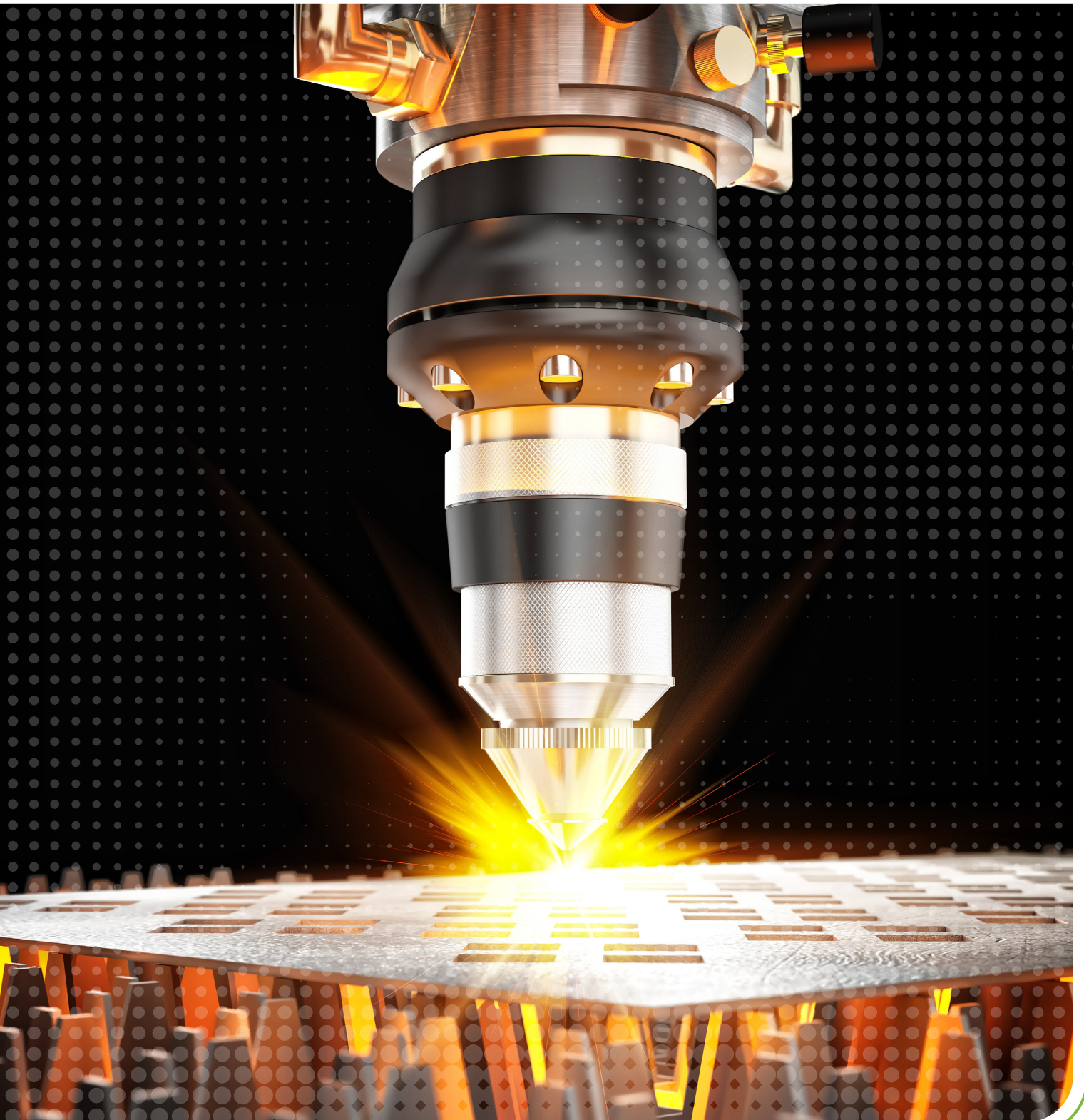


**OEM LASER OPTICAL COMPONENTS AND
ASSEMBLIES MANUFACTURING**
CUSTOMIZED SOLUTIONS FOR A WIDE SPECTRAL RANGE



COMBINING DECADES OF EXPERTISE WITH THE LATEST, CUTTING-EDGE TECHNOLOGIES

Key Benefits

- End-to-End solutions – from design through high-volume production
- Unique, innovative engineering techniques
- Cutting-edge manufacturing technologies
- Optical coating proficiency for outstanding results
- Strict QA standards and procedures
- Unparalleled experience and expertise

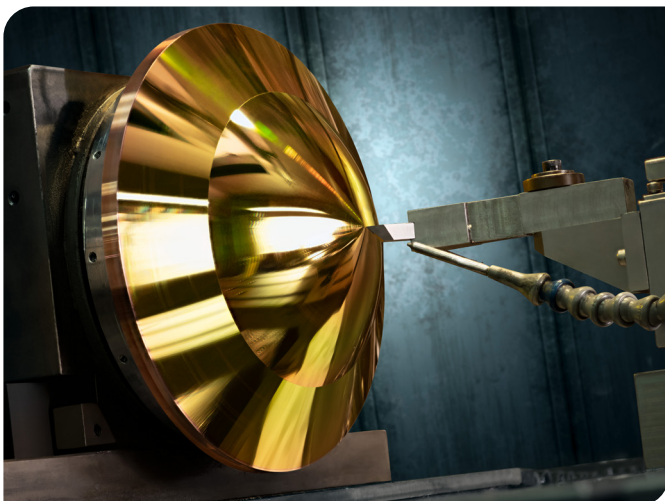
Ophir has earned its reputation as a world-leading, one-stop-shop designer and manufacturer of laser-optics components for industrial applications. Our R&D engineering team is known worldwide for collaborating with customers to develop, design and deliver optimized optics with unparalleled performance quality. They deliver solutions for high precision applications, answering the strict demands of customers worldwide, enabling today's most advanced industrial deployments.

Core capabilities

- Superior design capabilities for a diverse range of advanced optical components and assemblies
- In-house, cutting-edge manufacturing technologies:
 - MRF technology - optical polishing and measurement for improved surface quality and complex surface shapes production for a wide variety of sizes and geometries with demanding specifications.
 - Lumpho Scan Profilometers technology - for maximized precision non-contact 3D form measurement of aspheric surfaces. A multi-wavelength interferometry based on an optical (non-contact) point probe.
 - Grinding
 - CNC polishing
 - Plano Polishing
 - Diamond turning
 - Coating
 - Metrology
- Highest production standards
- Complete control of production processes
- Statistical Process Control (SPC) over full production cycle
- Lean and Six-Sigma for excellence and continuous improvement
- Large volume high-end production capabilities
- Manufacturing sites in Israel and Europe (Romania) with a clean room for the coating, inspection and packing processes.

Manufacturing a wide range of components to meet any specification

- Wavelengths: 1.06 μ m, 9.3-9.4 μ m, 10.6 μ m and others per demand
- Types: Lenses, mirrors, windows
- Shapes: Spherical, aspheric, flat
- Substrates: Fused-Silica, Germanium, Silicon, Zinc selenide, Zinc sulfide cleartran, Copper and more



The most advanced optical coatings, developed by world-leading experts

With over 4 decades of experience, Ophir is recognized as a world leader in the development, production and application of advanced optical coatings.

Our high LIDT, low absorption coatings, are ideal for high-power lasers, minimizing power loss, ensuring accurate cutting quality & prolonging machine lifetime. Using class 1,000 clean rooms, our anti-reflective (AR) coatings include DLC laser coatings and provide maximum durability and longer life expectancy.

Coating types

- Anti-reflective (AR), mirrors, filters
- Beam delivery mirror, cavity mirror, cutting head
- Output coupler (RPR), end-mirror, phase shift mirrors, MMR
- Wavelengths: 1.064 μ m, 9.3-9.4 μ m and 10.6 μ m
- DLC laser coating

Coating Technologies

- Physical Vapor Deposition (PVD) – Thermal heating and electron gun
- Ion Assisted Deposition (IAD) – Ion gun
- Plasma Enhanced Chemical Vapor Deposition (PECVD) for DLC coatings



Coating manufacturing – capabilities matrix

Coatings for 10.6 μ m

Lenses	HeNe Transparency	Max Absorption	Product lifetime	Pricing	Radioactivity (ThF4)
Duralens™	Yes	0.20%	Standard	Standard	Yes
Duralens Extra™	Yes	0.16%	High	Mid	No
Black Magic™	No	0.15%	High	Mid	No
Clear Magic	Yes	0.13%	High	High	No

Beam Delivery Mirror	Substrate	%R@45°@10.6	%S-Pol@45°@10.6	%P-Pol@45°@10.6	%R@45°@0.6328	PS@45°AOI
ZPS-HR	Si	99.7%	99.8%	99.6%	630-670nm≥80%	0°±2°
ZPS	Si&Cu	99.5%	-	-	630-670nm≥80%	0°±2°
90PS	Si&Cu	98%	-	-	630-670nm≥80%	90°±2°
90PS-HR	Si&Cu	99%	-	-	≥80%	90°±2°
AFTR-HR	Si&Cu	-	99%	≤1%	-	0°±2°

Beam Delivery Mirror	Substrate	%R@45°@10.6	%S-Pol@45°@10.6	%P-Pol@45°@10.6	%R@45°@0.6328	PS@45°AOI
MMR	Si&Cu	99.8%	99.9%	99.75%	40%	0°±2°
MMR-A	Si&Cu	99.8%	99.85%	99.60%	40%	0°±2°
MMR-H	Si&Cu	99.7%	99.8%	99.60%	650±20nm>80%	-
MMR-P	Si&Cu	-	99.9%	99.80%	900-1000nm≥55%	0°±2°
PLM	Si	-	99.5%	≤90%	-	-
PLM-W	Cu	-	99.8%	≤90%	-	-
PLM-HR	Cu	-	>99.9%	≤97%	630-670nm≥65%	-
PLM-HR	Si	-	>99.9%	≤93%	630-670nm≥65%	-

Coatings for 9.4μm

Lenses	Substrate	λ(um)	AOI	Environmental Durability
AR on ZnSe FOR 9.4	ZnSe	9.4	0-20	HE
AR HE on ZnSe for 9.4 LA	ZnSe	9.4	0-20	HE
AR LRHC on ZnSe for 9.4	ZnSe	9.4	0-20	HC
HE on ZnSe for 9.4 mic ULA	ZnSe	9.4	0-20	HE
AR on ZnSe for 9.4 mic AOI 0-32deg	ZnSe	9.4	0-30	HE
AR on Ge for 9.4 mic	Ge	9.4	0-20	HE
AR on Ge for 9.4 mic AOI 0-46deg	Ge	9.4	0-45	HE

Unique coatings	Substrate	λ(um)	AOI	Environmental Durability	Type
EM on ZnSe for 9.4mic	ZnSe	9.4	0-45	HE	EM
OC 70% on ZnSe for 9.3	ZnSe	9.4	0-20	HE	OC
90PS-HR on Si for 9.3	Si	9.4	0-45	HE	PS
TFP for 9.3μ A	ZnSe	9.4	0-45	HE	TFP
TFP on ZnSe for 9.4 mic	ZnSe	9.4	0-45	HE	TFP
EM on ZnSe for 9.4mic	Si	9.4	0-45	HE	ZPS
OC 70% on ZnSe for 9.3	Si	9.4	0-45	HE	ZPS

Coatings for 1.06μm

Coating	5011	5120	5175	5178	5324	5418
Transmittance (optics with both surfaces coated)	> 99.8% at 1064 nm > 60% at 650 nm	> 99.6% at 1064 nm > 90% at 650 nm	> 99.8% at 1064 nm > 60% at 650 nm	> 99.8% at 1064 nm > 85% at 650 nm	> 99.8% at 1020-1090 nm > 80% at 650 nm	> 99.8% at 1030-1120 nm > 80% at 650 nm
Reflectance at 1064 nm (one surface)	< 0.1 %	< 0.2 %	< 0.1 %	< 0.1 %	< 0.1 % at 1020 -1090 nm	< 0.1 % at 1030-1120 nm
Absorption* at 1 μm (one surface)	< 8 ppm*	< 10 ppm*	< 10 ppm*	< 10 ppm*	12 ppm*	12 ppm*
Maximum Laser Power (CW) in kW	20	15	16	10	15	17

*Upper tolerance level for production; real values may be significantly lower.

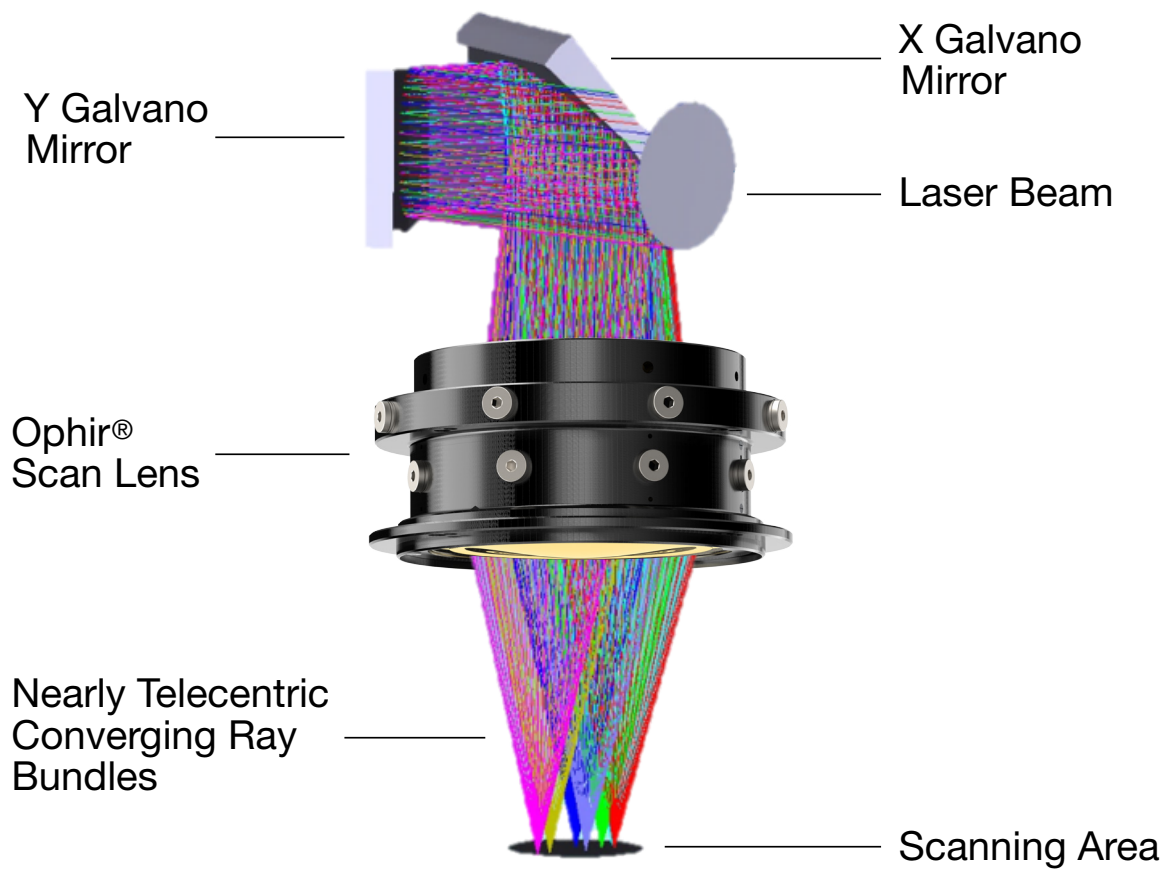
90PS = 90deg Phase Shift | ATFR = Absorption Thin Film Reflector | DLC = Diamond Like Carbon | EM = End Mirror | HC = Hard Carbon | HD = High Durability | HE = High Efficiency | LRHC = Low Reflection Hard Carbon | MMR = Metal Mirror Reflector | OC = Output Coupler | PLM = Phase Lock Mirror | TFP = This Film Polarizer | ZPS = Zero Phase Shift

Optical Assembly Solutions – Ophir® Scan Lenses for CO₂ laser processing

Ophir laser Scan Lenses are customized for advanced, high-resolution laser micromachining applications.

Specifically, Ophir CO₂ scan lenses deliver the performance for PCB via hole drilling applications, including:

- Small spot sizes with tight tolerances
- Excellent beam roundness
- High telecentricity
- Wide scanning areas
- Unique AR coatings for high incidence angles
- Diffraction limited performance





About Ophir Laser Optics

With vast knowledge and extensive experience accumulated over four decades, Ophir Laser Optics Group, an MKS (NASDAQ:MKSI) company, offers a full range of high quality OEM and replacement optics for high power CO₂ and 1 μ m laser applications, in the 10.6 μ m, 9.3 μ m and 1 μ m wavelength ranges. Used by leading laser manufacturers around the world, our products meet the highest industry standards and have been widely tested with outstanding results. All manufacturing is carried out in-house using automated CNC, patented diamond turning technologies, and advanced, cutting-edge coating processes and measuring equipment. With a global distribution and support network, our commitment to our customers is unparalleled.

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