Oblique incidence.