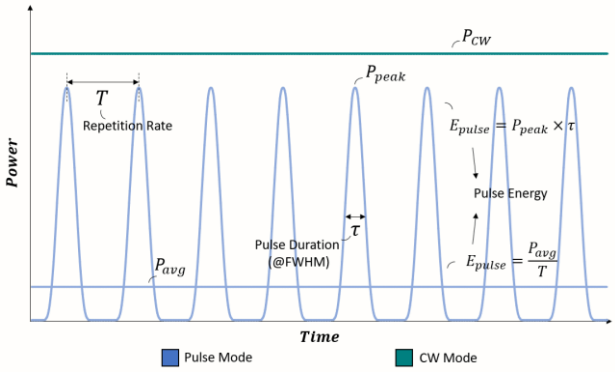
WAVELENGTH OPTO-ELECTRONIC

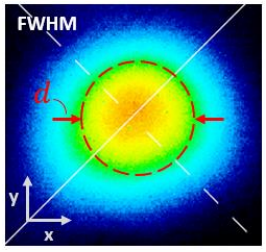
Laser Induced Damage Threshold (LIDT)
— *Quality assurance of optical components*

Introduction

Laser Induced Damage Threshold (LIDT) is a qualitative measurement defined by ISO 21254 for determining the maximum laser intensity (CW, W/cm^2) or fluence (Pulse, J/cm^2) an irradiated optical component can withstand before irreversible damage occurs. LIDT test is suitable at all wavelengths, pulse lengths, coated or uncoated materials.

CW vs. Pulse Damage Mechanisms





Beam Area (at FWHM)

$$A_{beam} = \pi \left(\frac{d}{2}\right)^2$$

Intensity (CW)

$$I = \frac{P_{cw}}{A_{beam}}$$

Fluence (Pulse)

$$F = \frac{E_{pulse}}{A_{beam}}$$

Figure 1. CW Intensity and Pulse Fluence Relationship

The damage mechanisms induced by a continuous-wave (CW) and pulse laser source is very different. While a CW laser-induced damage has a high dependency on thermal diffusion that translates to heat accumulation on coating and substrate of optics, pulse-induced damage allows for thermal relaxation between the repetition rate in a pulse train. The thermal stresses are negligible due to this relaxation, and the damage mechanisms are temporally dependent on the laser pulse duration. Typical pulse duration for LIDT ranges from femto- to nano-second irradiation time.

Manufacturing process defects are particularly sensitive to pulse-induced damage mechanisms. These mechanisms include dielectric breakdown, avalanche and tunnel ionization, multiphoton ionization and absorption.

In rare cases, parasitic lasing effects of highly unsaturated pulse laser gain may affect the quality of the pulse energy by limiting or clamping on the lasing output. It is always essential to check the laser pulse quality prior to LIDT measurement.

LIDT Measurement at WOE

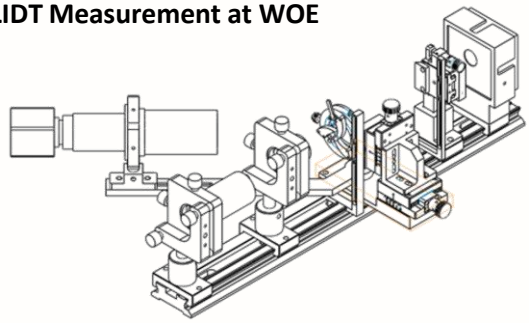


Figure 2. LIDT Pulse Measurement Layout

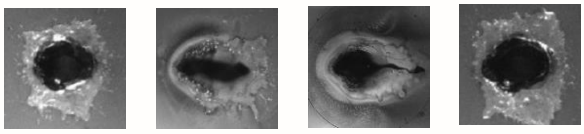
To maintain product quality and constantly improve our manufacturing process for optical components, we perform stringent quality checks through LIDT measurement. We design and calibrate our own measurement setup for customization to various optics. Our specifications is as follows:

Wavelength	10.6um
LIDT Mode	Pulse
Output Power	110W max
Repetition Rate	5-20 kHz
Pulse Duration	10us
Beam Diameter	62-77um, 4-5mm, 16-20mm

Table 1. Key specifications of WOE LIDT Facility

Conclusion

The durability of optical components is subjected to many factors that affect their performance. At Wavelength Opto-Electronics, we promise the highest quality of our products through LIDT quality checks. Our QA facilities ensure that contaminants and micro/nano defects are cleaned and isolated prior to conducting measurements according to ISO 11254 standard. Our LIDT measurements provide assurance to our customers on the quality of our optical components.



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