

Laser Induced Damage Threshold Testing

Request Information

Customer	Perkins Precision Developments LLC
Purchase Order Number	23-4189
Contact	Kipp Bauchert
Email	kipp@perkinsprecision.com

Test Facility

Company	Lumibird / Quantel USA 49 Willow Peak Drive Bozeman, MT 59718
Contact	testing@lumibird.us
Work Order Number	2305-0013 #1
Issued	May 9, 2023

Laser Operating Parameters

Center Wavelength	[nm]	1064
Repetition Rate	[Hz]	20
Pulse Width (FWHM)	[ns]	8.9
Effective Pulse Width	[ns]	9.23
Spot Diameter	[mm]	0.41
Incidence Angle	[degrees]	45
Polarization State:		Linear S
Transverse Modes:		TEM ₀₀
Temporal Mode:		Single

Testing Protocol

Test type		S on 1
Number of Shots per Site	[S=]	200
Number of Sites Tested		90
Preparation		Acetone / Methanol Drag-Wipe
Damage Definition		Permanent surface change
Inspection Method		Nomarski / Darkfield 150X

Special Requirements

Per Perkins PO

REVIEWED
By G Shaffer at 2:06 pm, May 09, 2023

Testing Parameters and Results #1

Sample Information

Substrate Material	Unknown
Coating Type	IBS HR
Part Number	Sample 1
Lot Number	NA
	Arrow Side

Results

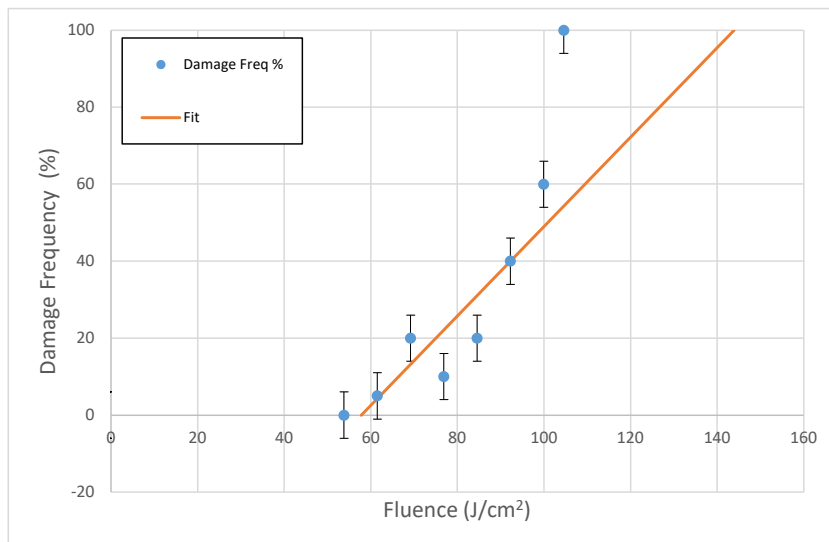
Damage Threshold Fluence	[J/cm ²]	57.81
Damage Threshold Peak Irradiance	[MW/cm ²]	6265.81
Damage Type	Flash, Propagating pits	

Reference the guide sheet on the final page for additional information on Damage Types

Supporting Information

Engineer's Notes:

- Root T scaled: 57.81 J/cm² @ 8.9 ns is equivalent to 61.28 J/cm² @ 10 ns
- Root T scaled: 6265.81 MW/cm² @ 8.9 ns is equivalent to 5911.16 MW/cm² @ 10 ns
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J/cm ²	MW/cm ²	%Fail
104.6	11332	100%
99.9	10832	60%
92.3	9999	40%
84.6	9165	20%
76.9	8332	10%
69.2	7499	20%
61.5	6666	5%
53.8	5833	0%

Figure 1: Plot of damage frequency as a function of fluence

Testing Parameters and Results #2

Sample Information

Substrate Material	Unknown
Coating Type	IBS HR
Part Number	Sample 2
Lot Number	NA
	Arrow Side

Results

Damage Threshold Fluence	[J/cm ²]	67.41
Damage Threshold Peak Irradiance	[MW/cm ²]	7305.74
Damage Type	Flash, Propagating pits	

Reference the guide sheet on the final page for additional information on Damage Types

Supporting Information

Engineer's Notes:

- Root T scaled: 67.41 J/cm² @ 8.9 ns is equivalent to 71.45 J/cm² @ 10 ns
- Root T scaled: 7305.74 MW/cm² @ 8.9 ns is equivalent to 6892.22 MW/cm² @ 10 ns
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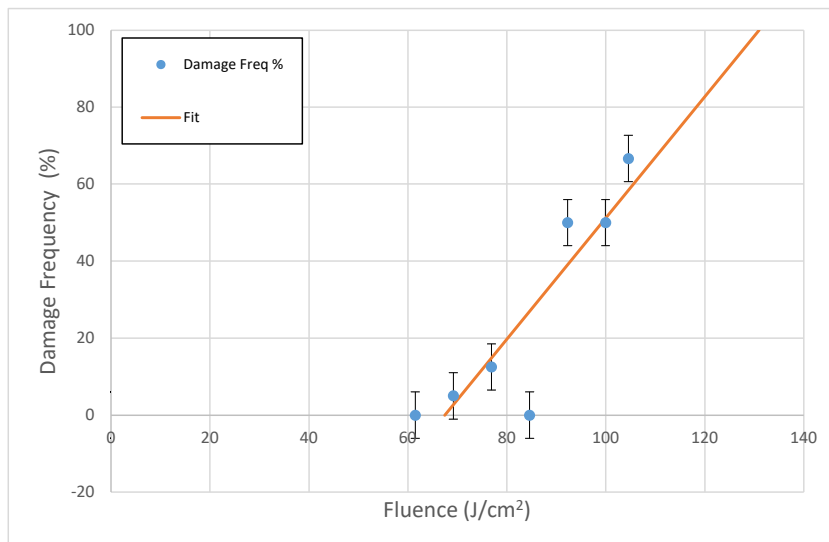


Figure 1: Plot of damage frequency as a function of fluence

J/cm ²	MW/cm ²	%Fail
104.6	11332	67%
99.9	10832	50%
92.3	9999	50%
84.6	9165	0%
76.9	8332	13%
69.2	7499	5%
61.5	6666	0%

Damage Type Descriptions

Propagating Pits	Damage sites that continue to grow in diameter and/or depth as the laser exposure continues.
Non-Propagating Pits	Damage sites that do not continue to grow in diameter and/or depth as the laser exposure continues.
Catastrophic	Damage sites with large scale pits and fractures which are clearly visible with the unaided eye.
Flash	Plasma formation which etches at or just below the surface.
Flash/Pit/Noise	Plasma formation which etches at or just below the surface accompanied with an audible sound.
Ejecta	Material from the coating and/or substrate are "ejected" from the surface.
Scatter Increase	A decrease in the intensity of scattered incident radiance from the collinear visible HeNe.
Scatter Decrease	A decrease in the intensity of scattered incident radiance from the collinear visible HeNe.
Melt	The surface of the sample is heated to a molten state during the irradiation and results in a permanent physical change.
Audible Pop	An audible sound is heard.
Discoloration	A change in the coloration of the sample.