

**I-Photonics**  
Optical coatings manufacturer

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# ABOUT I-PHOTONICS

I-Photonics has many years experience in working with Ion Beam technology and the Physics of Thin Films. Our team have decades of experience in Research and Development of coatings for all aspects of precision optics, as well as expertise in developing hardware to improve the capability of existing coating technologies. Over the years, we have built a large portfolio of coating equipment and processes within optics and for other industries. This has allowed I-Photonics to provide competitive turn-key equipment and coating solutions to a range of customers worldwide.

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

To improve accuracy and reliability in optical coatings we developed a automatic optical process control system called OCP BroadBand and OCP SingleWave Monitoring. This advanced technology allows the user to make high precision multilayer optical coatings for UV, VIS, NIR, Mid IR ranges with an improved high yield.

The wide range of requests and specifications from customers for unusual and high precision optics, has pushed our team to continuous Research & Development. This has lead to the constant improvement to our equipment and techniques, and has defined I-Photonics not just as a coating systems provider, but as a developer of holistic industrial coating solutions.

The accumulated experience of our team in process integration and the methodology of thin film coating has helped I-Photonics to become specialized to provide our own "in house" coating services as well. It also positioned I-Photonics as a company which provides ongoing technological support for each customer and shares our knowledge of thin films.

With each customer our aim is to establish long-term cooperation based on our experience and our capacity to continuously improve as a coating solution provider.

# CAPABILITIES

## Optical coatings design

With extensive experience in the calculation and design of optical coatings, as well as the use of advanced software and in-situ optical monitoring systems, our specialists will help you to find the best solution for your industrial or development requirements.

## Optical coatings service

We offer a wide range of optical coatings at the Customer's requests.

Among the possible optical coatings, we offer: anti-reflection, filtering, beam splitting, semitransparent, reflective coatings, optical diamond coatings, optical coatings for visible and infrared wavelengths range.

We cover a range from 250 up to 14 000 nm.

The following technologies can be used to apply a coating for you: ion-beam and magnetron sputtering method, electron-beam evaporation, direct ion beam PECVD deposition, Langmuir-Blodgett methodology and others.

Our large base of internal state of the art vacuum coating equipment allows us to develop coatings for our clients with a wide-range of applications, with a quick turn around time.

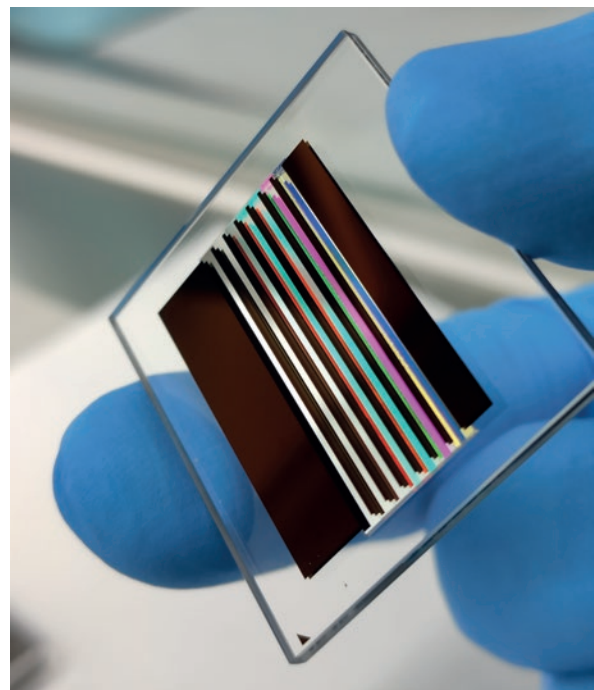
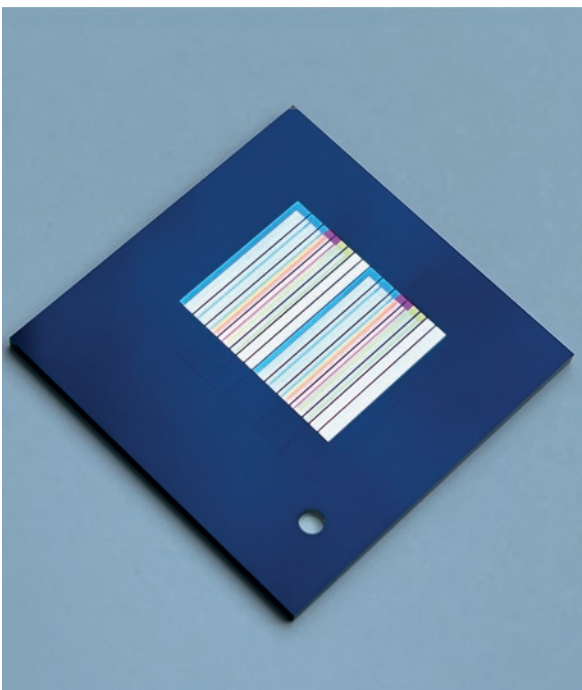
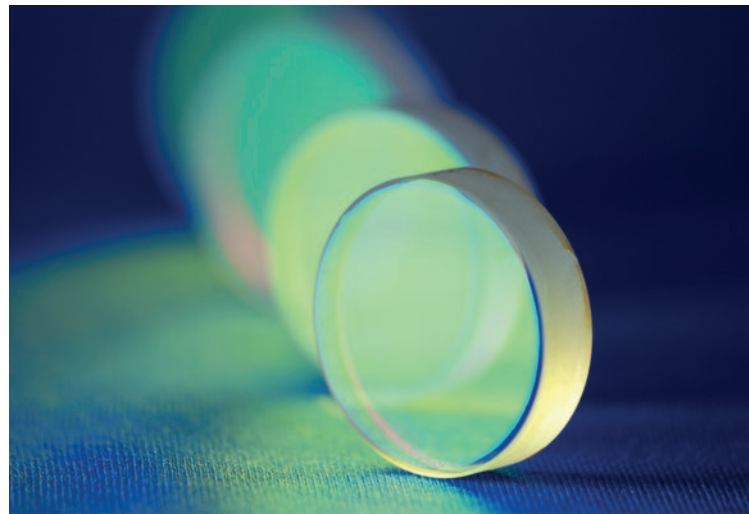
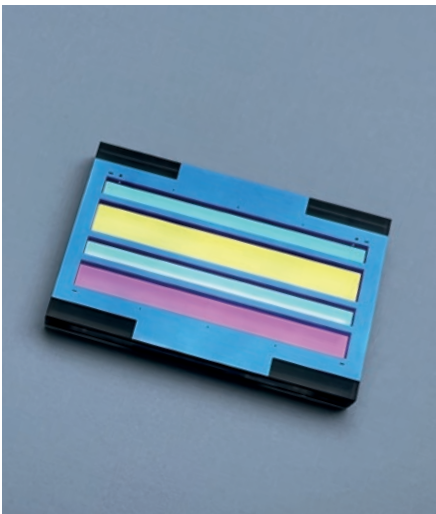
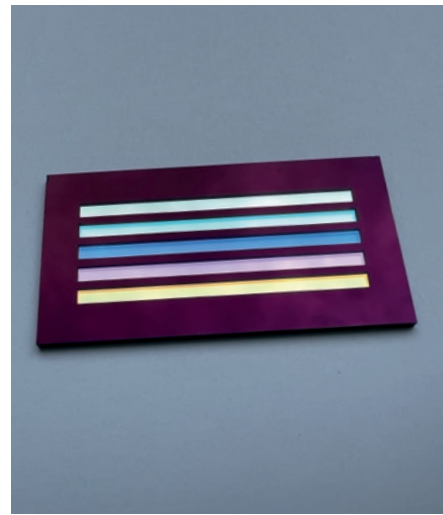
## Optical components production

We offer a variety of optical components with thin-film coatings according to customer's drawings. Our company's manufacturing capabilities include the manufacturing of narrowband and broad band filters, optical mirrors, beam splitters and a wide variety of optics for VIS and IR ranges.

A trial batch of a few pieces can often be made in at short notice in order to conduct experimental trials and work out a proof-of-concept.

## R&D in thin-film technologies

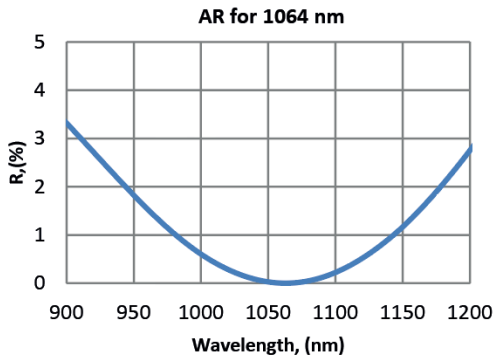
We pay great attention to research work. Our R&D team is experienced in a broad range of physical-chemical coating technologies and the development new optical coatings and coating components.



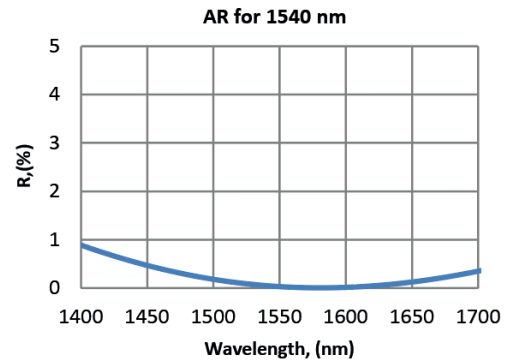
# ANTI-REFLECTION COATINGS

We offer single/double/triple AR coating as well as broad band or multiple anti-reflection coating on the desired wavelength range. Wide angle AR coating can be optimized for required AOI. In addition to standard anti-reflection coatings we offer durable diamond-like optical coatings on silicon and germanium substrates.

## Single wave AR coatings

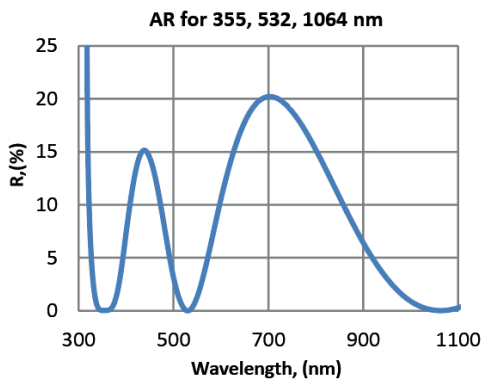


Anti-reflection coating for  $\lambda = 1064 \text{ nm}$ ;  
 $R \leq 0.05 \%$  for  $\lambda = 1064 \text{ nm}$ ;  
 Substrates: optical glass, fused silica, sapphire, etc.

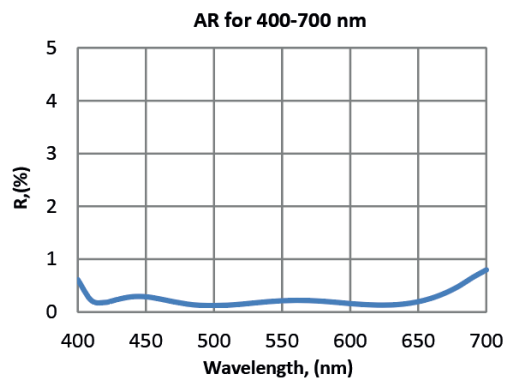


Anti-reflection coating for  $\lambda = 1540 \text{ nm}$ ;  
 $R \leq 0.05 \%$  for  $\lambda = 1540 \text{ nm}$ ;  
 Substrates: optical glass, fused silica, sapphire, etc.

## Broad band AR coatings

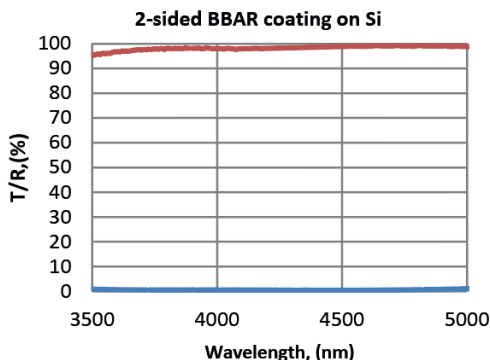


Anti-reflection coating for 3 wavelength:  
 $R \leq 0.1 \%$  for  $\lambda = 355, 532, 1064 \text{ nm}$ ;  
 Substrates: optical glass, fused silica, sapphire, etc.

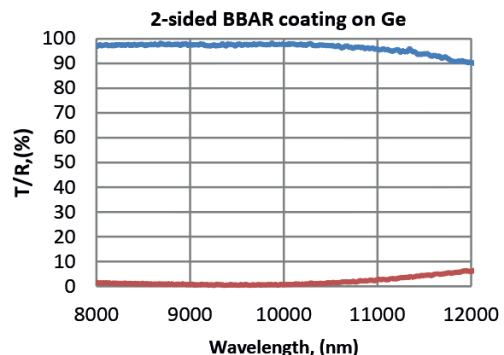


Anti-reflection coatings for visible spectrum range;  
 $R \leq 0.3\%$  for  $400 - 700 \text{ nm}$ ;  
 Substrates: optical glass, fused silica, sapphire, etc.

## Anti-reflection coatings for 3-5 and 8-12 $\mu\text{m}$



2-sided BBAR coating on Si-substrate  
 $T_{int} > 98\%$  for  $\lambda=3.5-5 \mu\text{m}$ ,  $R_{int} < 1\%$ .



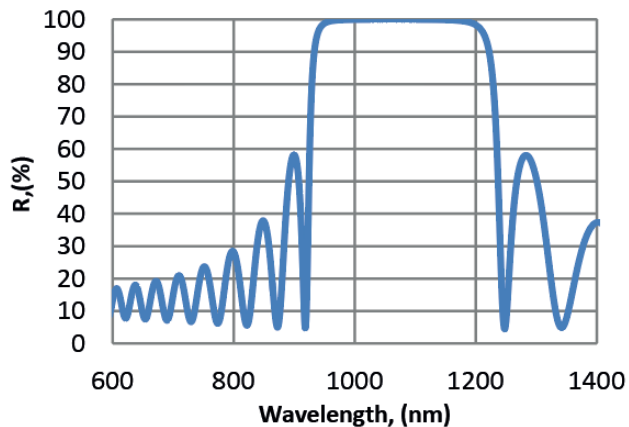
2-sided BBAR coating on Ge-substrate  
 $T_{int} > 96.5\%$  for  $\lambda=8-12 \mu\text{m}$ ,  $R_{int} < 2\%$ .

# HIGH-REFLECTION COATINGS

We offer single/double/triple HR coating as well as broad band or multiple high-reflection coating on the desired wavelength range. Wide angle HR coating can be optimized for required AOI.

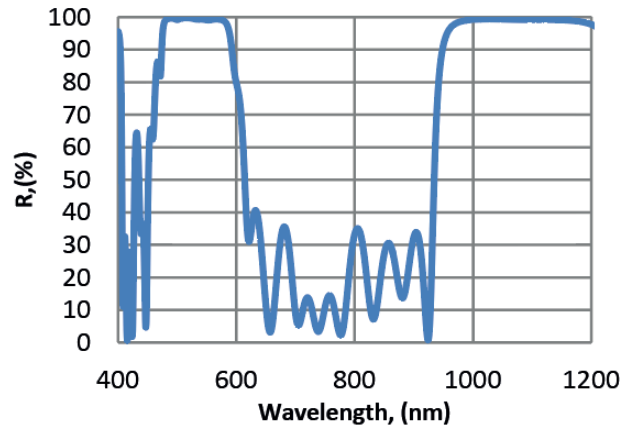
## Single wave and multiline mirrors

**Mirror for 1064 nm**



High-reflection coating for one wavelength  $\lambda = 1064$  nm;  
 $R \geq 99.9\%$  for  $\lambda = 1064$  nm, AOI - 0/45°;  
 Substrates: optical glass, fused silica, sapphire and other.

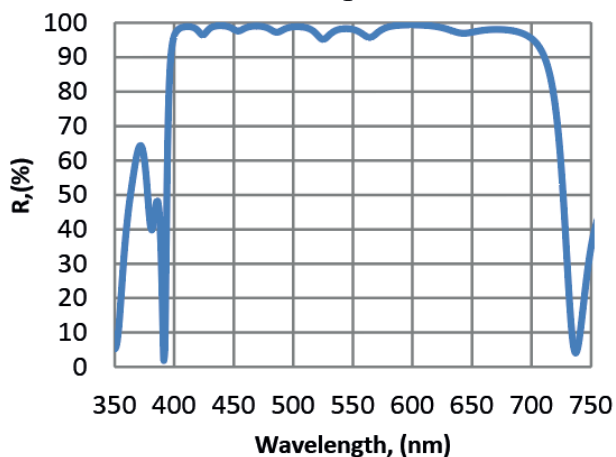
**Mirror for 532 and 1064 nm**



High-reflection coating for two wavelength  $\lambda = 532$  and 1064 nm;  
 $R \geq 99.5\%$  for  $\lambda = 532, 1064$  nm, AOI - 0/45°;  
 Substrates: optical glass, fused silica, sapphire and other.

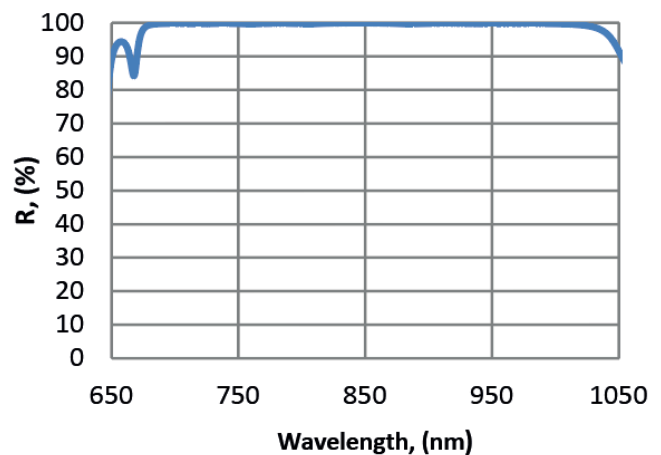
## Broad band mirrors

**VIS range mirror**



High-reflection coatings for visible range;  
 $R_{int} \geq 99\%$  for  $\lambda = (400 - 700)$  nm;  
 Substrate: optical glass, fused silica, sapphire and other.

**Mirror for Ti:Sa laser**



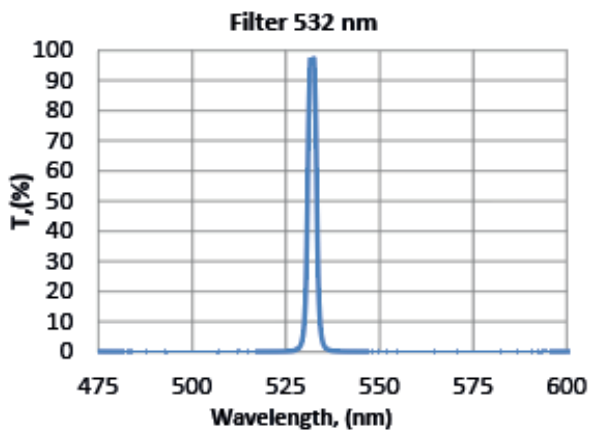
High-reflection coatings for 690-1000 nm;  
 $R \geq 99.5\%$  for  $\lambda = (690-1000)$  nm, AOI - 0/45°;  
 Substrate: optical glass, fused silica, sapphire and other.

# OPTICAL FILTERS

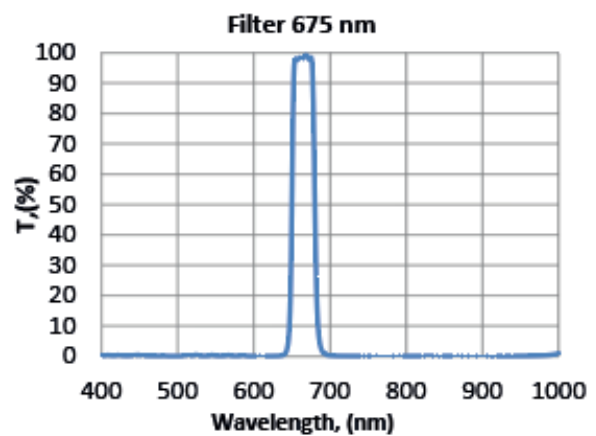
Optical filters are used to pass selectively or block a specific wavelength or a wavelength range. We offer fully customized filters for a wide variety of applications: science, medicine, sensing, analytical equipment and many more.

Our process portfolio allows us to produce filters from 250 nm up to 14 000 nm wavelength range.

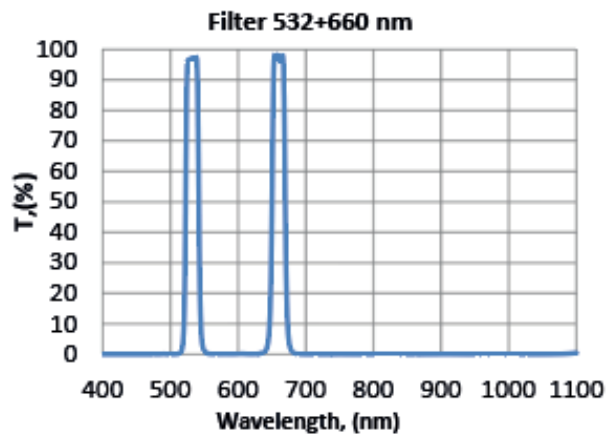
## Optical bandpass filters



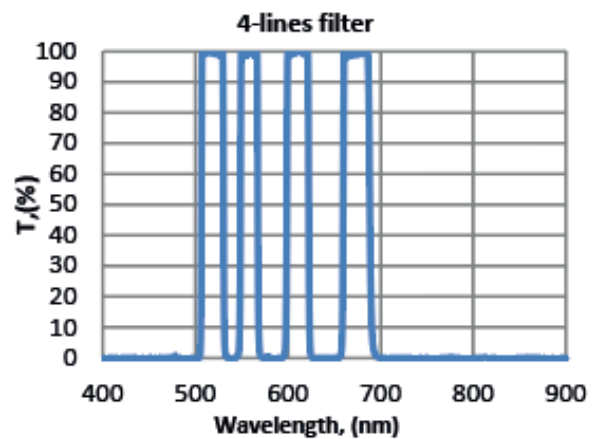
Filter coating for  $\lambda=532$  nm,  $T > 90\%$ ;  
FWHM up to 1 nm, OD 2-6 for  $\lambda=200-1100$  nm;  
Substrates: optical glass, fused silica, color glass.



Filter coating for  $\lambda=675$  nm,  $T > 90\%$ ;  
FWHM up to 1 nm, OD 2-6 for  $\lambda=200-1100$  nm;  
Substrates: optical glass, fused silica, color glass.



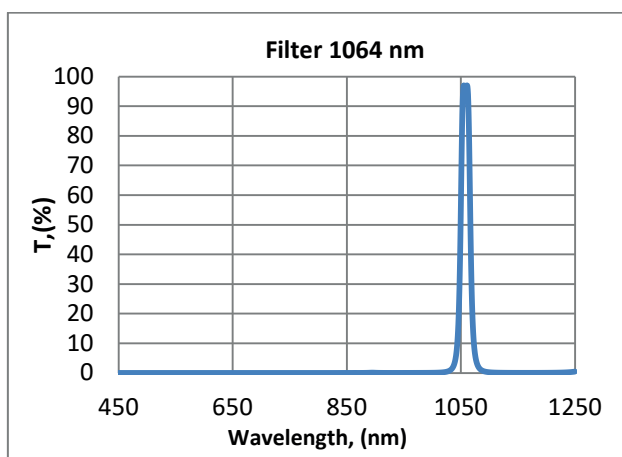
Filter coating for  $\lambda=532 + 660$  nm,  $T > 90\%$ ;  
FWHM up to 10 nm, OD 2-6 for  $\lambda=200-1100$  nm;  
Substrates: optical glass, fused silica, color glass.



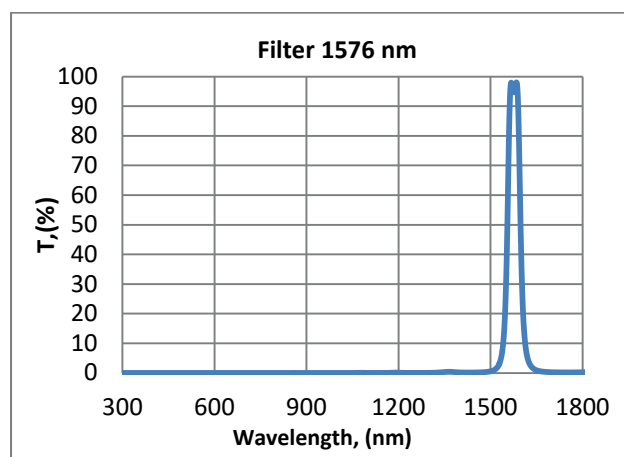
Filter coating for  $\lambda=518, 557, 610, 674$  nm,  $T > 90\%$ ;  
FWHM up to 10 nm, OD 2-6 for  $\lambda=200-900$  nm;  
Substrates: optical glass, fused silica, color glass.



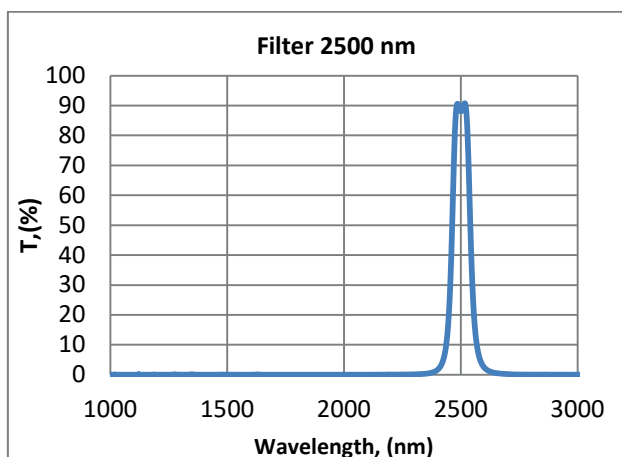
## Optical bandpass filters for IR range



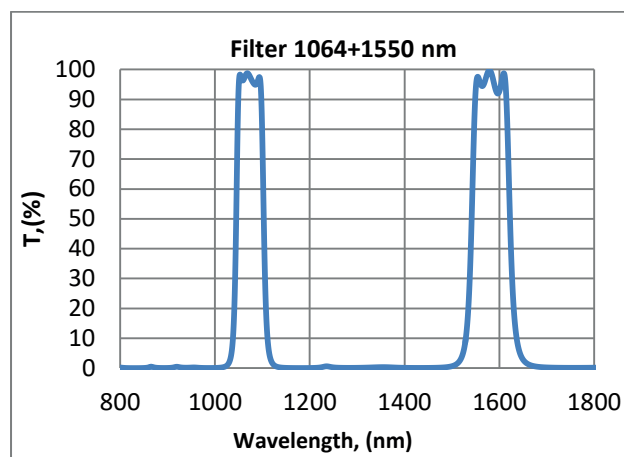
Filter coating for  $\lambda=1064$  nm,  $T > 90\%$ ;  
FWHM up to 1 nm, OD 2-6 for  $\lambda=200-1200$  nm;  
Substrates: optical glass, fused silica, color glass.



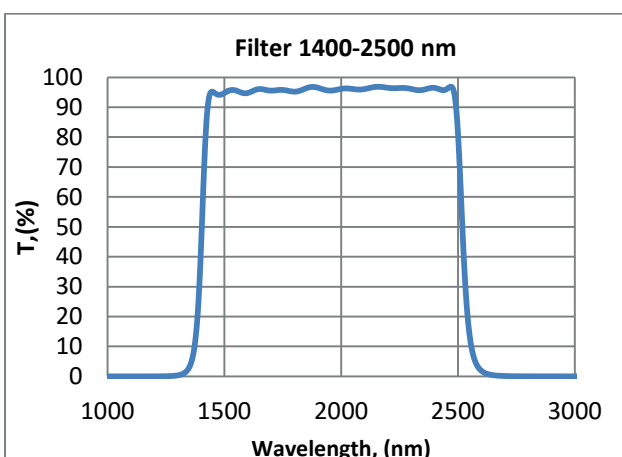
Filter coating for  $\lambda=1576$  nm,  $T > 90\%$ ;  
FWHM up to 1 nm, OD 2-6 for  $\lambda=200-1200$  nm;  
Substrates: optical glass, fused silica, color glass, Si.



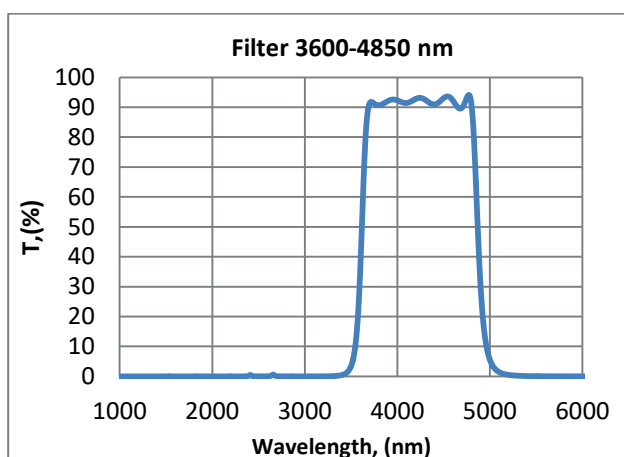
Filter coating for  $\lambda=2500$  nm,  $T > 90\%$ ;  
FWHM up to 50 nm, OD 2-6 for  $\lambda=200-3000$  nm;  
Substrates: Si, Ge, sapphire



Filter coating for  $\lambda=1064 + 1550$  nm,  $T > 90\%$ ;  
FWHM up to 50 nm, OD 2-6 for  $\lambda=200-1800$  nm;  
Substrates: optical glass, fused silica, color glass.

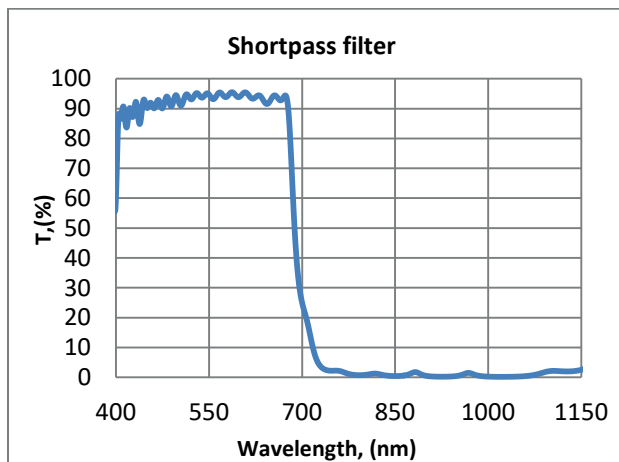


Filter coating for  $\lambda=1400-2500$  nm,  $T > 90\%$ ;  
OD 2-6 for  $\lambda=200-3000$  nm;  
Substrates: Si or sapphire

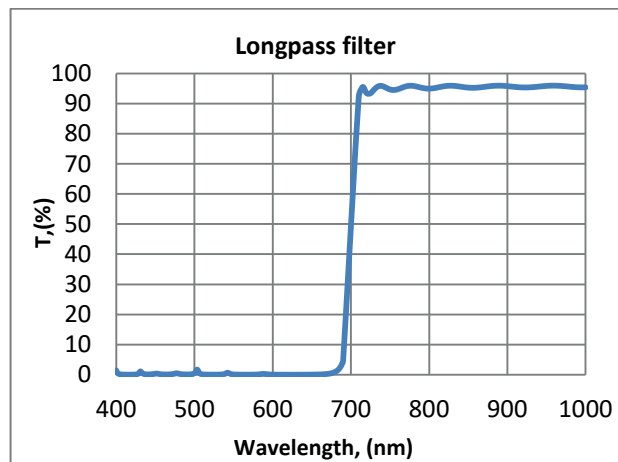


Filter coating for  $\lambda=3700-4900$  nm,  $T > 90\%$ ;  
OD 2-6 for  $\lambda=200-6000$  nm;  
Substrates: Si or Ge.

## Short pass and long pass filters

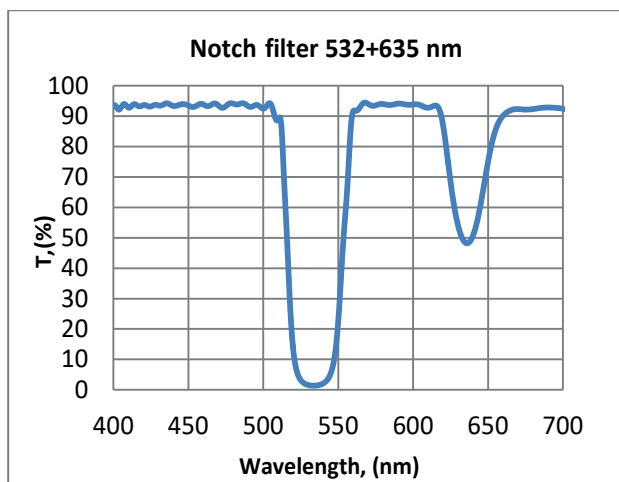


Tint > 90% for  $\lambda=400-680$  nm;  
OD up to 6 for  $\lambda=720-1150$  nm.

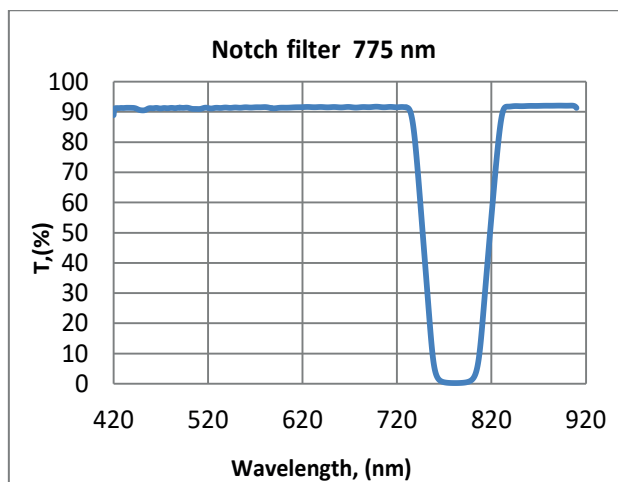


Tint > 90% for  $\lambda=710-1000$  nm;  
OD up to 6 for  $\lambda=400-680$  nm.

## Notch filters



Notch filter Ra > 99% for  $\lambda=532$  nm, Ra= $50\pm 2\%$  for  $\lambda=635$  nm; Tint > 90% for  $\lambda=400-510$ , 560-620 and 660-700 nm, AOI 45°;  
Substrate: optical glass, fused silica, sapphire and other.

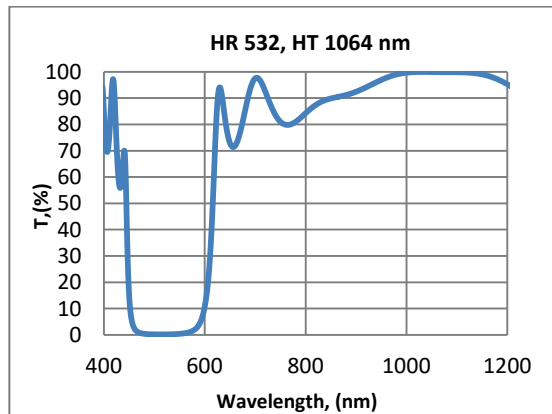


Notch filter Ra > 99% for  $\lambda=785\pm 10$  nm, Tint > 90% for  $\lambda=420-730$  and 830-900 nm, AOI 0°;  
Substrate: optical glass, fused silica, sapphire and other.

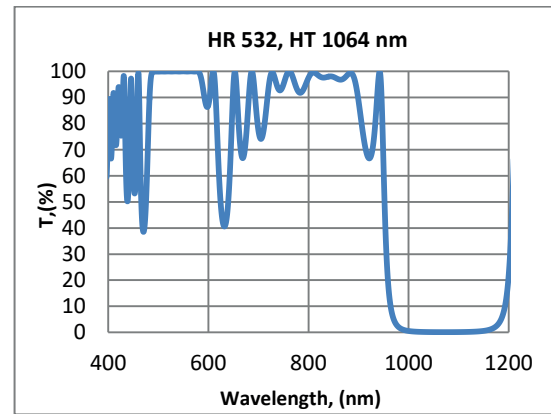
# OTHER COATINGS

Focusing on customized solutions, we offer a variety of nonstandard optics: dichroic mirrors, notch filters for several zones, high performance short pass and long pass filters, polarizers for various angles of incidence, beam splitter, neutral or color coatings and many more.

## Dichroic mirrors

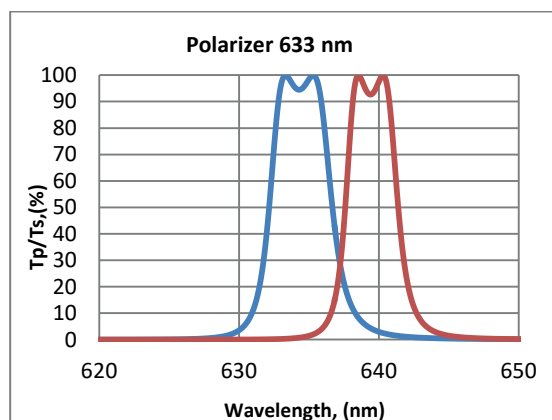


Dichroic mirror  $R > 99.9\%$  for  $\lambda=532$  nm;  
 $T > 99\%$  for  $\lambda=1064$  nm, AOI  $45^\circ$ ;  
 Substrate: optical glass, fused silica, sapphire and other.

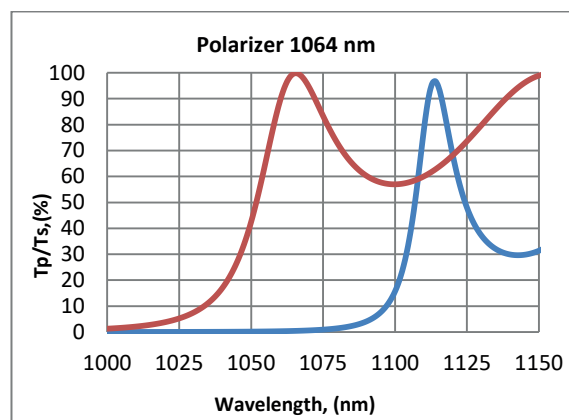


Dichroic mirror  $R > 99.9\%$  for  $\lambda=1064$  nm;  
 $T > 99\%$  for  $\lambda=532$  nm, AOI  $45^\circ$ ;  
 Substrate: optical glass, fused silica, sapphire and other.

## Polarizers

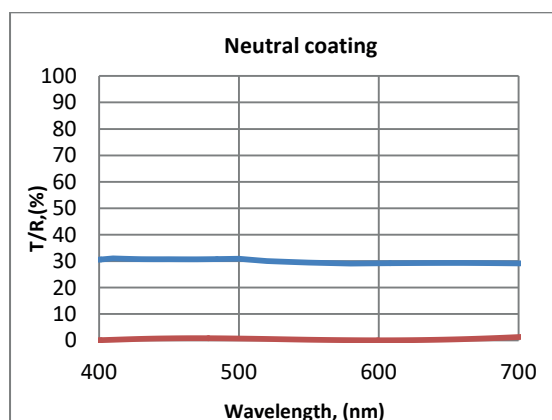


$T_p/T_s > 100/1$  for  $\lambda=633$  nm, AOI  $20^\circ$  or more;  
 Substrate: optical glass, fused silica, sapphire and other.

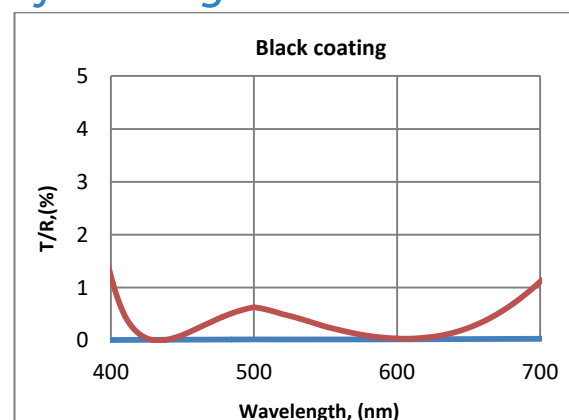


$T_p/T_s > 100/1$  for  $\lambda=1064$  nm, AOI  $20^\circ$  or more;  
 Substrate: optical glass, fused silica, sapphire and other.

## Neutral density coatings



$T = 30 \pm 2\%$  for  $\lambda=400-700$  nm;  
 $R < 1\%$  for  $\lambda=400-700$  nm.



$T < 0.1\%$  for  $\lambda=400-700$  nm;  
 $R < 1\%$  for  $\lambda=400-700$  nm.

# MULTI-ZONE FILTERS

Multi-zone optical filters offer spatially varying spectral performance on a single substrate. We offer custom patterned as well as assembled multi-zone filters of various types.

## Main features

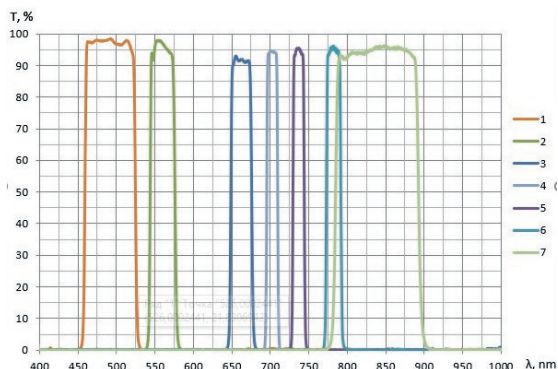
Customization for size, spectral performance, and lay-out (number and size of zones)

Different approaches are possible: patterning or assembling

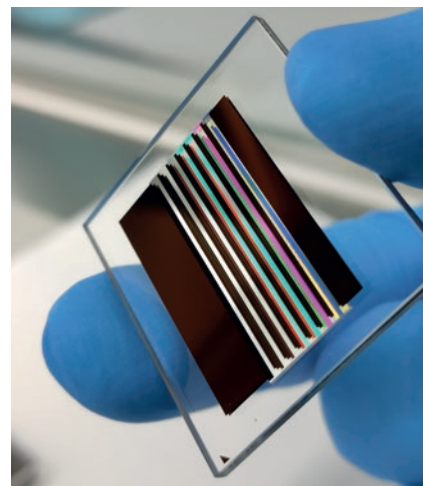
IBS sputtering technology guarantees reliability and no shifts in time

Black absorbing coatings between zones

High level of accuracy - up to 10 μm between zones



7 zones filter with bandpass zones in 400-900 nm range



	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						
Blocking range, nm	300-1100						

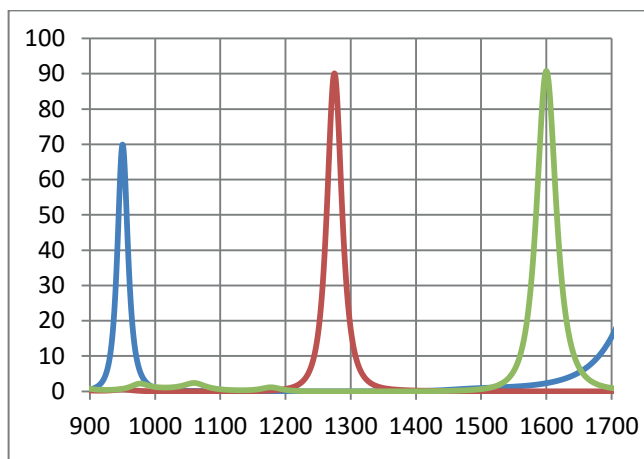
# LVF — LINEAR VARIABLE FILTERS

A linear variable filters (LVF) are spatially variable response filters in which a center wavelength changes in a linear manner along one side.

With its broad blocking and transmission range, a single linear variable filter can replace an entire filter set.



Pic.1 Linear variable filter 950-1600 nm



Pic.1 Transmission graph. LVF 950-1600 nm

# DLC COATING

I-Photonics has developed and successfully implemented in production diamond-like- carbon protective optical anti-reflection coatings (DLC-coatings) on germanium and silicon substrates. Such optical coatings significantly increase mechanical strength of the products as well as their transmittance coefficient. The unique I-Photonics method uses ion beam sources to provide deposition of the DLC coating with superior thickness uniformity.

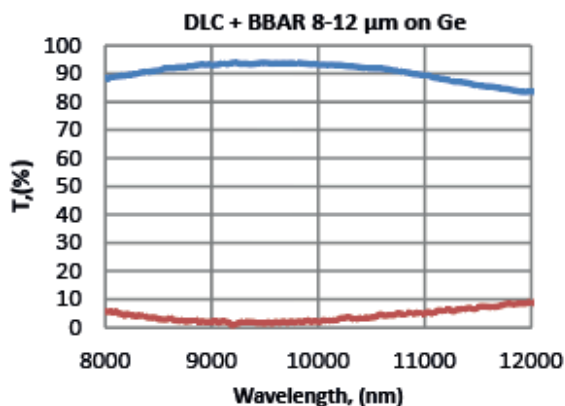
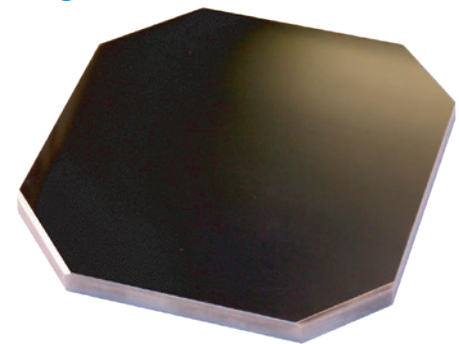
Presently diamond-like coatings are custom-deposited on germanium and silicon substrates with maximum dimensions 380x410 mm and guaranteed coating uniformity  $\pm 3\%$ .

Our vacuum coating system "Diamanta" is used for diamond-like carbon coatings application.

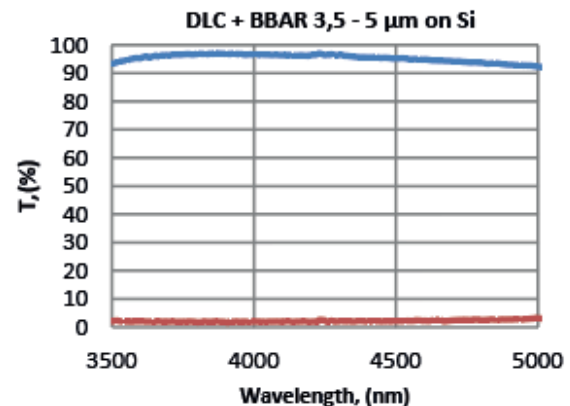
Germanium and silicon optical parts with deposited coatings have passed all required environmental tests and optical mechanical evaluations, including MIL-685C and MIL- 810G.

## The main characteristics of diamond-like coating

- Hardness
- Durability
- Chemical resistance
- Climatic resistance
- Stability
- High adhesion to germanium, silicon and glass surfaces
- Broad band anti-reflection for germanium and silicon



Parameter	Measured data
Average reflection in the 8-12 $\mu\text{m}$ range	<5%
Average transmission in the 8-12 $\mu\text{m}$ range	>90%



Parameter	Measured data
Average reflection in the 3.5-5 $\mu\text{m}$ range	<3%
Average transmission in the 3.5-5 $\mu\text{m}$ range	>95%

# ANTI-REFLECTIVE COATED GLASS

Anti-reflective, anti-glare glass allows the removal of the ambient light glare. Among the possible applications can be displays, where such glass improves contrast and reduces reflection from the monitor's surface. The product is a glass coated in a vacuum environment with anti-reflection multilayer coating. The coating can be applied both on the outer and on the inner side of the substrate.

## Main characteristics

Integral transmittance coefficient, T – at least 97%

Integral reflection coefficient, R – 0.5...1%

Chemical resistant and climatic resistant

# ITO COATED GLASS

Controlled self heating display glass is designed to be installed together with monitors and allow extending the range of displays' operation temperatures. Additional characteristic is "demisting". The product is a glass, coated in a vacuum with anti-reflection multilayer coating. The coating has high transmission in the visible range. On both sides or along the perimeter current-conducting buses are deposited for soldering supply wire.

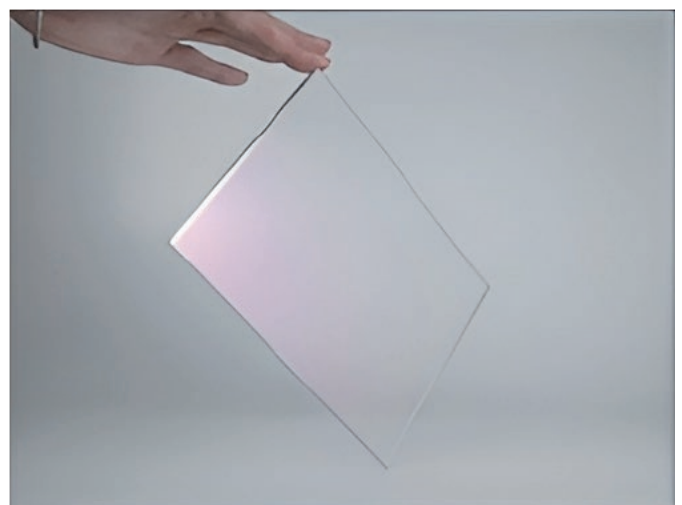
## Main technical characteristics of ITO coated glass

Integral transmittance coefficient, T – 85%

Integral reflection coefficient, R – (1.5 - 2.0)%

Sheet resistance of transparent conductive coating, (3 – 300)  $\Omega$ /sq

Diagonal size 21", thickness from 0.5 to 10 mm



# HYDROPHOBIC AND OLEOPHOBIC COATING

I-Photonics developed and successfully applied an oleophobic (anti-fingerprint) coating technology on glass and polymer surfaces. Oleophobic coatings could be combined with anti-reflective coatings on one glass side.

These coatings obtain an extreme long-term resistance, withstanding up to 10,000 cycles of abrasion steel wool with a load of 10 N. The contact angle of water remains in the range of 115-105°.

The multifunctional AR+AF coating is well suited for use in surface protection of optical glasses from contamination and mechanical scratches, wear-resistant coatings for displays, touch screens, architectural glass, cameras, optics and many more applications.

## The main performance features of the hydrophobic coating

High contact angle – 116 deg

Combination with anti-reflective coating

Long term wear-resistance and dirt-repellent properties

Reduces visual reflections

Resists more than 10,000 cycles of abrasion steel wool with a load of 10 N

Chemically inert

Transparent

Low thickness, defects free





I-Photonics is one of the world leaders in the development of thin film technologies and the design and manufacture of vacuum coating systems.

Originating from a scientific lab, today the company represents a great team of professionals in the area of physics of surfaces, plasma physics, ion beam source developments and the design and the production of turn key low pressure vacuum coating machines.

Our strength lies in the accurate selection and design of best performing hardware for the specific precision optics coating applications. Our, both active and if needed even pro-active, customer support on coating process questions, requirements and developments bring outstanding value and productivity intelligence to our customer's production facilities.

We believe that the quality of support to be performed for the customer by training and supervising production specialists and providing production solutions with automatic real time deposition process control is and will be the key for all future precision optical coating business.

We strive to best perform on behalf and this with the highest priority and accuracy.

**I-Photonics UAB**  
Parko g. 3, Avizieniai  
Vilniaus raj., 14198  
Lithuania

Tel: +37066890702  
info@i-photonics.lt  
www.i-photonics.lt  
www.i-coatings.lt

