Laser-Induced Damage Threshold (LIDT) Measurement Report

ISO21254-2: S-on-1 Test Procedure

Sample: R14006-12
Request from: STFC RAL
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Tester/date: E. Pupka / 2015-06-09

Specimen
Name of sample: R14006-12
Type of specimen: Yb:YAG, uncoated
Storage, cleaning: Plastic box, wrapped in paper for optics

Test specification

First harmonic of pulsed Nd:YAG InnoLas Laser: SpitLight Hybrid laser (\(\lambda = 1064\) nm, linear polarization, pulse duration 10.2 ns), \(\lambda/2\) plate combined with additional polarizer attenuator, online scattered light damage detection, offline inspection of damage detection using Nomarski microscopy (100x).

Laser parameters used for testing

- Wavelength: 1064 nm
- Angle of incidence: 0 deg.
- Polarization state: linear
- Pulse repetition frequency: 100 Hz
- Spatial beam profile in target plane: TEM\(_{00}\)
- Longitudinal beam profile: Single mode (SLM)
- Beam diameter in target plane (\(1/e^2\)): 250.0 ± 5.4 µm (average from 64 pulses)
- Pulse duration: 10.2 ns
Fig. 1. Spatial beam profile in target plane (left) and oscilloscope curve (right).

**Test procedure:**

- Number of sites per specimen: 203
- Arrangement of test sites: equally spaced
- Minimum distance between sites: 875 µm
- Damage detection: Scattered light diode
- Storage of the specimen: Manufacturer’s packaging, normal laboratory conditions
- Test environment: Industrial environment
- Cleaning: Dust blown off with clean air
- Definition of LIDT: Nonlinear fit to 0% of damage Probability
Test result:

Table 1. Summarized LIDT’s for sample R14006-12.

<table>
<thead>
<tr>
<th>Test mode</th>
<th>Threshold - front surface, J/cm²</th>
<th>Threshold - rear surface, J/cm²</th>
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<tbody>
<tr>
<td>10-on-1</td>
<td>$15.98 \leq 19.15 \leq 22.14$</td>
<td>$19.36 \leq 22.77 \leq 25.96$</td>
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<tr>
<td>1000-on-1</td>
<td>$11.40 \leq 13.66 \leq 15.73$</td>
<td>$9.98 \leq 11.94 \leq 13.61$</td>
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Measured at LIDARIS 2015-06-09
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Fig. 2. Characteristic damage curve.
Typical damage morphology:

Fig. 3. Typical front surface damage morphology (Energy density 30.42 J/cm², damage after 11 pulses)

Fig. 4. Typical front surface damage morphology (Energy density 15.06 J/cm², damage after 602 pulses)
Fig. 5. Typical rear surface damage morphology 
(Energy density 30.42 J/cm², damage after 11 pulses)

Fig. 6. Typical rear surface damage morphology 
(Energy density 12.40 J/cm², damage after 1000 pulses)