

LOW OPTICAL ABSORPTION MEASUREMENT REPORT

SAMPLE: SAMPLE

Request from		Testing institute	
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	Country		Lithuania
Contact person	Name Surname	Tester	Name Surname
Inquiry ID	0001	Sale order	SO0001
Purchase order	-	Test ID	-
		Test date	01/01/2022

Specimen

Name	Sample
Type	HR Dielectric Coating
Dimensions	Ø50.8 x 6.4 mm
Packaging	Wrapped in paper
Storage before test	Normal laboratory conditions
Dust blow-off	Canned air
Cleaning	None

Measurement

Method	Photothermal common-path interferometry (PCI)
Protocols	Longitudinal scan (L-scan), Temporal scan, Transverse scan (T-scan). Sample absorption is evaluated from Transverse scan protocol.

SUMMARY OF MEASUREMENT RESULTS

Wavelength	AOI	Polarization	Location	Sample absorption
1070.0 nm	2.0 deg	Linear P	Front surface (S1)	3601 ⁺⁷⁵ ₋₄₆ ppm

TEST EQUIPMENT

Definitions and test description

Photothermal common-path interferometry (PCI) for low absorption measurements is based on spatially resolved pump-probe technique: low power probe beam senses the heating effect of an absorbed pump beam ¹. Several different scanning protocols are performed to measure the absorption of the sample.

Irradiation sources	Pump laser	Probe laser
Manufacturer	IPG Photonics	Lumentum
Model	YLR-10-LP	1122P
Type	Continuous wave Ytterbium fiber	Continuous wave HeNe
Central wavelength	1070 nm	632.8 nm
Angle of incidence	(2.0 ± 1.0) deg	(9.0 ± 1.0) deg
Polarization state	Linear P	Linear S
Spatial beam profile in target plane	TEM00	TEM00
Beam diameter in target plane (1/e ²)	(65 ± 5) μm	(210 ± 5) μm
Average power	(3.979 ± 0.024) W	(100 ± 1) mW

Measurement setup calibration

Surface

Calibration sample	UVFS Metallic ND Filter
Absorption	44.7 %
Responsivity	(24.4 ± 0.2) 1/W

Power meter

Manufacturer	Ophir
Model	3A-PF-12
Calibration due date	2023-05

Test environment

Environment	Air
Cleanroom class (ISO 14644-1)	ISO7
Pressure	1 bar
Temperature	24 C
Humidity	62 %

¹A. Alexandrovski, M. Fejer, A. Markosian, and Roger Route "Photothermal common-path interferometry (PCI): new developments", Proc. SPIE 7193, Solid State Lasers XVIII: Technology and Devices, 71930D (28 February 2009)

LONGITUDINAL SCAN (L-SCAN) RESULTS

Scan parameters

Scanning axis	Longitudinal (from S1 to S2)
Scanning distance	3.0 mm
Scanning step	20 μm
Pump laser power	(4.001 \pm 0.019) W
Number of scans	1

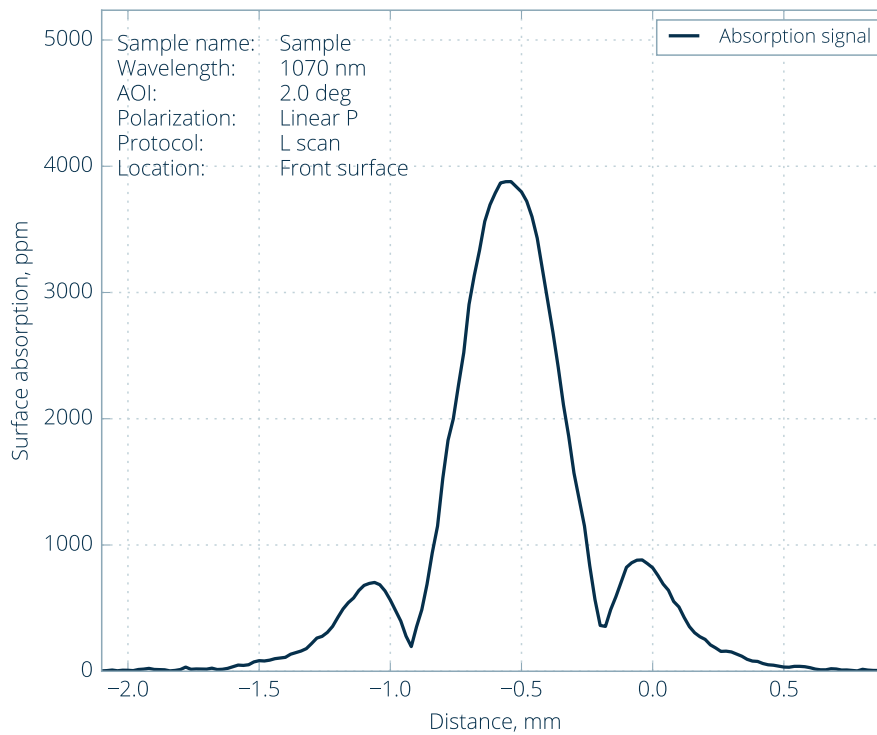


Figure 1. Longitudinal scan.

TEMPORAL SCAN RESULTS

FRONT SURFACE (S1)

Scan parameters

Scanning axis	Time
Scanning duration	625 s
Scanning step	1 s
Pump laser power	(4.035 ± 0.019) W
Number of scans	1

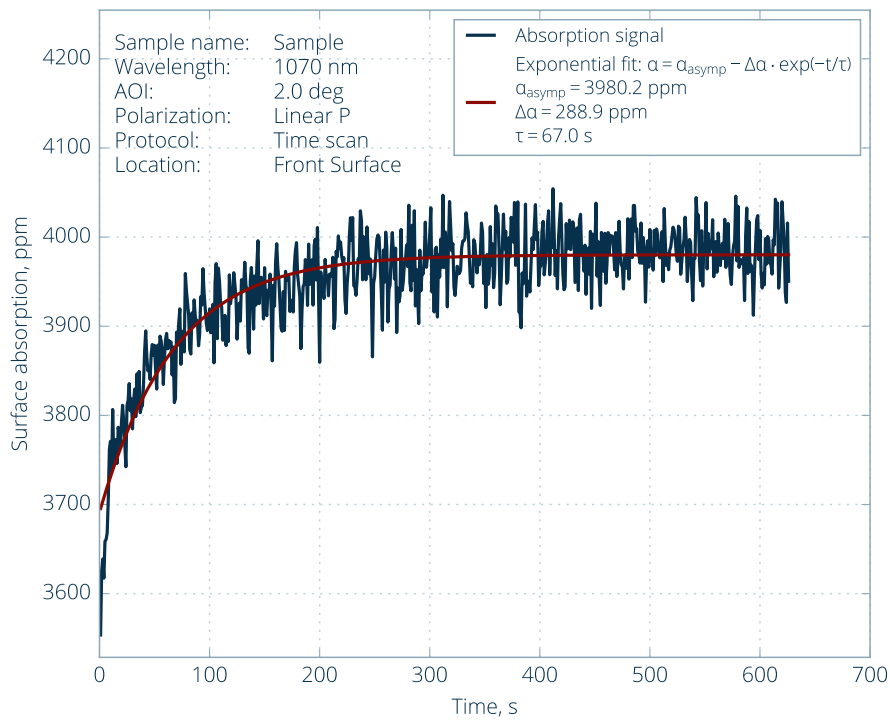


Figure 2. Temporal scan on front surface (S1) .

TRANSVERSE SCAN (T-SCAN) RESULTS

FRONT SURFACE (S1)

Definitions and protocol description

Sample absorption is defined as median absorption value of T-scan measurement. Uncertainty is evaluated as minimum and maximum absorption values of T-scan measurement without outliers, i.e. within range $[Q1 - 1.5 \cdot IQR, Q3 + 1.5 \cdot IQR]$, where Q1 - first quartile, Q3 - third quartile, IQR - interquartile range.

Scan parameters

Scanning axis	Transverse (vertical)
Scanning distance	3.0 mm
Scanning step	37 μ m
Pump laser power	(3.979 ± 0.024) W
Number of scans	1

Scan results

Sample absorption 3601^{+75}_{-46} ppm

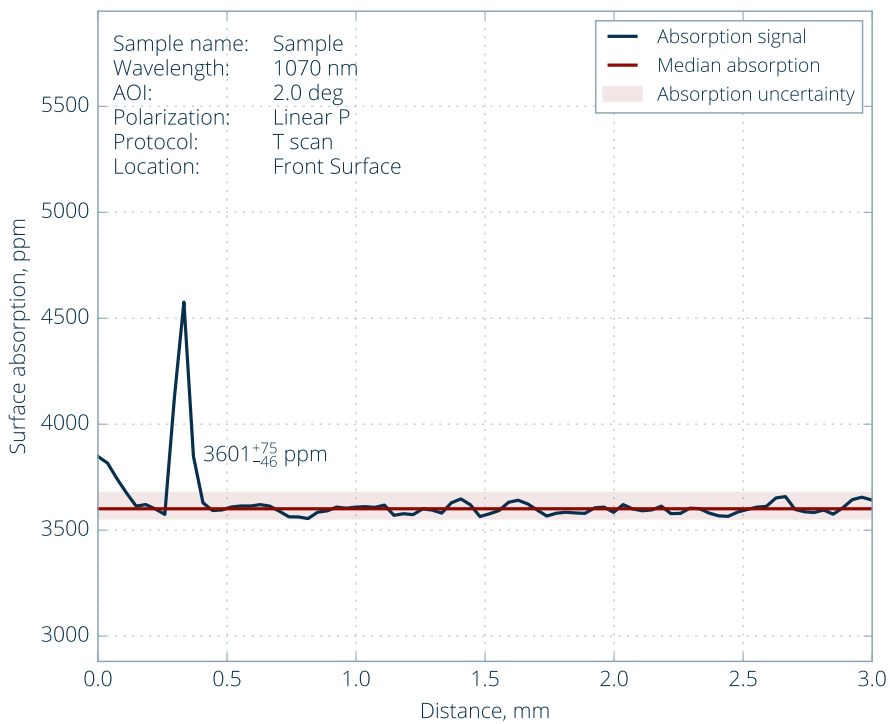


Figure 3. Transverse scan on front surface (S1) .