



LIDIZ®

IBS Vacuum systems



III Content



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About I-Photonics III

I-Photonics long year experience in working on Ion Beam technology and Thin Film physics and the related R&D works on thin film coatings and coating hardware developments testimony the importance of defining and improving continuously coating processes and provided over the years a consistent process portfolio which defines I-Photonics as an attractive and competitive solution provider.

Following the global market demands we developed Magnetron Sputtering Technology (MS, RMS, PARMS), Diamond Like Carbon Technology for IR optics (DLC by PECVD), E-Beam Evaporation (IBAD), Ion Beam Sputtering (IBS, RF IBS) for precision optics.

Being focused on optical coatings we developed automatic optical process control systems OCP BroadBand an OCP SingleWave that allow to make high precision multilayer optical coating for UV, VIS, NIR, Mid IR ranges with high yield.

Ongoing updates on behalf of the requirements for coatings from the customer demanded from us incessant R&D, which lead to a constant improvement of our equipment and defined the role of the entire company not only as a developer of equipment, but more as a developer of coating solution provider.

The accumulated experience in processes and methods of thin films coatings helps I-Photonics to be specialized in coating services as well. It also positioned I-Photonics as company which provides technological support for each customer and shares the knowledge in thin films.

With each customer our aim is to possibly establish long-term cooperation based on our experience and continuous improvements as a solution provider.

IBS sputtering systems for ultra-high precision optics

LIDIZ vacuum systems family is the result and embodiment of 50 years' experience in Ion Beam Sputtering (IBS) technology. IBS technology is well known for its extremely low-loss optical coatings. LIDIZ IBS Sputtering Systems is an effective tool for deposition of optical coatings for a wide range of applications. LIDIZ is equipped with RF grid ion-beam sputtering source, RF grid ion-beam source for substrates pre-cleaning, surface activation, sputtering assisting and RF neutralizers. LIDIZ is designed to get thin films from a wide range of materials with high accuracy and excellent quality. Unique optical process control system OCP SingleWave and OCP BroadBand with intellectual real-time optimization of optical coatings design provides automation of complicated filters coating with high accuracy and repeatability.

▶▶ Main Features

- ▶ RF Grid high-power IBS for deposition with RF neutralizer to ensure high deposition rates and film quality
- ▶ RF IBS assist with RF neutralizer to ensure maximum stoichiometry control and substrate pre-cleaning and activation
- ▶ Automatic Optical control system OCP in various configuration:
 - OCP BroadBand,
 - OCP SingleWave,
 - OCP Duo with 2 control types in one system
 - OCP Laser
- ▶ Multiple choice of substrate holders to provide maximum product flexibility and to match productivities needs:
 - Single disk
 - Planetary system
 - High speed single disk



IBS sputtering systems for ultra-high precision optics

HIGH YIELD and **RELIABILITY** in deposition of multilayer coatings for precision optics and lasers

REAL-TIME PROCESS OPTIMIZATION OF OPTICAL STRUCTURE

The intellectual OCP BroadBand real-time optimization function controls the current result of coating and in case of deviation from the target it recalculates and makes correction in next layers in order to correct mistake and deviation

▶▶▶ Film quality

- ▶ High purity
- ▶ Low scatter and absorption loss
- ▶ High laser damage threshold
- ▶ Low surface roughness
- ▶ High density
- ▶ Excellent adhesion
- ▶ Low humidity sensitivity

▶▶▶ Application

- ▶ Laser mirrors
- ▶ Bandpass filters
- ▶ Multi-band bandpass filters
- ▶ Notch filters
- ▶ Multi-notch filters
- ▶ Rugate filters
- ▶ Steep edge filters
- ▶ Low scatter and absorption loss optics
- ▶ Thin-film polarizers

▶▶▶ Markets

- ▶ Telecommunication
- ▶ Laser based instrumentation
- ▶ Internet of things (IoT)
- ▶ Light identification detection and ranging (LIDAR)
- ▶ Fluorescence microscopy
- ▶ Hyper-spectral imaging
- ▶ Raman spectroscopy
- ▶ High power lasers
- ▶ Biomedical filters
- ▶ Wide-angle anti-reflection coatings
- ▶ Coatings on fibers
- ▶ AR coatings on laser diodes
- ▶ Coatings with low defects
- ▶ Low loss HR or AR coatings (total loss is less than 10 ppm)
- ▶ Multi-layers filters (>100 layers) with high requirements to precision and thickness control

LIDIZ® 700 III

IBS sputtering systems for precision optics

► Applications

- ▶ Laser optics with low optical loss
 - High power lasers
 - Laser gyroscope
 - Various AR/HR and filters for laser application
- ▶ Internet of things (IoT)
- ▶ Light identification detection and ranging (LIDAR)
- ▶ Medical equipment and measurement devices
 - Beam splitters
 - Band pass filters
 - Edge filters
 - Notch filters





Technical data

Installation area	3540×1840×2000 mm (L×W×H)
Weight	3500 kg
Sputtering source	RF Grid IBS with RF neutralizer
Assistance source	RF Grid IBS with RF neutralizer
Substrate holder and coating area	Single disk Ø320 mm (area 700 cm ²) Planetary 4x Ø210 mm (area 1256 cm ²) and planetary 3×Ø320 mm (area 2100 cm ²)
Load lock	For single disk substrate holder
Coating uniformity	≤±0.25% for planetary 4x Ø210 mm ≤±0.5% for single disk Ø320 mm ≤±0.5% for planetary 3×Ø320 mm
Process control system	Automatic optical control system OCP: OCP BroadBand, OCP SingleWave, OCP Duo (BB and SW 2 in 1)
Substrate materials	glass ceramics, chromatic and achromatic optical glass, quartz, potassium fluoride, sapphire, etc.
Number of targets, max.	4 pcs.
Sputtering targets	Ti, Ta, Nb, Zr, Hf, Al, Si, SiO ₂ etc.
Coating rate	Up to 5 Å/sec (depends on the material)
Substrate temperature during the process (without heater)	<100°C
Substrate heating system temperature	<250°C
Substrate heating uniformity	±2°C
Ultimate pressure	5E-5 Pa
Time to reach ultimate pressure	12 hours
Base pressure	8E-4 Pa
Time to reach base pressure	30 min (without load lock) ≤8 min (with load lock)
Pumping system	Dry mechanical pump & cryogenic pump Turbo molecular pump is optional

LIDIZ[®] 1100 III

IBS vacuum coating system for precision optics
with high throughput

► Applications

- ▶ Laser optics with low optical loss
 - High power lasers
 - Laser gyroscope
 - Various AR/HR and filters for laser application
- ▶ Internet of things (IoT)
- ▶ Light identification detection and ranging (LIDAR)
- ▶ Medical equipment and measurement devices
 - Beam splitters
 - Band pass filters
 - Edge filters
 - Notch filters



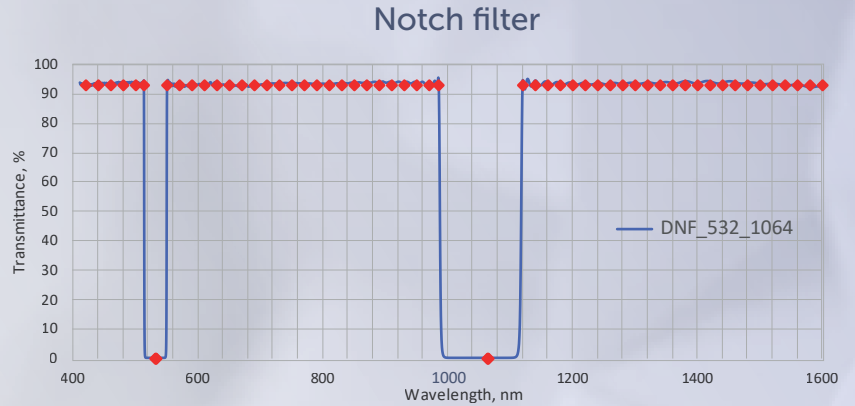
► Technical data

Installation area	3490×2730×2460 mm (L×W×H)
Weight	4500 kg
Sputtering source	RF Grid IBS with RF neutralizer
Assistance source	RF Grid IBS with RF neutralizer
Substrate holder and coating area	Single disk Ø440 mm (area 1520 cm ²) Planetary 7x Ø210 mm (area 2200 cm ²) Planetary 4x Ø350 mm (area 3840 cm ²) Other planetary by request
Coating uniformity	≤±0.25% planetary 7x Ø210 mm ≤±0.5% planetary 4x Ø350 mm ≤±0.5% for single disk Ø440 mm
Process control system	Automatic optical control system OCP: OCP BroadBand, OCP SingleWave, OCP Duo (BB and SW 2 in 1)
Substrate materials	glass ceramics, chromatic and achromatic optical glass, quartz, potassium fluoride, sapphire, etc.
Number of targets, max.	4 pcs.
Sputtering targets	Ti, Ta, Nb, Zr, Hf, Al, Si, SiO ₂ etc.
Coating rate	Up to 4 Å/sec (depends on the material)
Substrate temperature during the process (without heater)	<100°C
Substrate heating system temperature	<250°C
Substrate heating uniformity	±2°C
Ultimate pressure	5E-5 Pa
Time to reach ultimate pressure	12 hours
Base pressure	8E-4 Pa
Time to reach base pressure	40 min
Pumping system	Dry mechanical pump & cryogenic pump Turbo molecular pump is optional

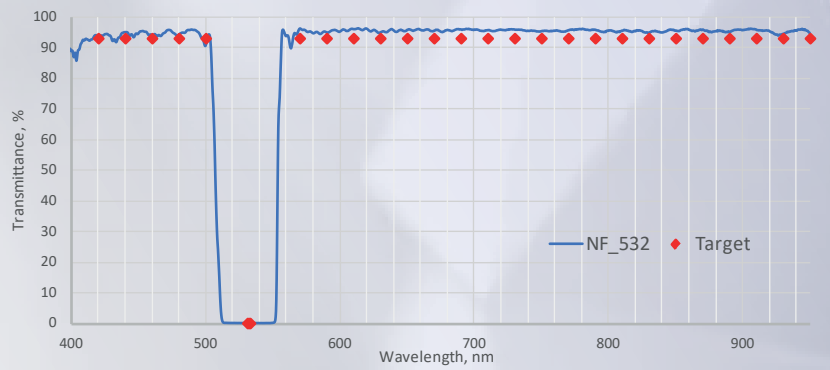


Coating examples

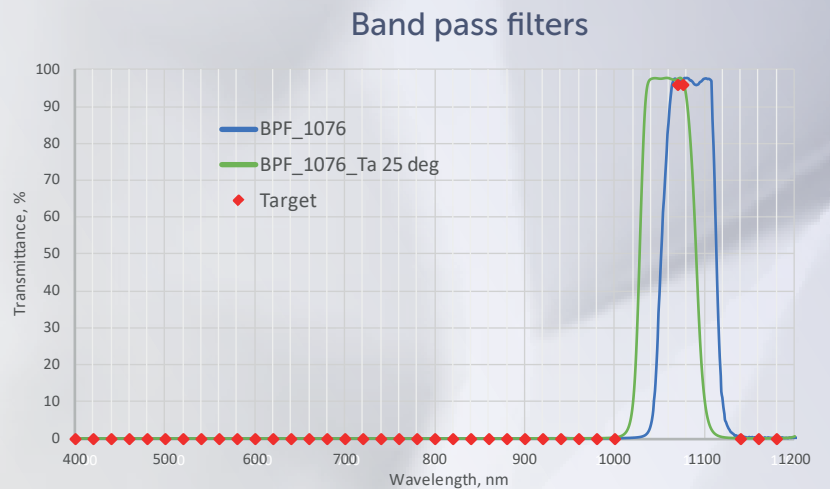
λ_{CWL}	532 + 1064 nm
Transmission band 1	Tavg > 93% 400 – 513 nm
Transmission band 2	Tavg > 93% 550 – 985 nm
Transmission band 3	Tavg > 93% 1120 – 1600 nm
Blocking band 1	ODabs > 6 $\lambda=532$ nm
Blocking band 2	ODabs > 6 $\lambda=1064$ nm
Full width-half max FWHM (nm)	35 $\lambda=532$; 130 $\lambda=1064$
Coating	Hard coated
Surface quality	60-40
Durability	MIL-C-48497A



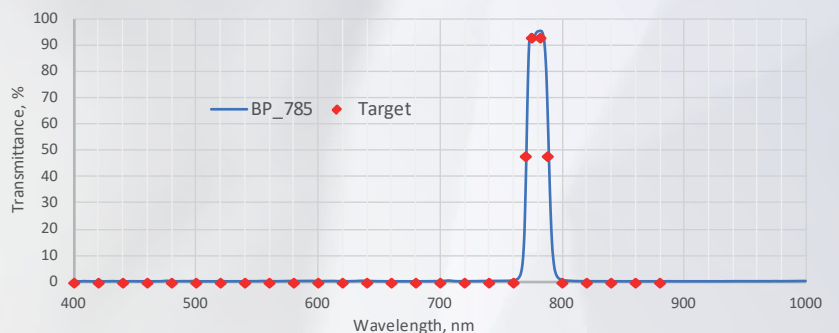
λ_{CWL}	532
Transmission band 1	Tavg > 93% 400 – 500 nm
Transmission band 2	Tavg > 93% 565 – 965 nm
Blocking band 1	ODabs > 4 532 nm
Full width-half max FWHM (nm)	45 @532
Coating	Hard coated
Surface quality	60-40
Durability	MIL-C-48497A



λ_{CWL}	1076
Tr, % for $\lambda=1076$ nm	>98 for incident angle 0-25°
Blocking band 1	ODabs < 3, 400-1000 nm
Blocking band 2	ODabs < 2, 1140-1250 nm
Coating	Hard coated
Surface quality	20-10
Durability	MIL-C-48497A
Substrate	RG850

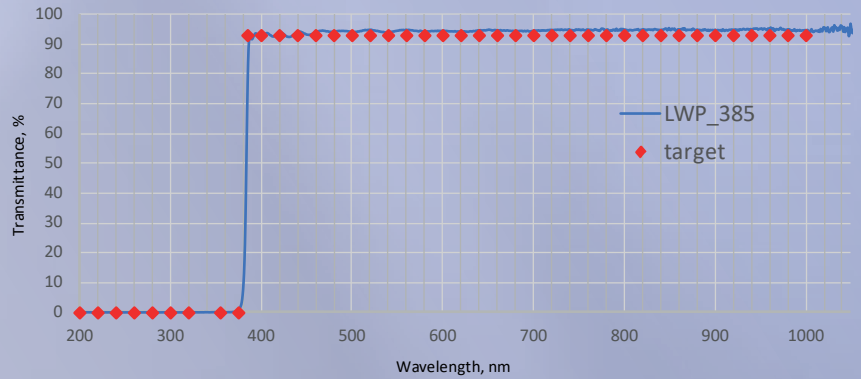


λ_{CWL}	780
Tr, % for $\lambda=1076$ nm	>93 without back side AR
Full width-half FWHM (nm)	18
Blocking band 1	ODav < 3, 400-760 nm
Blocking band 2	ODav < 3, 805-1000 nm
Coating	Hard coated
Surface quality	20-10
Durability	MIL-C-48497A
Substrate	BK7

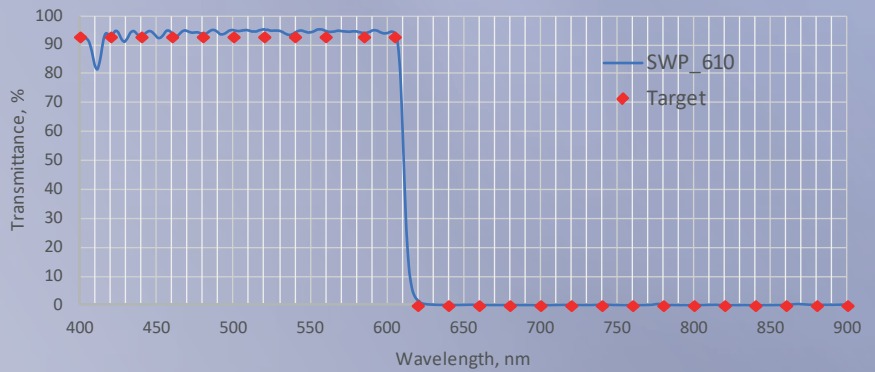


λ_{cwl} , nm	385
Tr av, %	>93, $\lambda=385-1050$ nm
Blocking band	ODav>3, $\lambda=200-380$ nm
Coating	Hard coated
Surface quality	20-10
Durability	MIL-C-48497A
Substrate	Fused silica

Cut filter

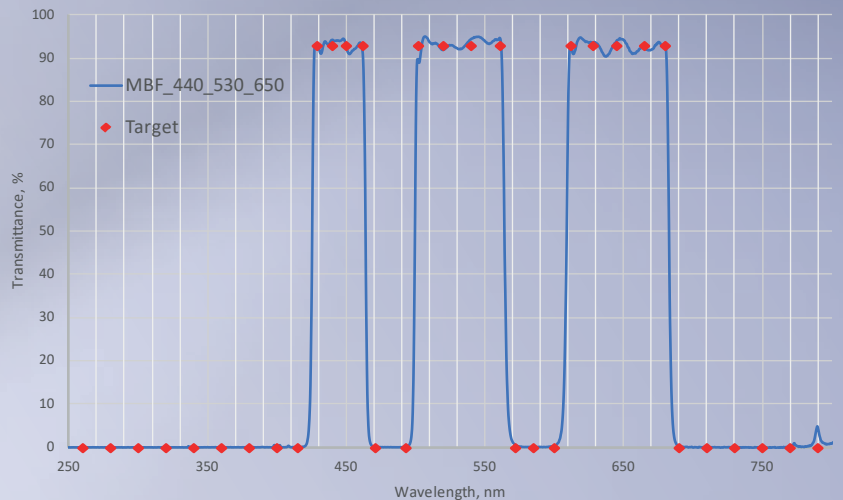


λ_{cwl} , nm	610
Tr av, %	>93, $\lambda=400-605$ nm
Blocking band	ODav >2, $\lambda=620-900$ nm
Coating	Hard coated
Surface quality	20-10
Durability	MIL-C-48497A
Substrate	BK7



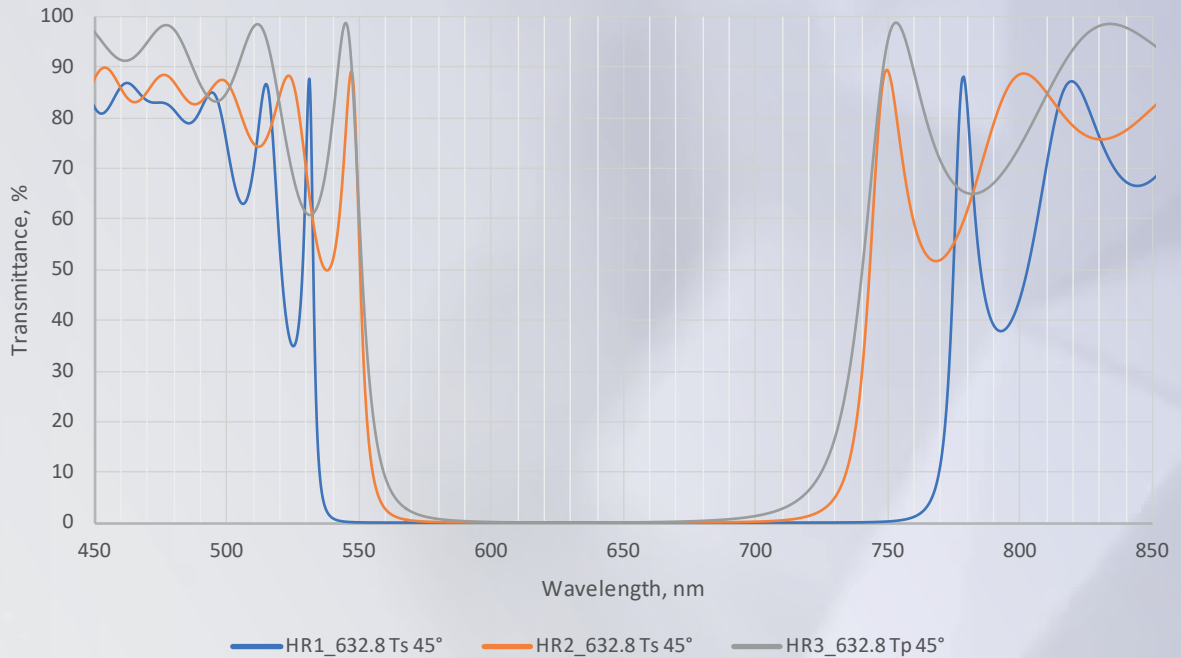
λ_{cwl} , nm	446, 532, 646
Transmission band 1	$T_{avg} > 93\%$, $\lambda=429-462$ nm
Transmission band 2	$T_{avg} > 93\%$, $\lambda=502-561$ nm
Transmission band 3	$T_{avg} > 93\%$, $\lambda=612-680$ nm
Blocking band 1	ODav > 4, $\lambda=200-415$ nm
Blocking band 2	ODav > 3, $\lambda=469-471$ nm
Blocking band 3	ODav > 3, $\lambda=571-598$ nm
Blocking band 4	ODav > 3, $\lambda=690-800$ nm
Coating	Hard coated
Surface quality	40-20
Durability	MIL-C-48497A
Substrate	BK7

Multispectral filter



Coating examples

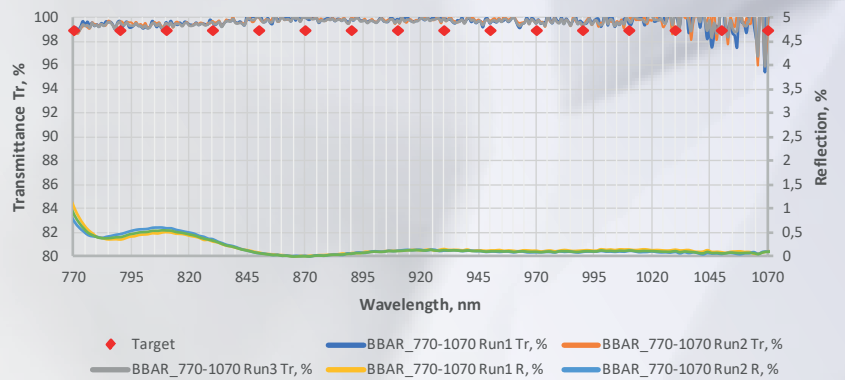
Low loss laser mirrors



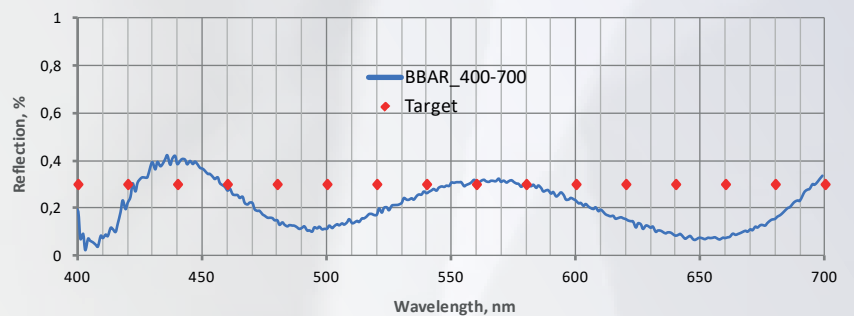
Coating name	HR1	HR2	HR3
λ_{cwl} , nm	632,8	632,8	632,8
Rs, %	>99.995	>99.98±0.004	>99.8
Incident angle	45°	45°	45°
Total losses	<50 ppm	<50 ppm	<50 ppm
Phase anisotropy	±0,11	±0,11	±0,11
Durability	MIL-C-48497A	MIL-C-48497A	MIL-C-48497A
Substrate	Sitall CO-115M	Sitall CO-115M	Sitall CO-115M

High efficiency broad band anti-reflection (BBAR)

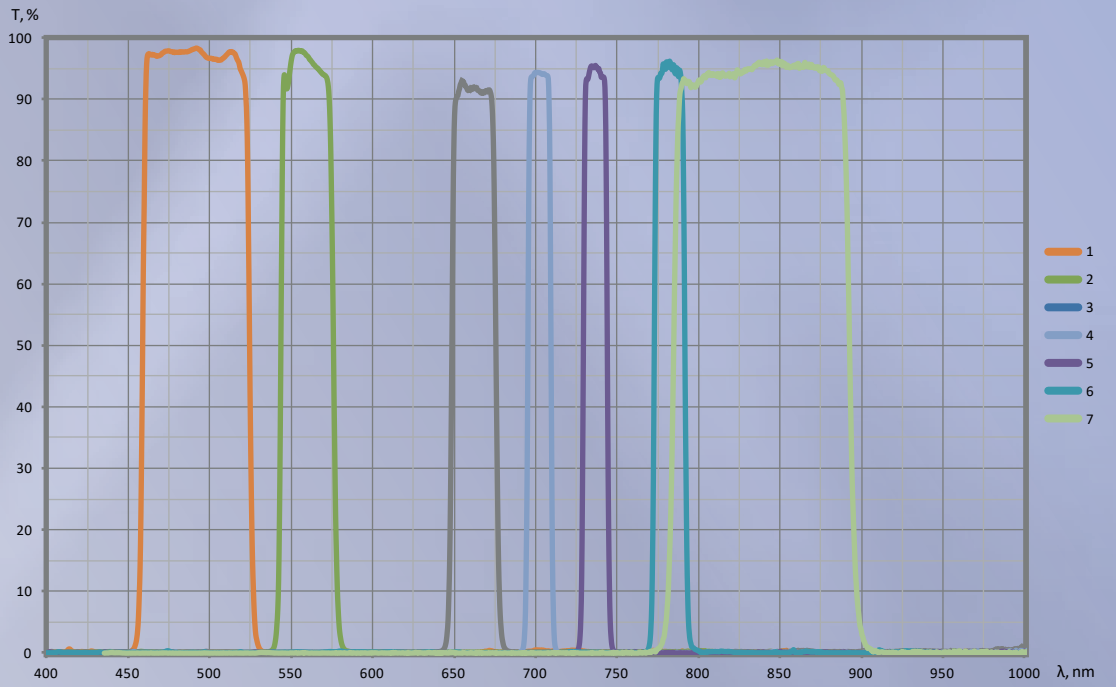
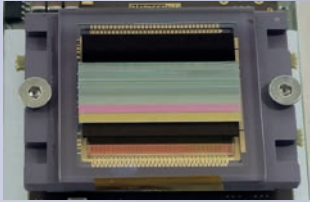
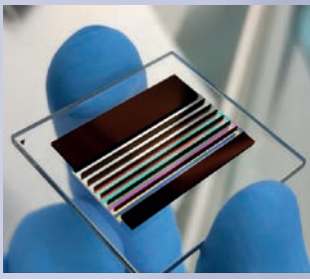
λ , nm	770-1070
Tr av, %	>99.5 double side coated
Rav, %	<1% for incident angle 0-30°
Coating	Hard coated
Surface quality	20-10
Durability	MIL-C-48497A
Substrate	BK7



λ , nm	400-700
Rav, %	< 0.3 double side coated
Coating	Hard coated
Surface quality	20-10
Durability	MIL-C-48497A
Substrate	BK7

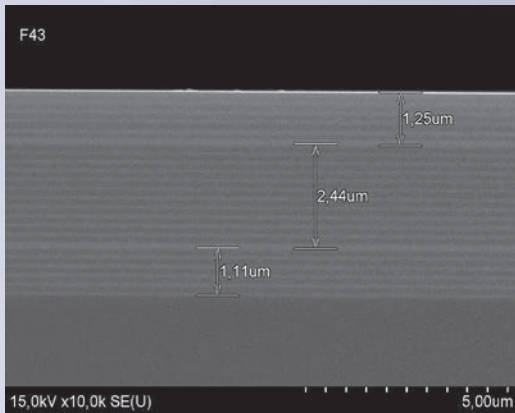


Multi zone optical filters

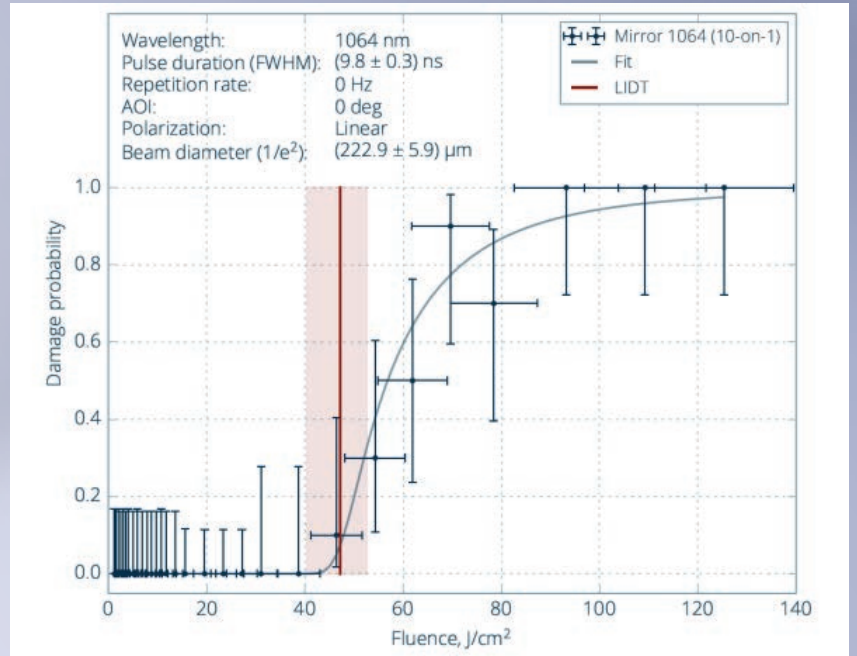


	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Bandpass, nm	460-525	545-575	650-675	695-710	730-745	775-795	785-895
Transmission, %	>90	>90	>90	>90	>90	>90	>90
Blocking range, nm	300-1100	300-1100	300-1100	300-1100	300-1100	300-1100	300-1100

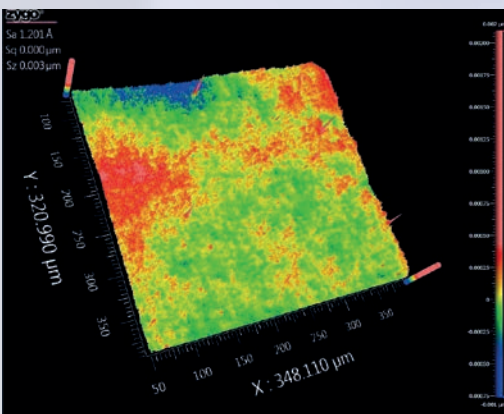
Coating quality



High film density

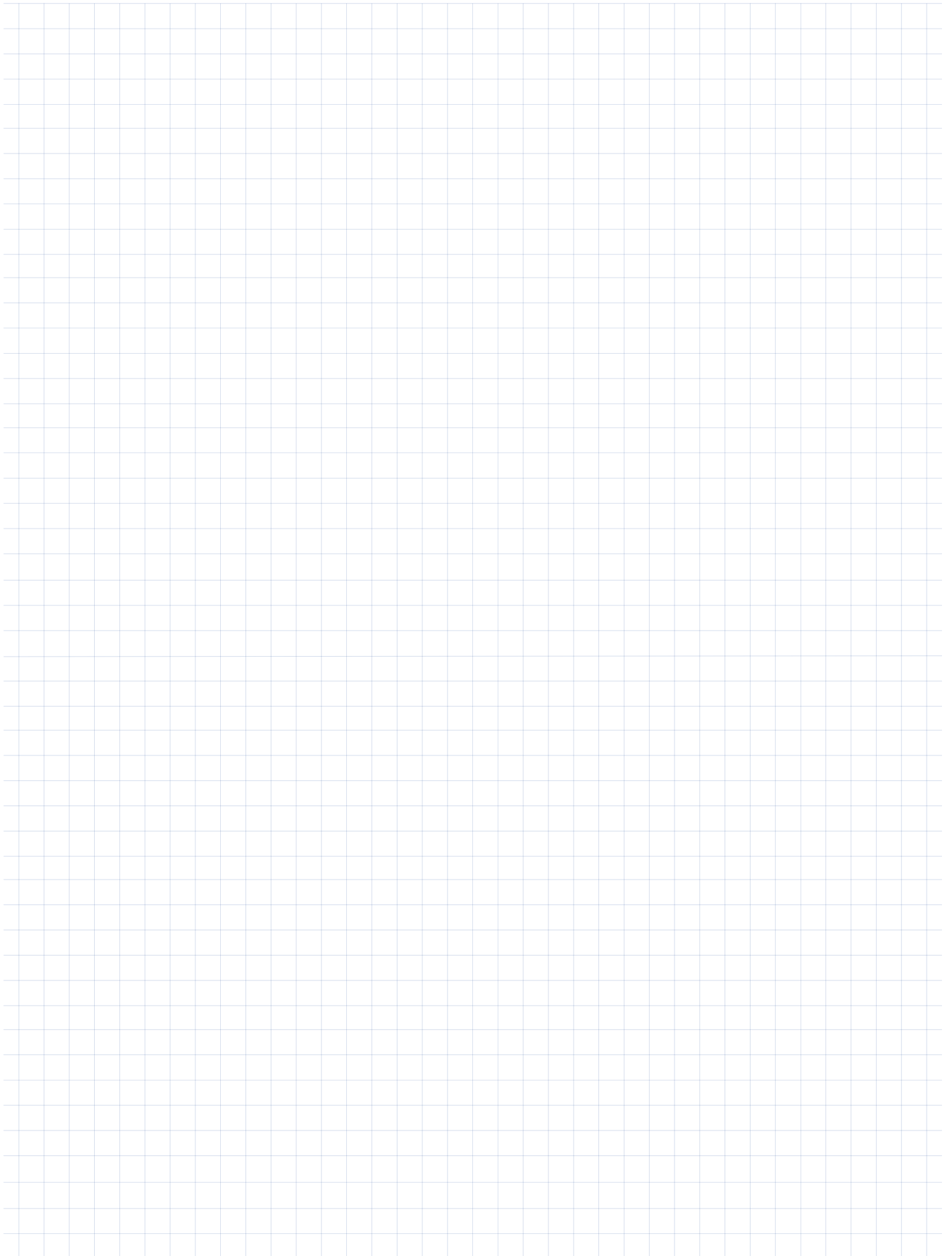


High LIDT

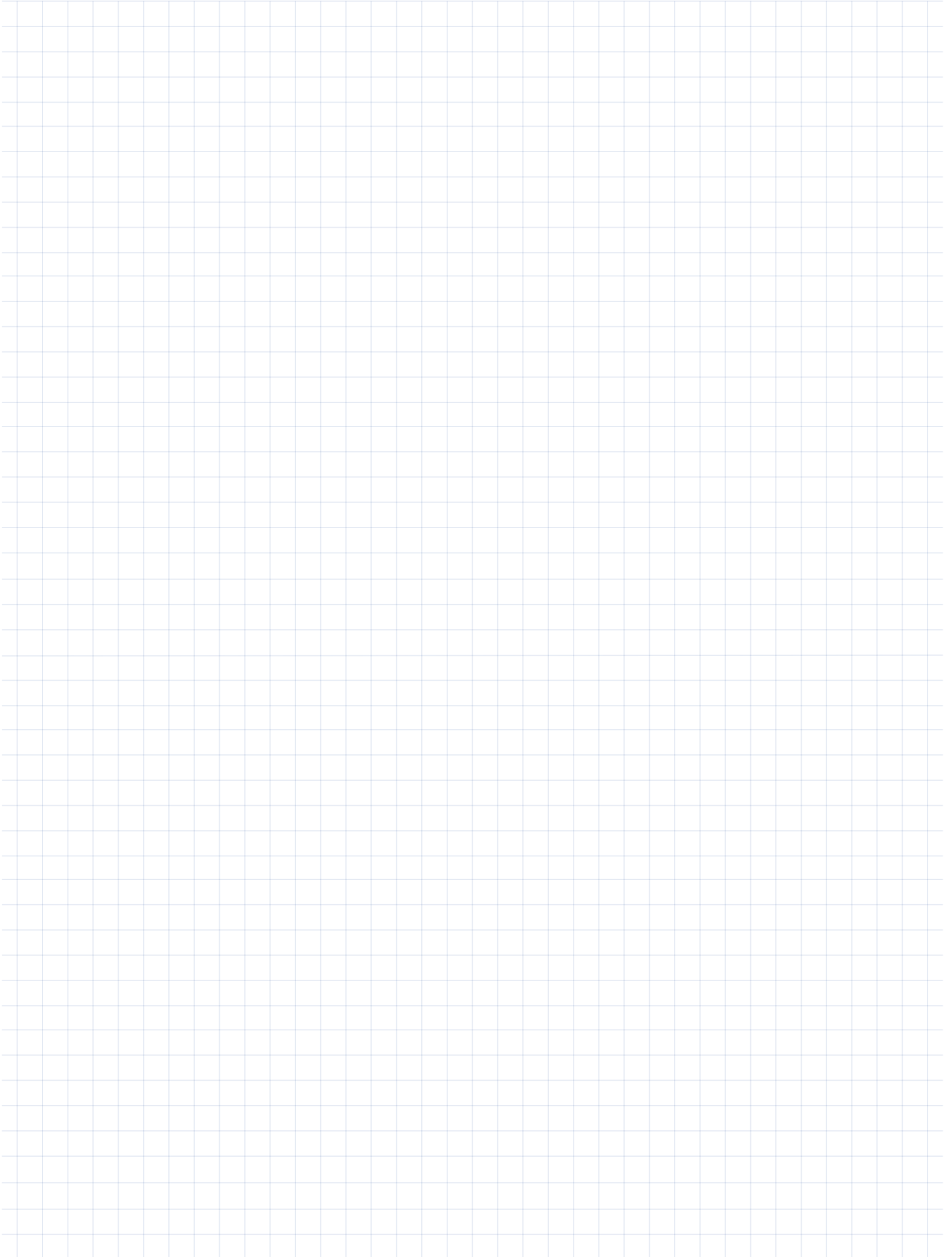


Small roughness 1.2 Å

For notes



For notes





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