Laser-Induced Damage Threshold (LIDT) Measurement Report

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

Sample: 2-HPCB-B-0125

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Tester/date: E. Pupka / 2016-11-02

Specimen

Name of sample: 2-HPCB-B-0125

Type of specimen: Polarizing Cube for High Energy Applications

Storage, cleaning: Membrane box

Test specification

Second harmonic of pulsed Nd:YAG InnoLas Laser: SpitLight Hybrid laser (λ = 532 nm, linear polarization, pulse duration 9.0 ns). $\lambda/2$ plate combined with additional polarizer attenuator, online scattered light damage detection, offline damage detection using Nomarski microscopy.

Laser parameters

Wavelength:	532 nm
Angle of incidence:	0 deg.
Polarization state:	linear S and P
Pulse repetition frequency:	100 Hz
Spatial beam profile in target plane:	TEM_{00}
Longitudinal beam profile:	Single mode (SLM)
Beam diameter in target plane $(1/e^2)$:	(193.8 ± 2.9) µm (average from 500 pulses)
Pulse duration:	(9.0 ± 0.4) ns

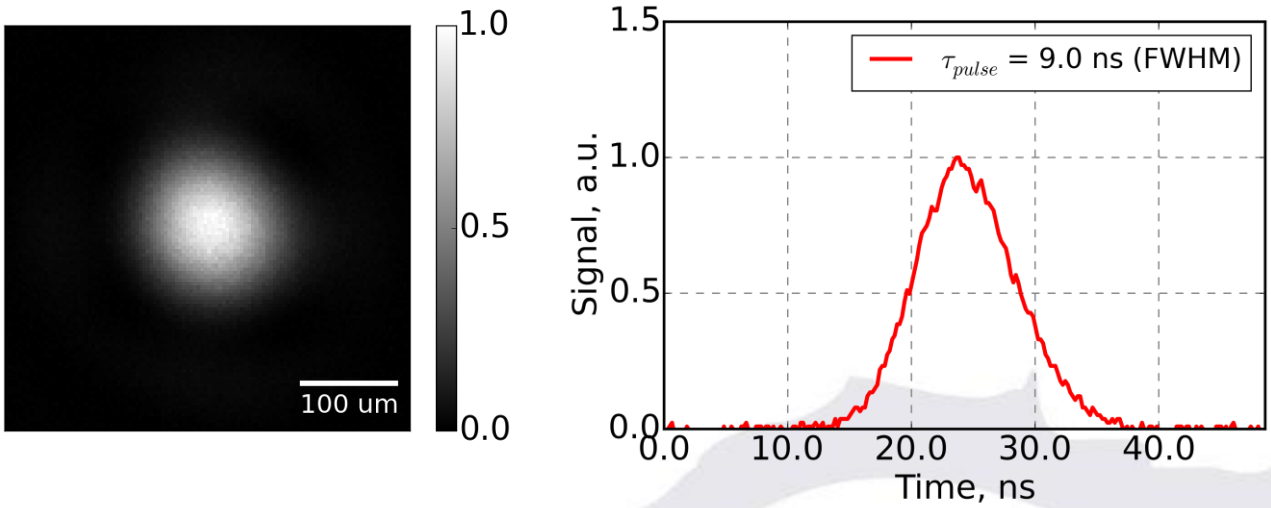

Fig. 1 Spatial beam profile in target plane (left) and temporal pulse profile (right)

Test procedure:	**S-on-1 test**
Number of sites per specimen:	125 (S pol.), 111 (P pol.)
Arrangement of test sites:	Equally spaced
Minimum distance between sites:	650 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-B-0125.

Test mode	Polarizing surface threshold (S pol.), J/cm2	Polarizing surface threshold (P pol.), J/cm2
10-on-1	4.89 ≤ 7.76 ≤ 9.03	12.23 ≤ 13.97 ≤ 15.34
100-on-1	3.08 ≤ 5.51 ≤ 6.40	12.22 ≤ 13.77 ≤ 14.89
1000-on-1	3.09 ≤ 5.20 ≤ 6.10	12.23 ≤ 13.73 ≤ 14.76

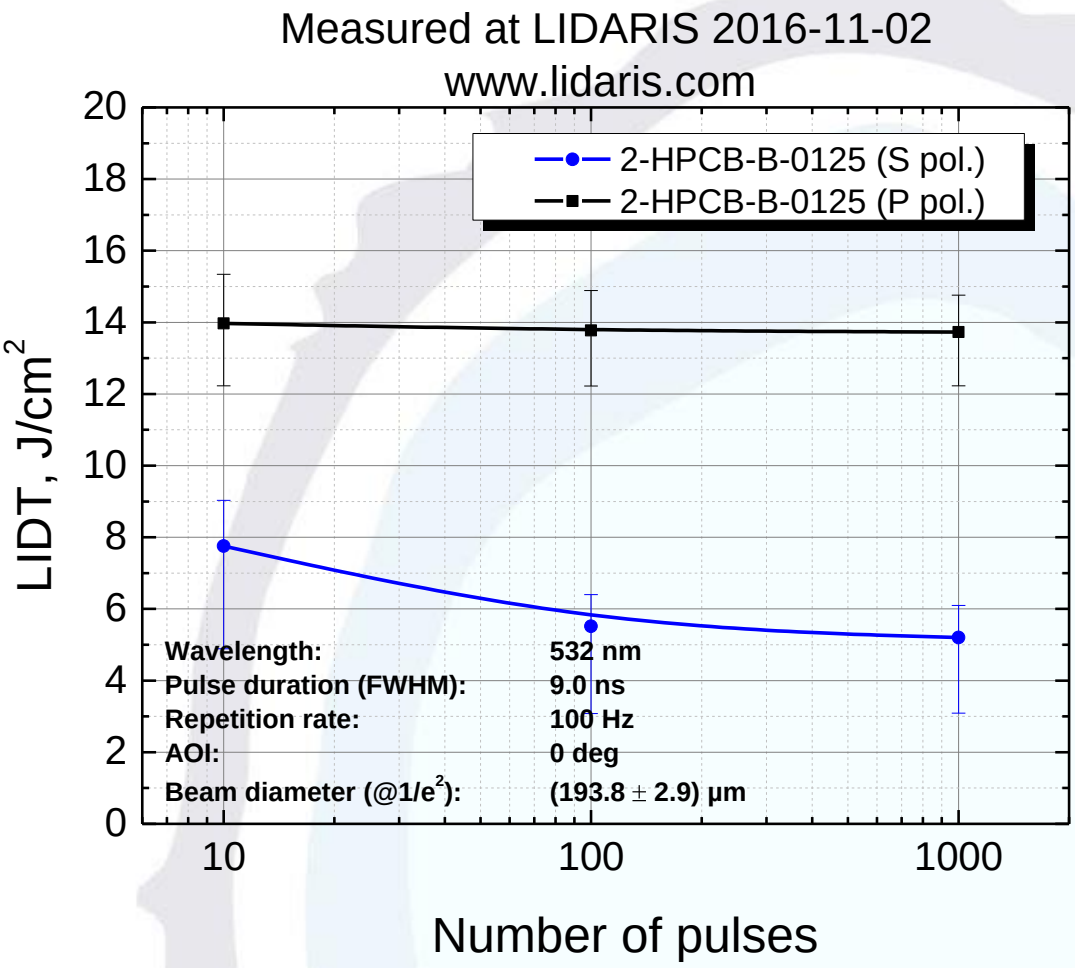

Fig. 2 Characteristic damage curve.

Typical damage morphology:

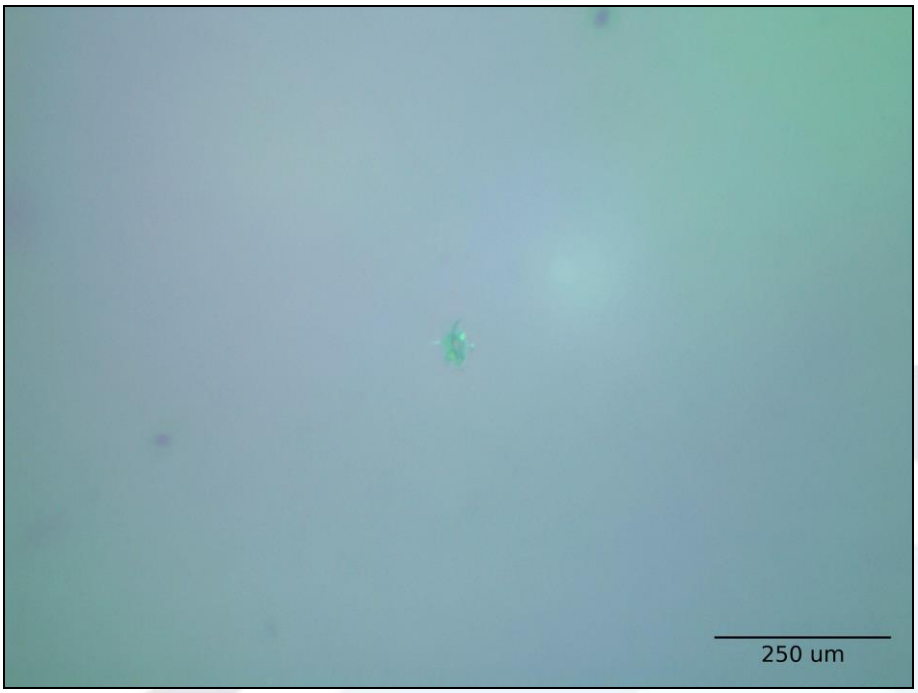

Fig. 3 Typical polarizing surface damage morphology (S pol.)
(Fluence 8.66 J/cm^2, damage after 7 pulses)

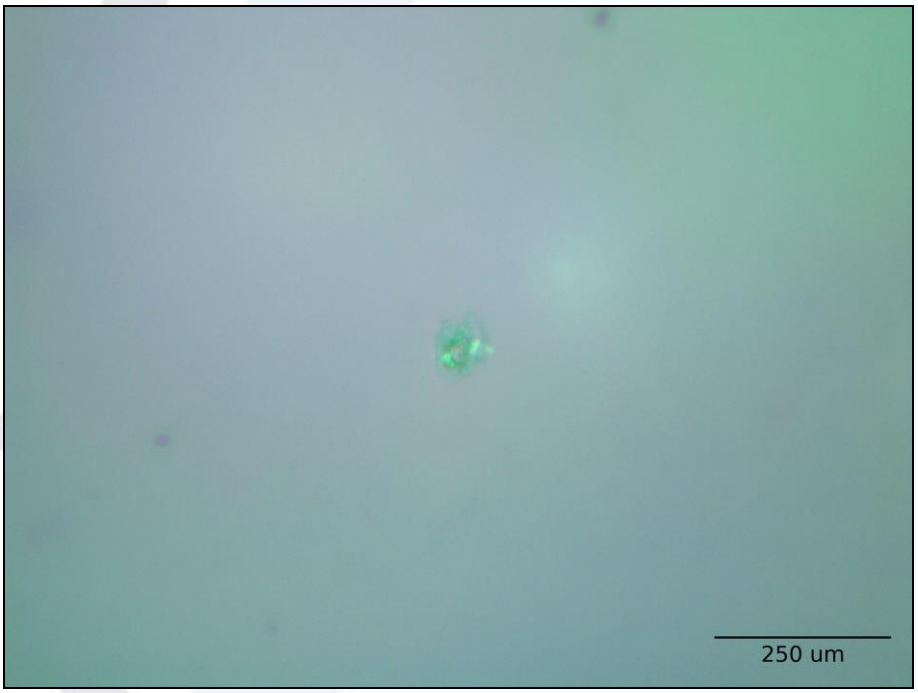

Fig. 4 Typical polarizing surface damage morphology (S pol.)
(Fluence 6.46 J/cm^2, damage after 802 pulses)

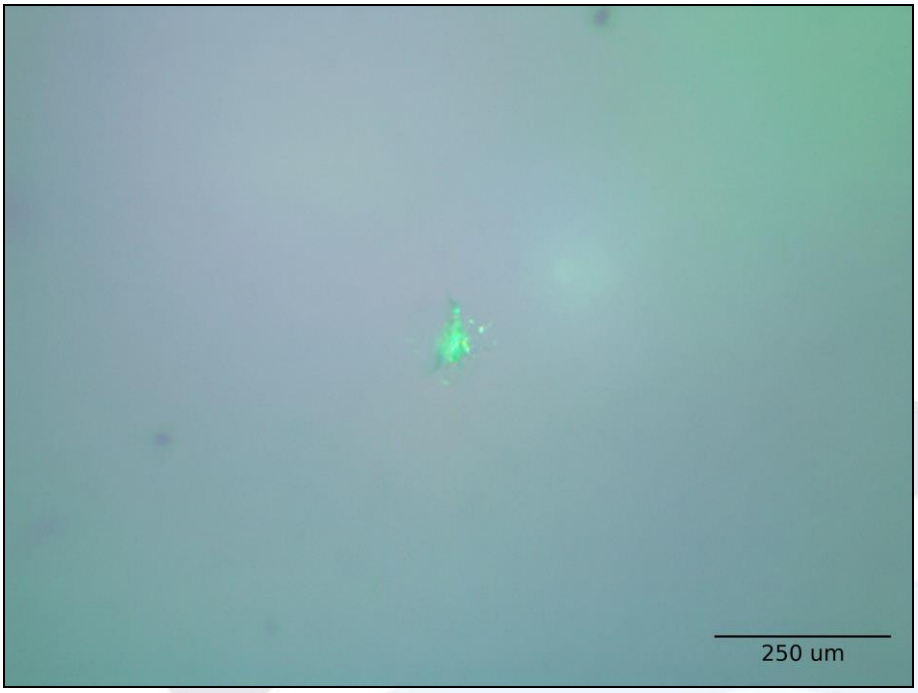

Fig. 5 Typical polarizing surface damage morphology (P pol.)
(Fluence 15.26 J/cm^2, damage after 2 pulses)

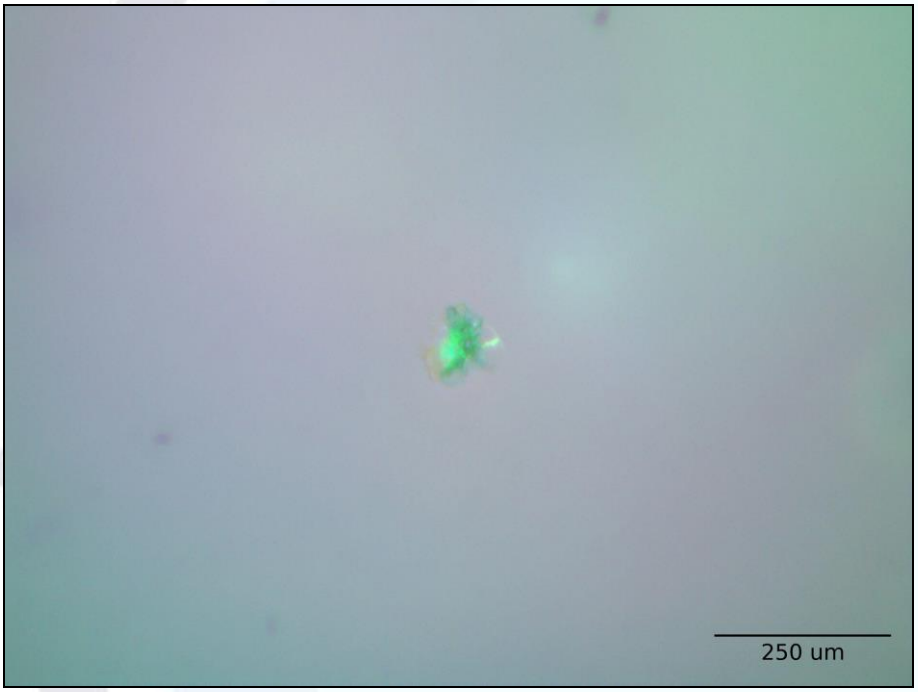

Fig. 6 Typical polarizing surface damage morphology (P pol.)
(Fluence 15.09 J/cm^2, damage after 209 pulses)

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Technical note:

1. 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°) ≈ 0.7 times lower.

2. Per customer request, beam waist was always kept on the polarizing surface when translating the sample, therefore fluence values for other surfaces are up to ~4% lower (Rayleigh length was 55 mm).

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