

Laser-Induced Damage Threshold (LIDT) Measurement Report

ISO 21254-2: S-on-1 Test Procedure

Sample: 2-HC45TFP-0355-0254

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Tester/date: E. Pupka / 2016-11-18

Specimen

Name of sample: 2-HC45TFP-0355-0254

Type of specimen: Polarizer

Storage, cleaning: Plastic box

Test specification

Third harmonic of pulsed Nd:YAG InnoLas Laser: SpitLight Hybrid laser ($\lambda = 355$ nm, linear polarization, pulse duration 7.8 ns). $\lambda/2$ plate combined with additional polarizer attenuator, online scattered light damage detection, offline damage detection using Nomarski microscopy.

Laser parameters

Wavelength: 355 nm
Angle of incidence: 45 deg.
Polarization state: linear S and P
Pulse repetition frequency: 100 Hz
Spatial beam profile in target plane: TEM₀₀
Longitudinal beam profile: Single mode (SLM)
Beam diameter in target plane ($1/e^2$): (192.3 ± 9.9) μm (average from 500 pulses)
Pulse duration: (7.8 ± 0.4) ns

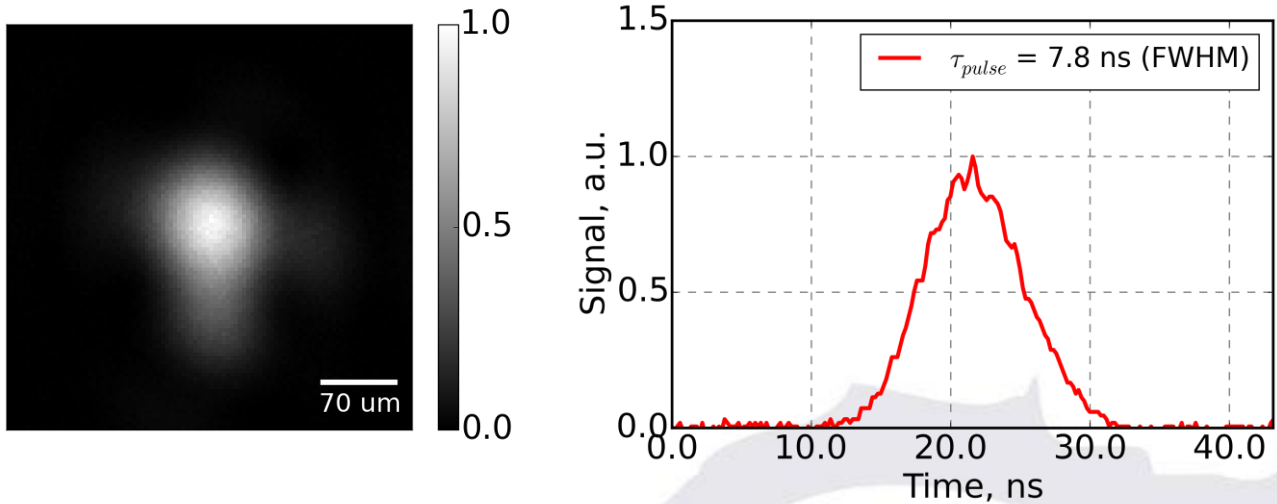


Fig. 1 Spatial beam profile in target plane (left) and temporal pulse profile (right)

Test procedure:

Number of sites per specimen:
Arrangement of test sites:
Minimum distance between sites:
Damage detection:

Storage of the specimen:
Test environment:
Cleaning:
Definition of LIDT:

S-on-1 test

199 (S pol.), 183 (P pol.)
Equally spaced
650 μm
Online scattered light diode,
offline Nomarski microscopy
Original packaging, normal laboratory conditions
Industrial environment
Compressed air
Nonlinear fit to 0% of damage probability

Test result:

Table 1 Summarized LIDT's for sample 2-HC45TFP-0355-0254.

Test mode	Polarizing surface threshold (S pol.), J/cm ²	Polarizing surface threshold (P pol.), J/cm ²
10-on-1	1.75 ≤ 3.10 ≤ 3.95	2.30 ≤ 2.88 ≤ 3.37
100-on-1	1.13 ≤ 2.20 ≤ 2.87	2.30 ≤ 2.78 ≤ 3.17
1000-on-1	1.13 ≤ 2.04 ≤ 2.63	1.77 ≤ 2.33 ≤ 2.68

Measured at LIDARIS 2016-11-18

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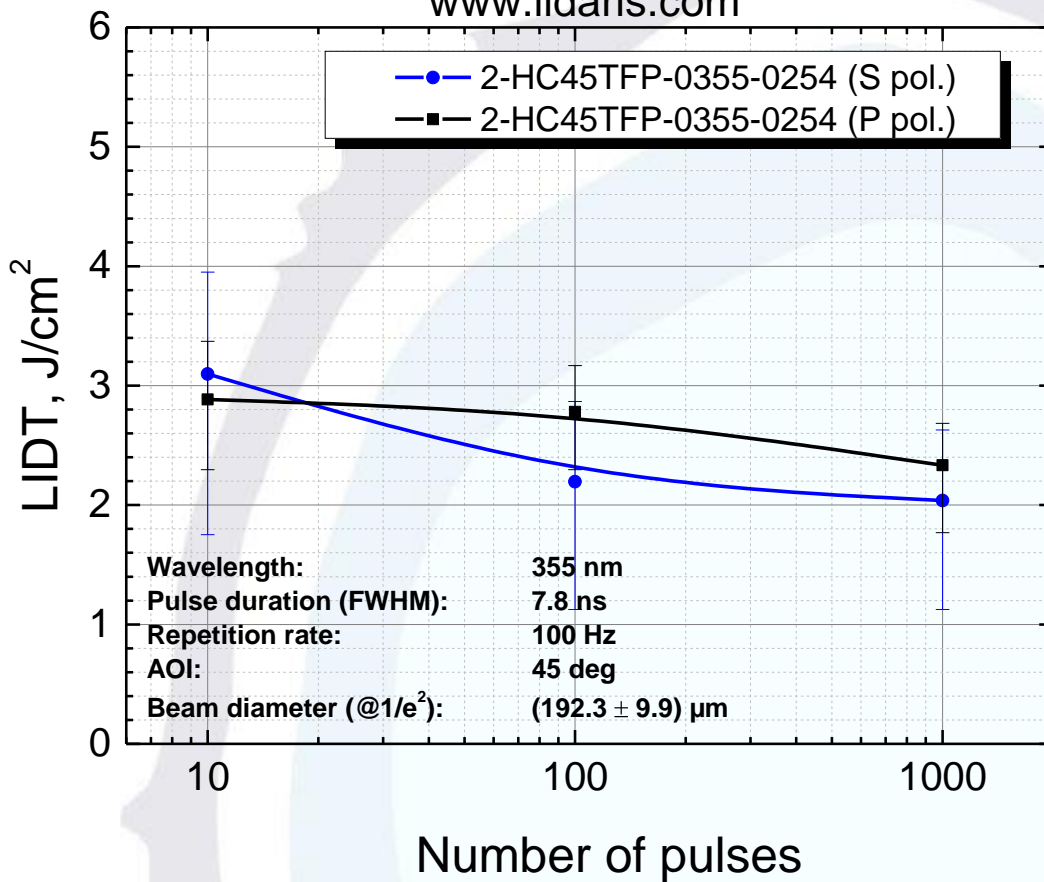
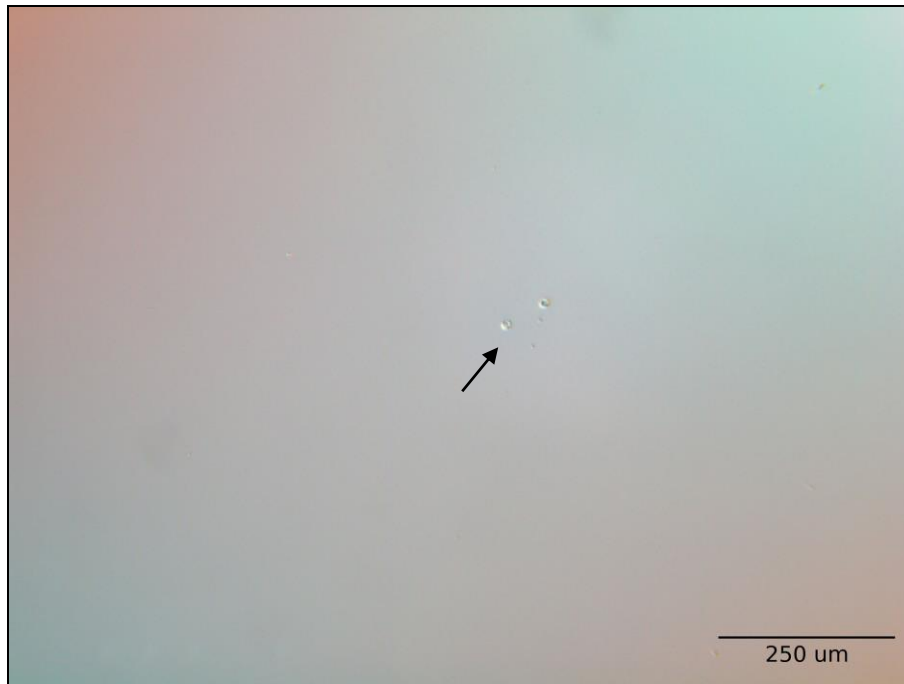
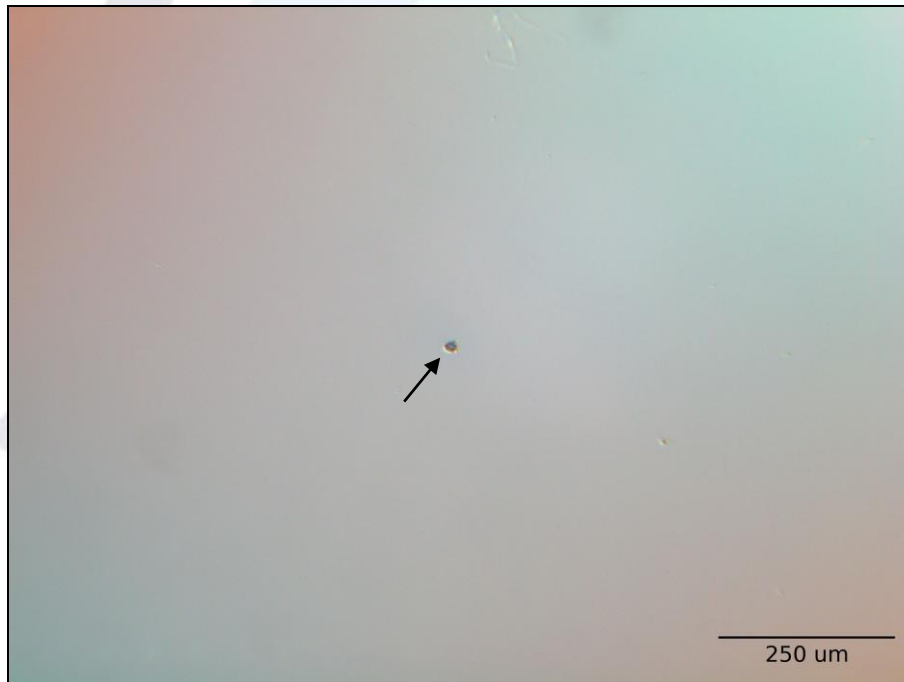


Fig. 2 Characteristic damage curve.

Typical damage morphology:



**Fig. 3 Typical polarizing surface damage morphology (S pol.)
(Fluence 5.84 J/cm², damage after 1 pulse)**



**Fig. 4 Typical polarizing surface damage morphology (S pol.)
(Fluence 6.15 J/cm², damage after 90 pulses)**



Fig. 5 Typical polarizing surface damage morphology (P pol.)
(Fluence 4.00 J/cm², damage after 2 pulses)

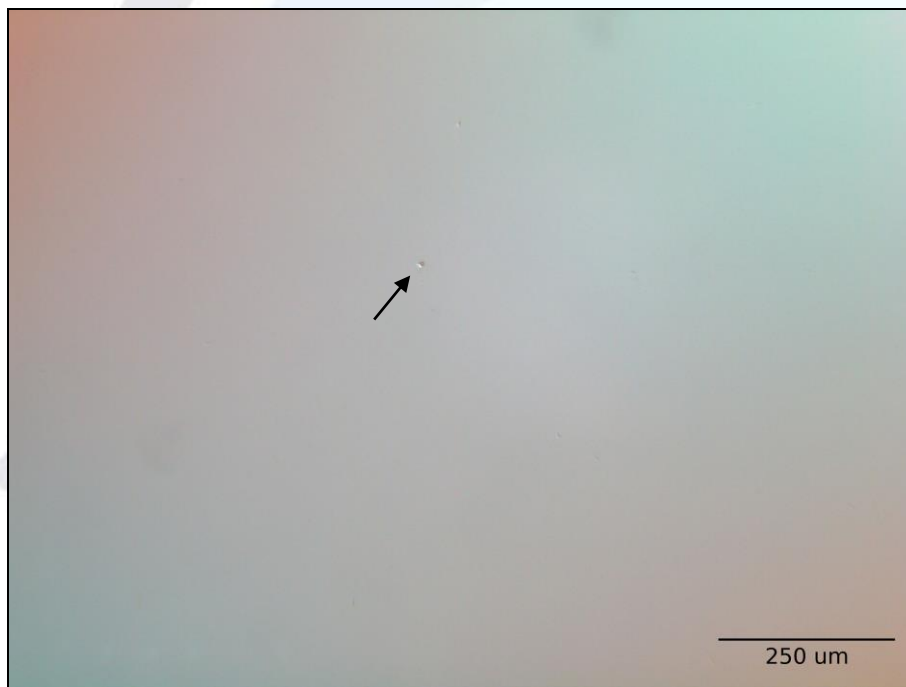


Fig. 6 Typical polarizing surface damage morphology (P pol.)
(Fluence 2.81 J/cm², damage after 1000 pulses)

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 fluence.

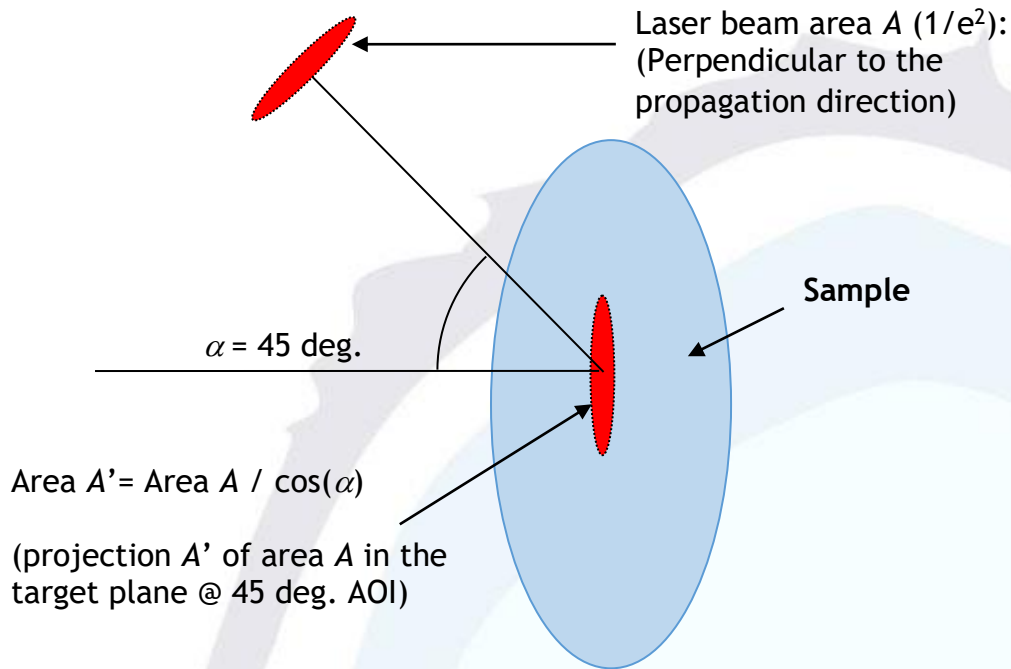


Fig. 7 Oblique incidence.