

Laser-induced damage threshold (LIDT) measurements of optical components

Measured values

- Laser induced damage threshold (fluence)

Principle

According to DIN EN ISO 21254-1:2011 and DIN EN ISO 21254-2:2011 optical components are irradiated with pulsed laser light and the occurrence of damage is monitored online by scattering light detection. In case of tests in vacuum pressure detection is used in addition. Any change observable under Nomarski microscope is defined as a laser-induced damage. The system has a detection resolution in the order of μm damage size. Statistical analysis of recorded data provides damage threshold fluence for laser irradiation, given in $[\text{J}/\text{cm}^2]$.

LIDT test setup is equipped with different Nd-YAG laser sources with frequency doubling and tripling (1064nm, 532 nm, 355nm, pulse width: 3-20 ns, repetition rate up to 200 Hz, pulse energy up to 500 mJ@1064 nm). The optics can be tested in high vacuum, ambient atmosphere or in pressurized condition.

Furthermore, after the tests optical surfaces are inspected by DIC-, scanning force microscopy or white light interferometry.

Application

1. Determination of laser-induced damage threshold for optical components
2. Study of physical processes involved in damage
3. Surface inspection for investigation of damage morphology

Literature / References

- 1. Allenspacher, P., Riede, W., Baehnisch, R.: Multiple ultrashort

pulse damage of coated beta barium borate. Boulder Damage Symposium, Boulder CO, USA, 21.-24.9.2003, SPIE, (2003)

- 2. Allenspacher, P., Riede, W., Hüttner, B.: Ultrashort pulse damage of Si and Ge semiconductors. Boulder Damage Symposium, Boulder CO, USA, 16.-18.9.2002, SPIE, Proceedings: Laser-Induced Damage in Optical Materials: 2002 and International Workshop on Laser Beam and Optics Characterization, S. 358-365, SPIE, (2003)
- 3. Riede, W., Allenspacher, P.: Laser damage test bench for space optics, International Conference on Space Optics (ICSO V), Toulouse, März 2004
- 4. Allenspacher, P., Riede, W., Wernham, D., Capanni, F., Era, F.: Vacuum laser damage test bench. Proc. of SPIE Vol. 5991, 599128, (2005)
- 5. Allenspacher, P., Riede, W., Wernham, D.: Laser qualification testing of space optics, Proc. SPIE Vol. 6403, 64030T, (2007)
- 6. Riede, W., Allenspacher, P., Jensen, L., Jupé, M.: Analysis of the air-vacuum effect in dielectric coatings, Proc. SPIE Vol. 7132, 7132OF-2, (2008)
- 7. Riede, W., Allenspacher, P., Schröder, H., Mahnke, P., Paunescu, G.: Aspects of laser optics qualification for space applications, Proc. SPIE Vol. 7504, 7504OT, (2009)

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Handout

*related measurement techniques and
facilities are available at: [http://messtec.
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