Laser-Induced Damage Threshold (LIDT) Measurement Report

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

Sample: 2-HPCB-C-0125

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Tester/date: E. Pupka / 2016-09-14

Specimen

Name of sample: 2-HPCB-C-0125

Type of specimen: Polarizing Cube for High Energy Applications

Storage, cleaning: Membrane box

Test specification

Fundamental harmonic of pulsed Nd:YAG InnoLas Laser: SpitLight Hybrid laser (λ = 1064 nm, linear polarization, pulse duration 12.0 ns). $\lambda/2$ plate combined with additional polarizer attenuator, online scattered light damage detection, offline damage detection using Nomarski microscopy.

Laser parameters

Wavelength:	1064 nm
Angle of incidence:	0 deg.
Polarization state:	linear S
Pulse repetition frequency:	100 Hz
Spatial beam profile in target plane:	TEM_{00}
Longitudinal beam profile:	Single mode (SLM)
Beam diameter in target plane $(1/e^2)$:	(196.8 ± 2.6) µm (average from 500 pulses)
Pulse duration:	(12.0 ± 0.4) ns

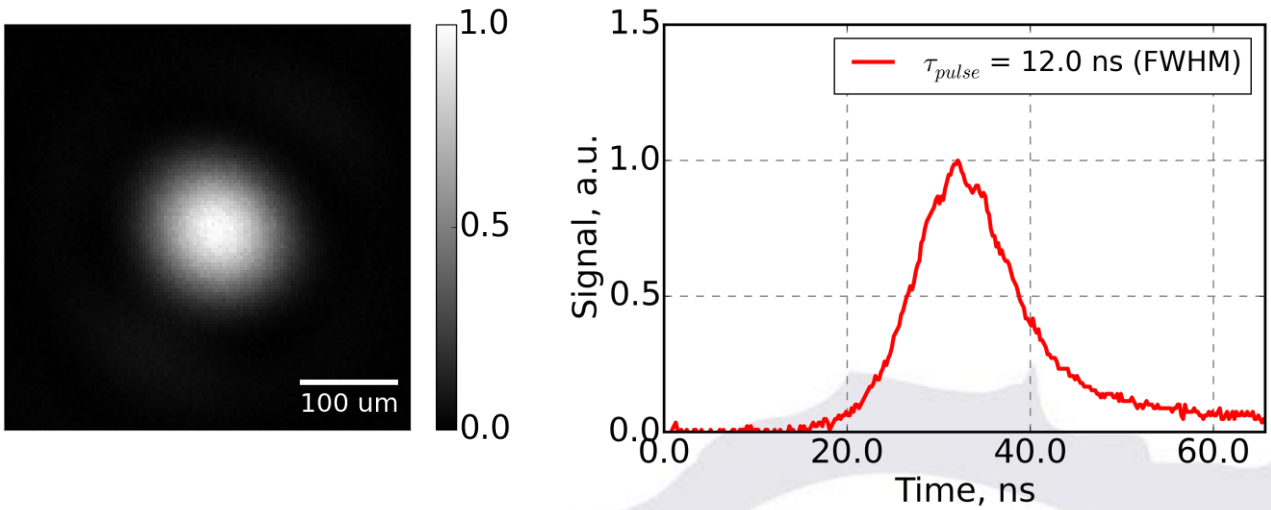

Fig. 1 Spatial beam profile in target plane (left) and temporal pulse profile (right)

Test procedure:	**S-on-1 test**
Number of sites per specimen:	80
Arrangement of test sites:	Equally spaced
Minimum distance between sites:	700 µm
Damage detection:	Online scattered light diode, offline Nomarski microscopy
Storage of the specimen:	Original packaging, normal laboratory conditions
Test environment:	Industrial environment
Cleaning:	Compressed air
Definition of LIDT:	Nonlinear fit to 0% of damage probability

Test result:

Table 1 Summarized LIDT's for sample 2-HPCB-C-0125.

Test mode	Polarizing surface threshold, J/cm2 (Lower limit)	Front surface threshold, J/cm2	Side surface threshold, J/cm2
10-on-1	*22.5*	25.9 ≤ 29.7 ≤ 33.1	22.6 ≤ 28.7 ≤ 31.7
100-on-1	*22.5*	25.9 ≤ 29.7 ≤ 33.1	19.5 ≤ 24.2 ≤ 26.4
1000-on-1	*22.5*	23.8 ≤ 29.7 ≤ 30.9	19.2 ≤ 24.1 ≤ 26.2

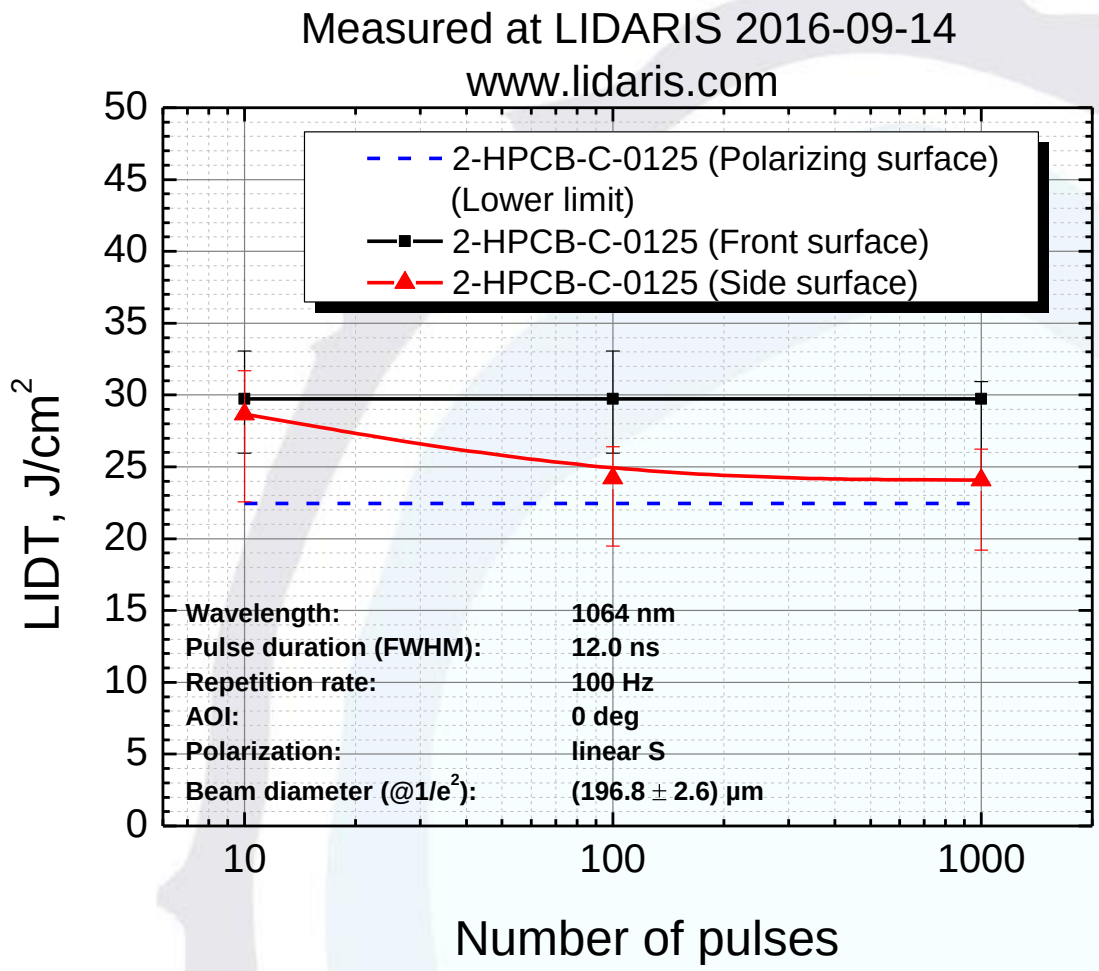

Fig. 2 Characteristic damage curve.

Typical damage morphology:

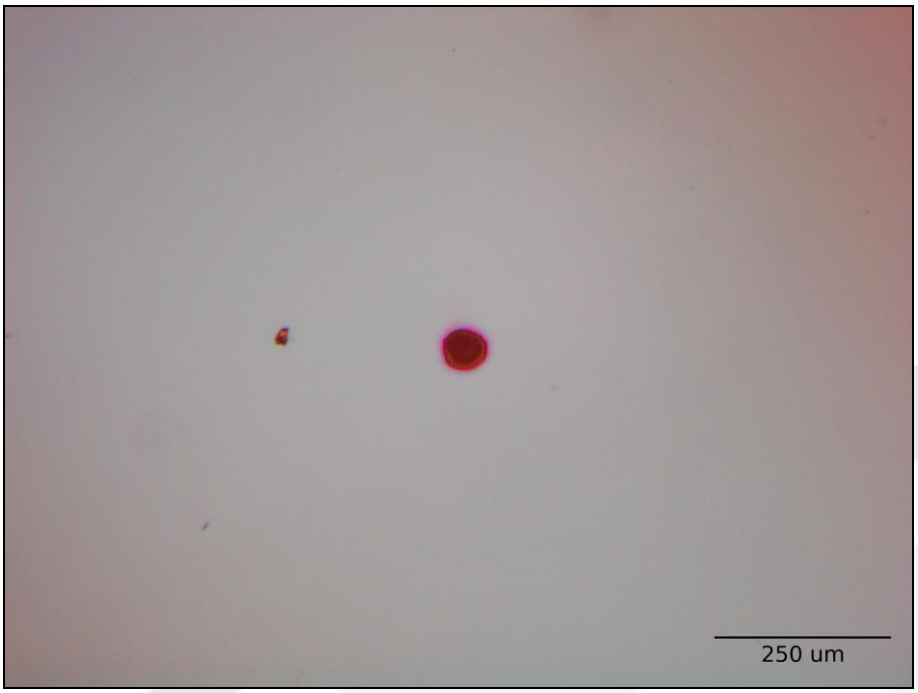

Fig. 3 Typical front surface damage morphology
(Fluence 30.7 J/cm^2, damage after 457 pulses)

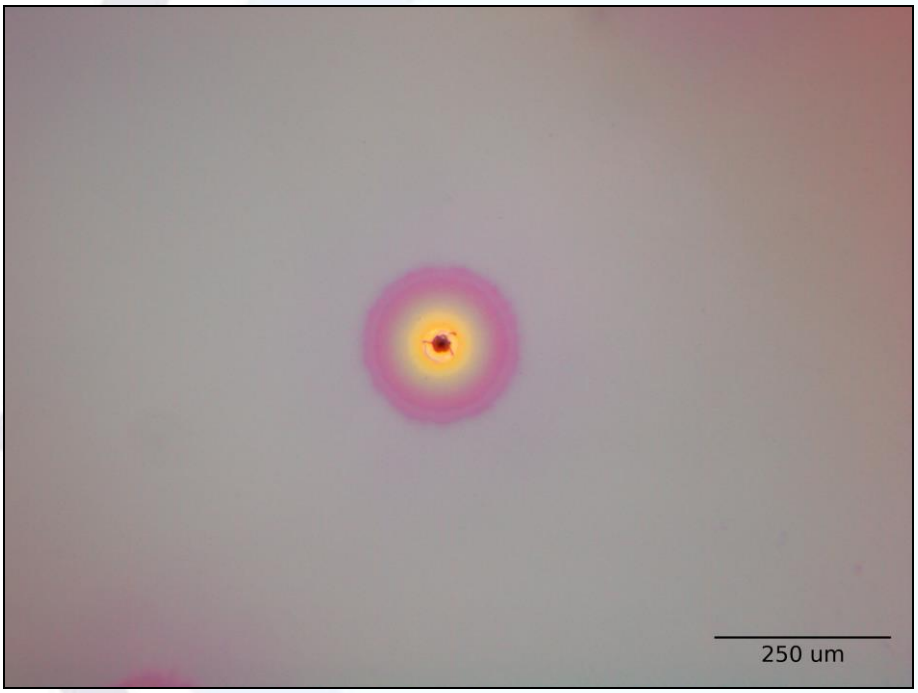

Fig. 4 Typical front surface damage morphology
(Fluence 46.7 J/cm^2, damage after 6 pulses)

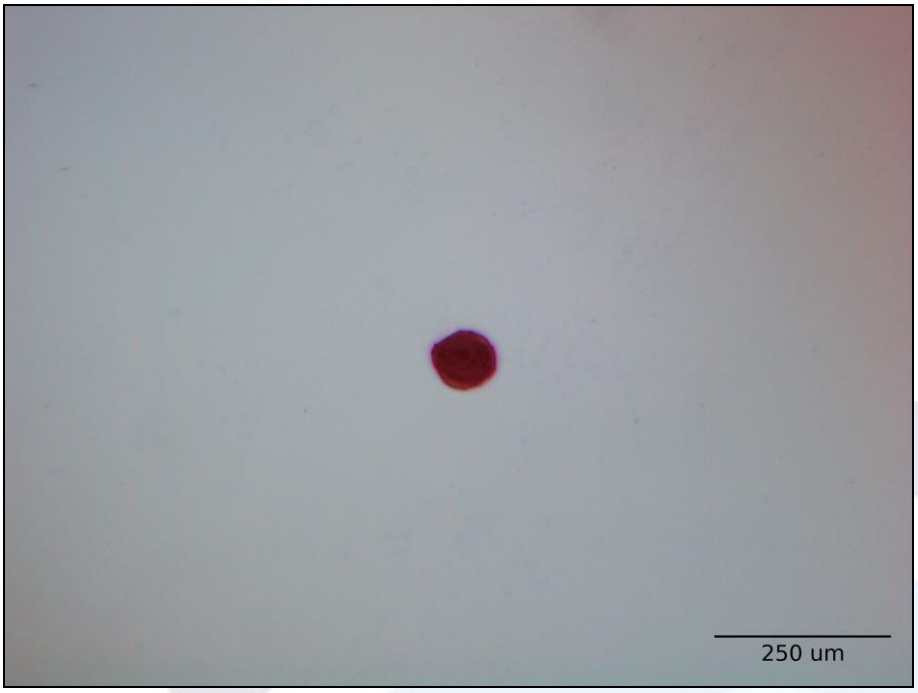

Fig. 5 Typical side surface damage morphology
(Fluence 25.3 J/cm^2, damage after 1000 pulses)

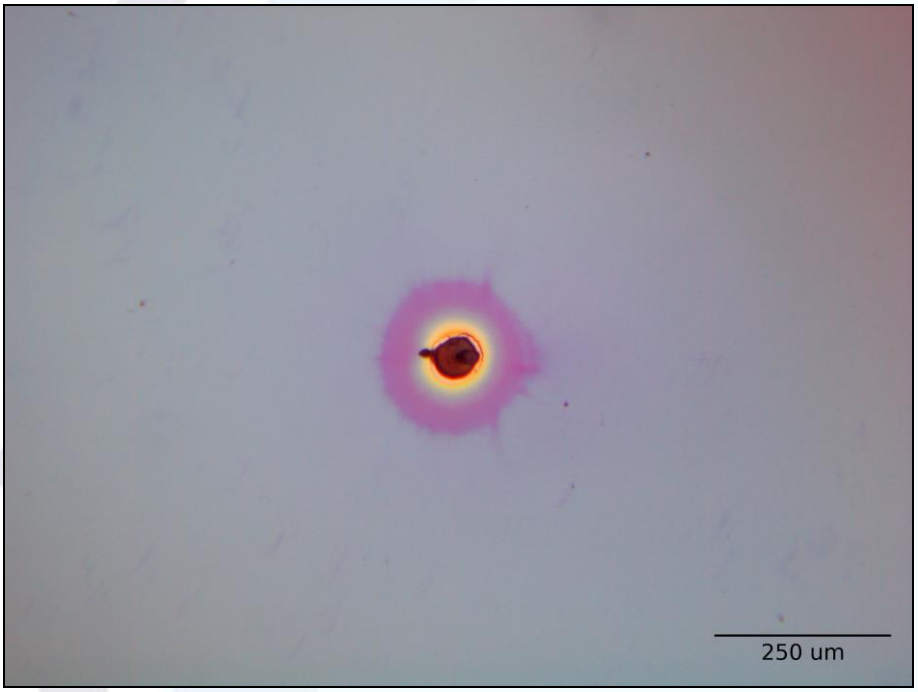

Fig. 6 Typical side surface damage morphology
(Fluence 36.1 J/cm^2, damage after 81 pulses)

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Technical note:

1. Polarizing surface did not experience any visible damage during the test, therefore the exact LIDT could not be evaluated. Only the lower limit of the LIDT is provided.

2. The provided threshold values are calculated for normal incidence in relation to the front surface in order to compare the LIDT values of different surfaces. The actual damaging fluence value on polarizing surface is $\cos(45^\circ) \approx 0.7$ times lower.

3. Per customer request, beam waist was always kept on the polarizing surface when translating the sample, therefore experimental fluence values for other surfaces are up to ~10% lower than provided in the measurement report (Rayleigh length was 28 mm).

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