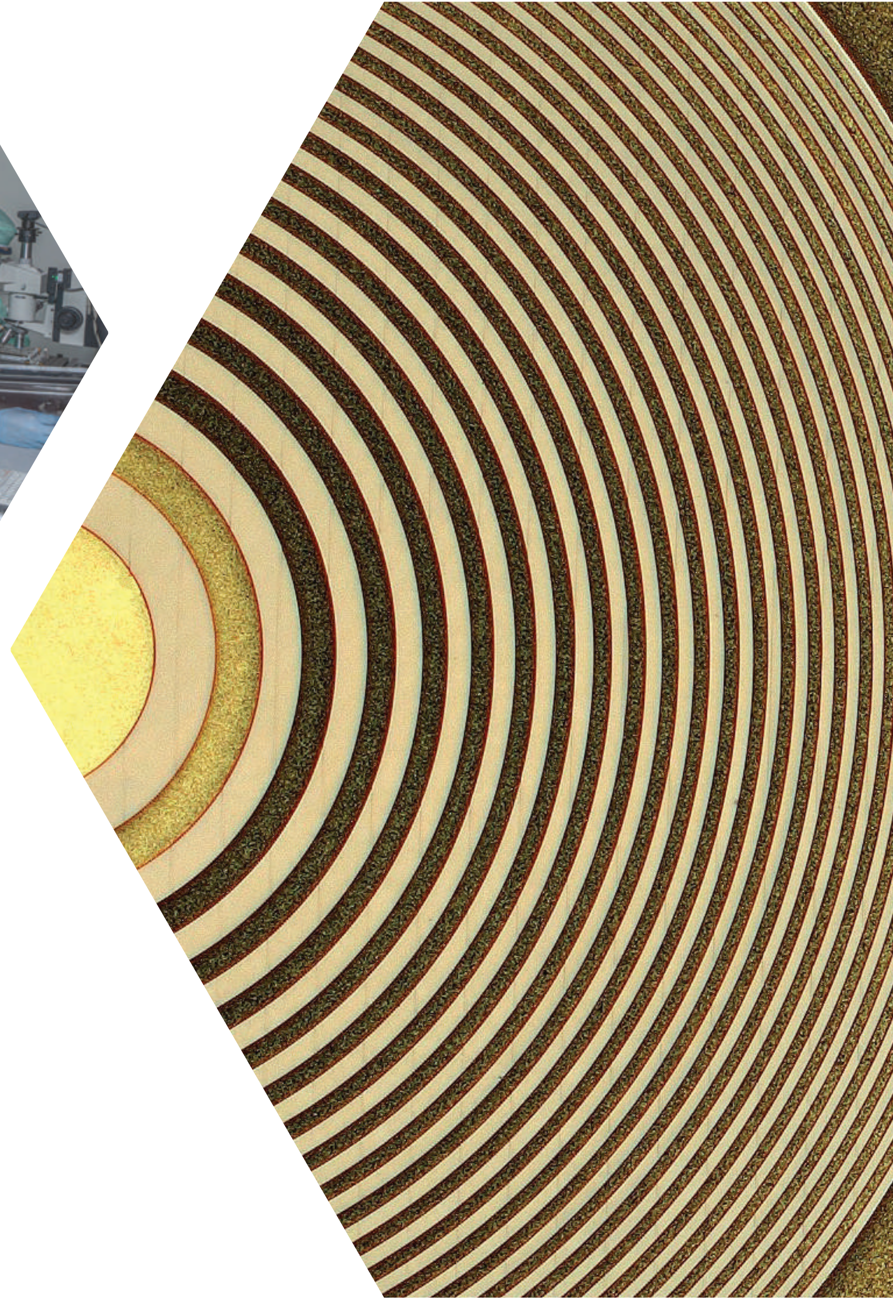
XRnanotech



Technology Brochure

Nanostructures & Optics with Swiss Precision

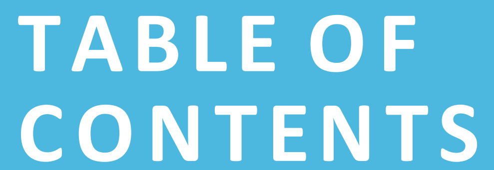


TABLE OF CONTENTS

About XRnanotech	01
Electron Beam Lithography	02
Direct Laser Writing	04
Two-Photon Polymerization	06
EUV Laser Interference Lithography	08
UV Lithography - Mask Aligners	09
Etching	10
Deposition	12

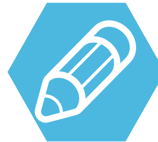
ABOUT XRNANOTECH

XRnanotech is the leading Swiss manufacturer of the highest-quality nanostructures and optics: from high-aspect-ratio fresnel zone plates with record breaking resolution to ultra-stable diamond optics and custom 3D-nanostructures for a wide range of applications.

XRnanotech is the culmination of more than 10 years of research and development at the world-renown Paul Scherrer Institut in Switzerland. The company was incorporated in 2020 with the goal to bring the newest groundbreaking innovations in nano-optics to market.

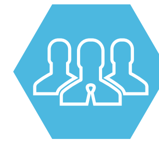
Vision

Enabling optical instruments around the world to reach their full potential.



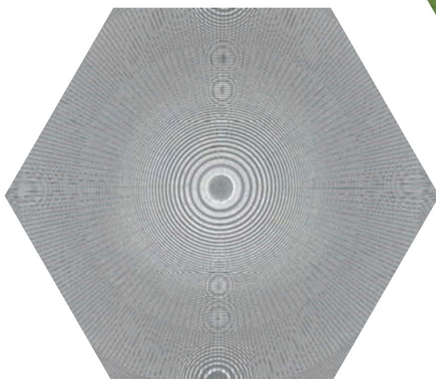
Mission

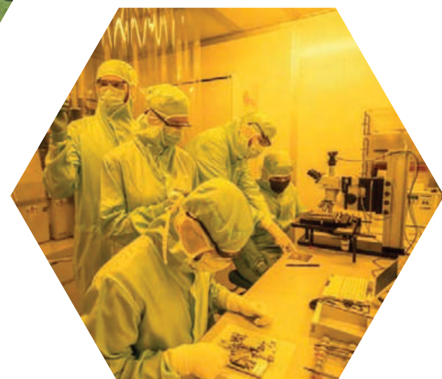
Developing and fabricating the most innovative nano-optics that reach the highest quality in resolution, efficiency, stability and design.



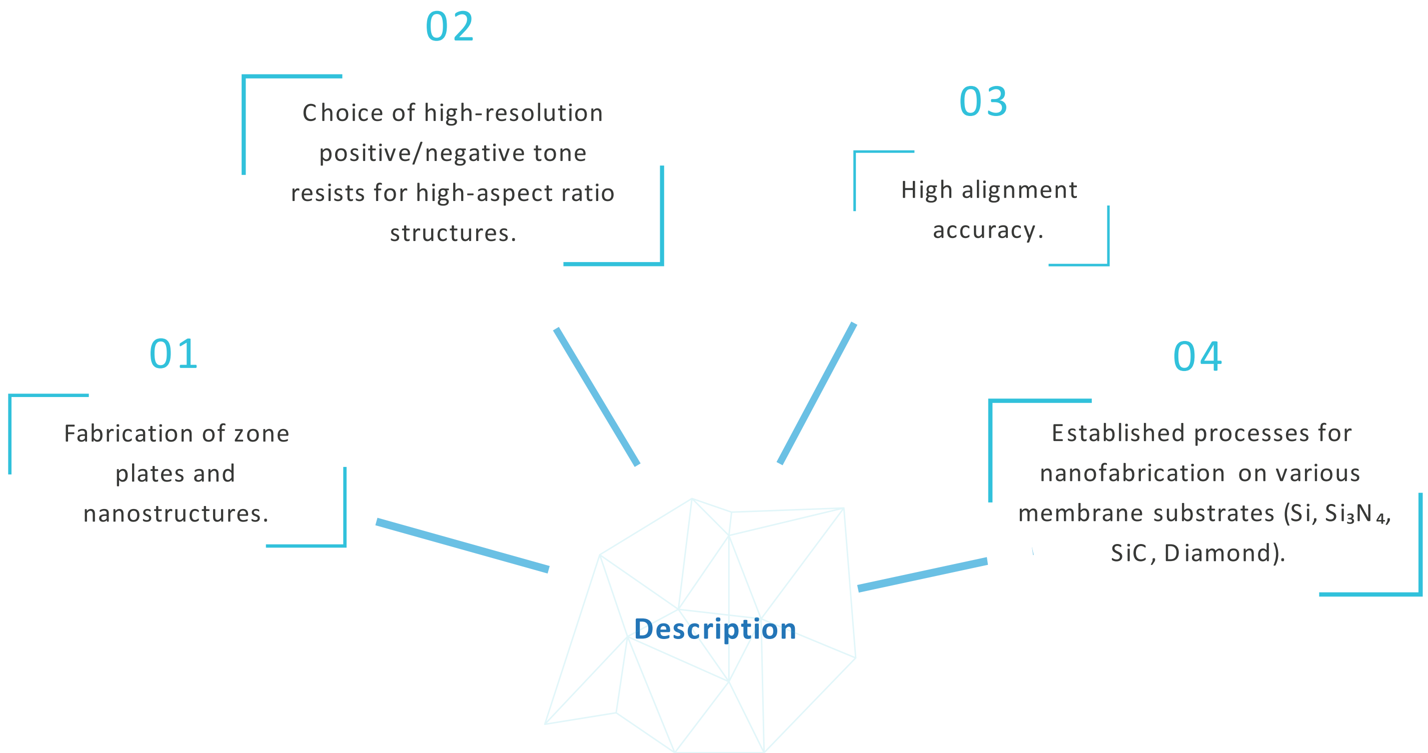
Team

Our team of engineers and scientists work tirelessly to find the ideal solution for our customers.





Electron Beam Lithography



Specifications

Tool	Technology	Minimum Feature Size	Holder Capacity
Raith / Vistec EBPG 5000Plus	Electron Beam Direct Writer	10 nm	4 inch

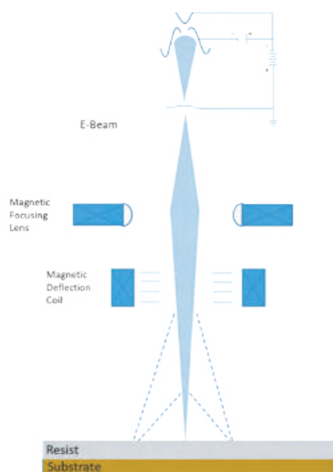


figure: 1.1
E-Beam Lithography

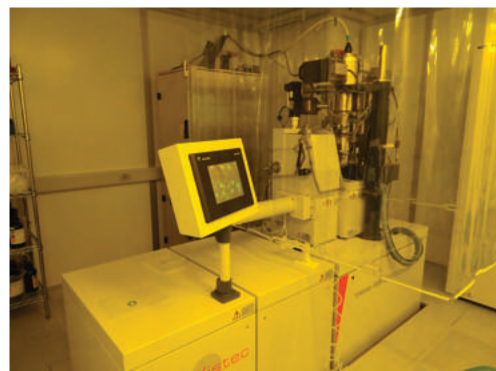


figure: 1.2
Raith / Vistec EBPG 5000Plus

Applications

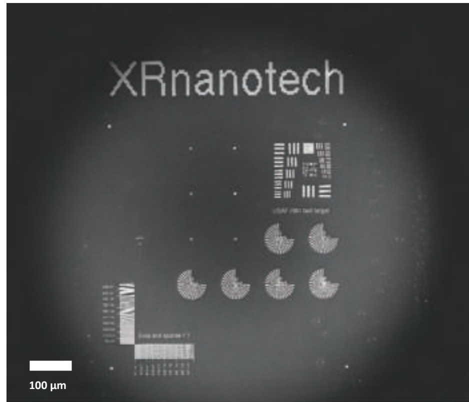


figure: 1.3
Test pattern

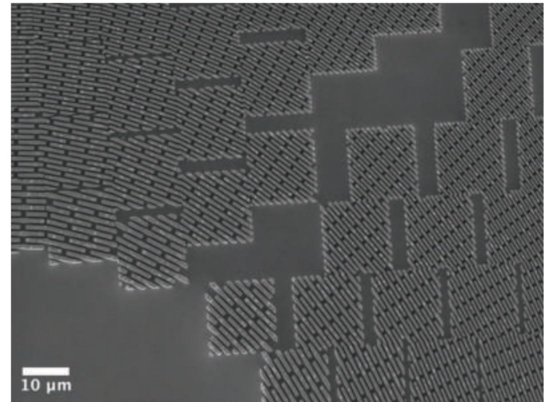


figure: 1.4
Line gratings with different orientations

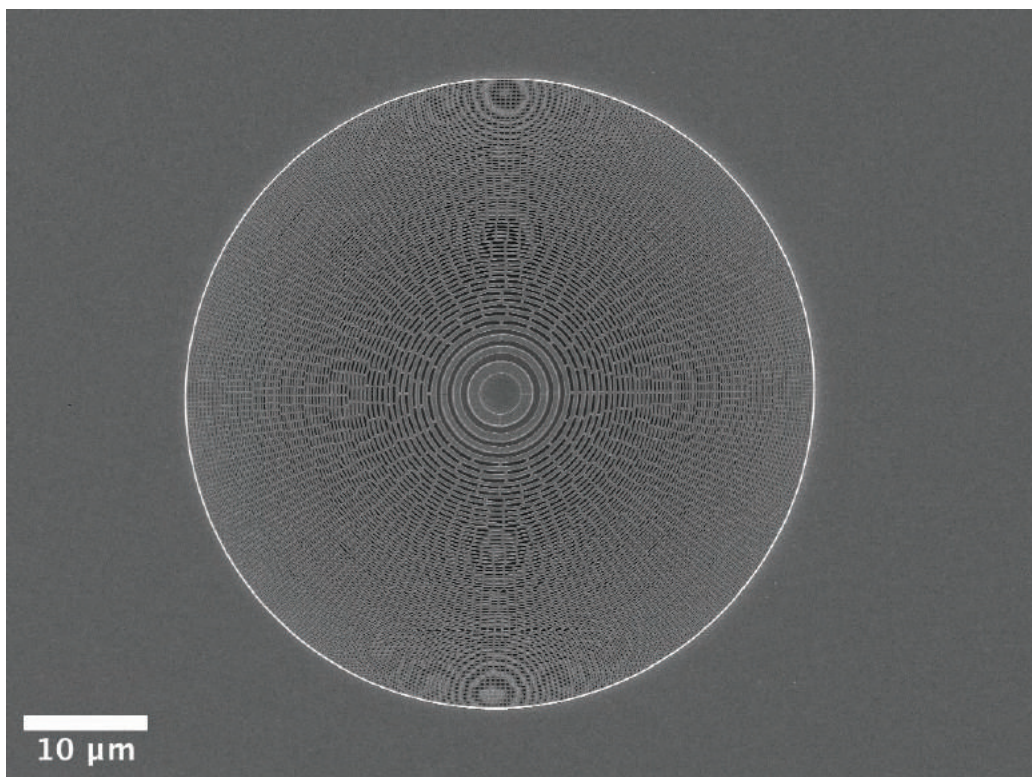
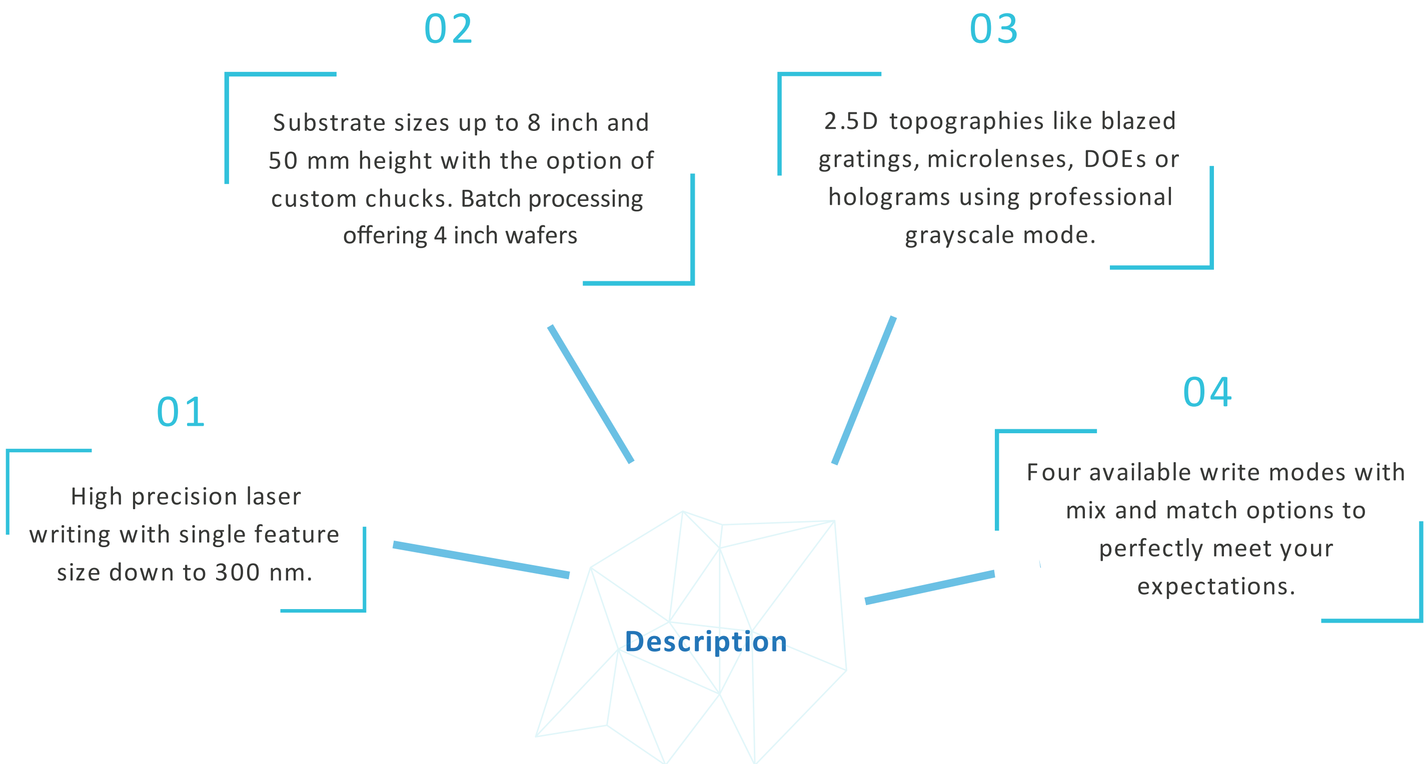


figure: 1.5
Fresnel zone plate

Direct Laser Writing



Specifications

Tool	Technology	Minimum Feature Size
Heidelberg DWL66+	200 mm Direct Laser Writer	300 nm single line
Write Mode	**Minimum Half Pitch / nm**	**Minimum Feature Size / nm**
HiRes	500	300
I	800	600
III	1500	1000
V	5000	4000

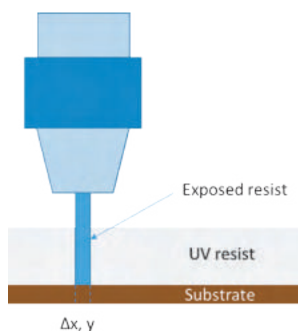


figure: 2.1
Direct Laser Exposure

figure: 2.2
Heidelberg DWL66+

Applications

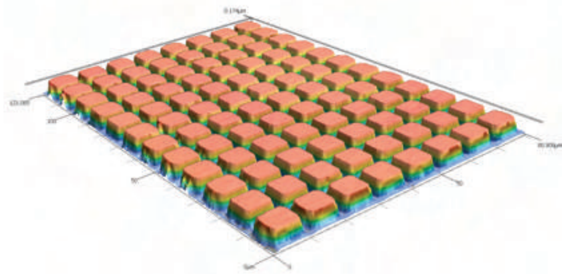


figure: 2.3
2D grating

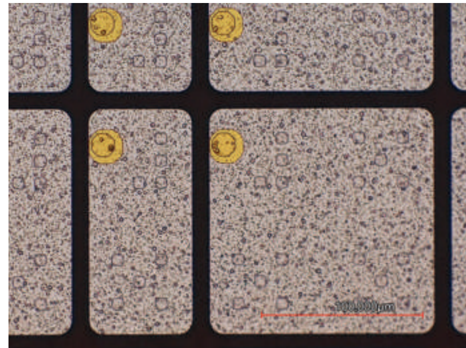


figure: 2.4
Rapid prototyping of UBM layers for detector developments

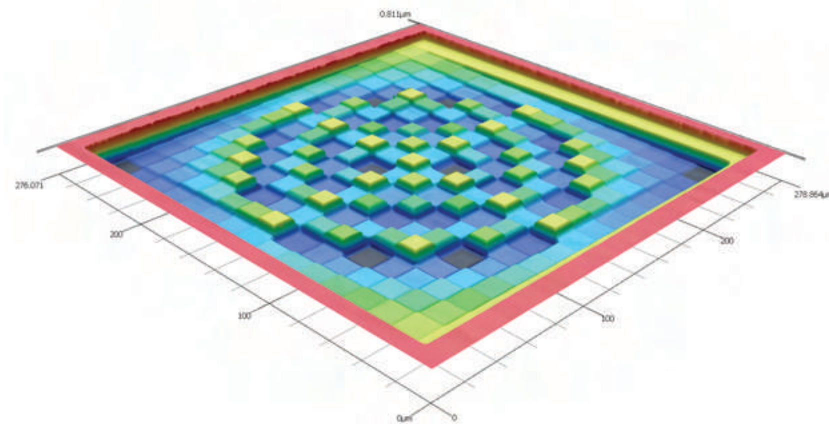
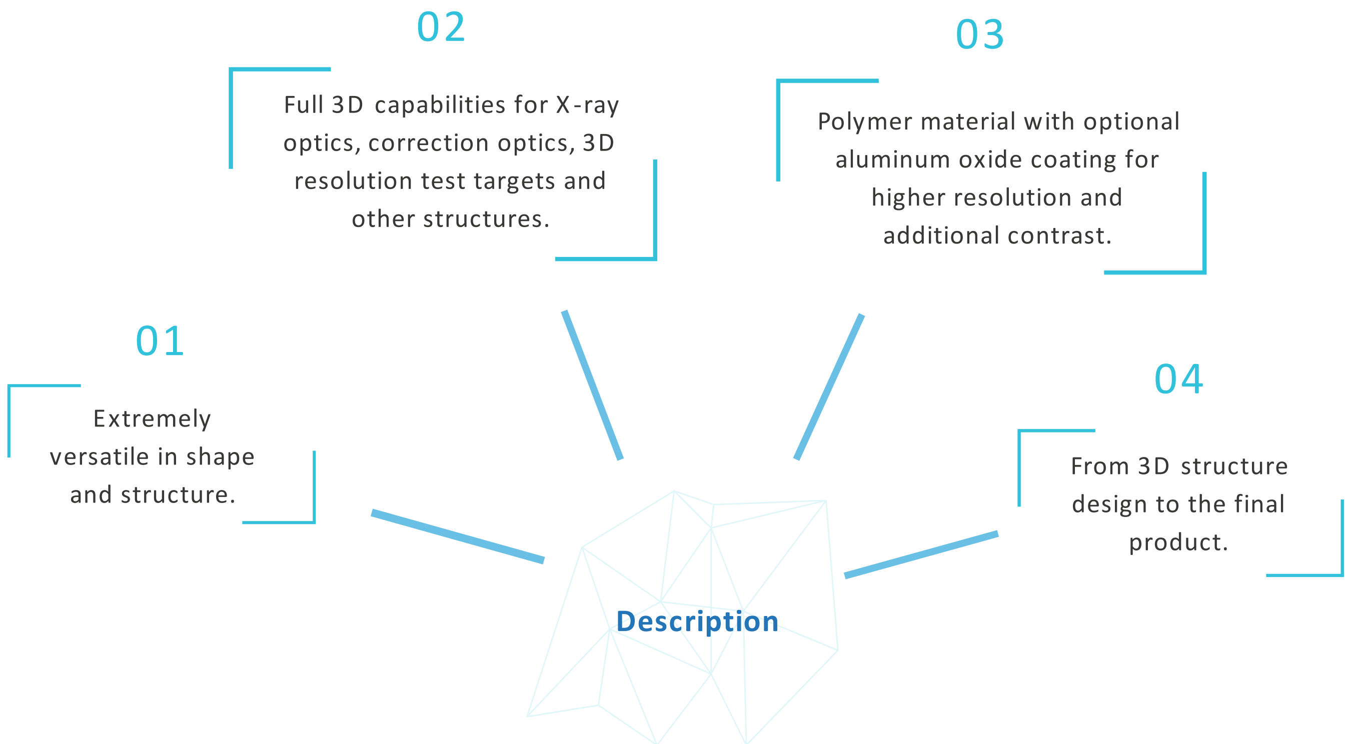


figure: 2.5
Diffractive optical element (DOE) made via grayscale exposure

Two - Photon Polymerization



Specifications

Tool	Technology	Minimum Feature Size
Nanoscribe GT	Layer-by-layer two - photon polymerization	< 200 nm

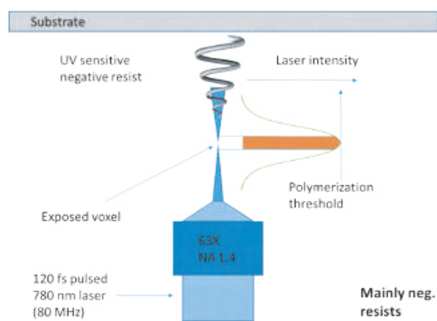


figure: 3.1
Two - Photon Polymerization

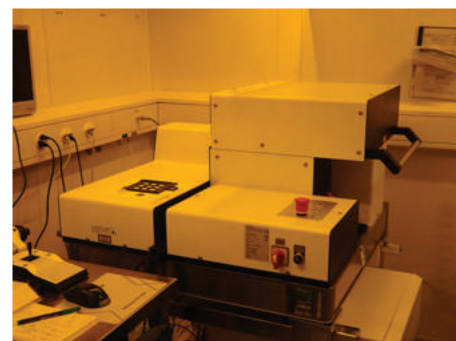


figure: 3.2
Nanoscribe GT

Applications

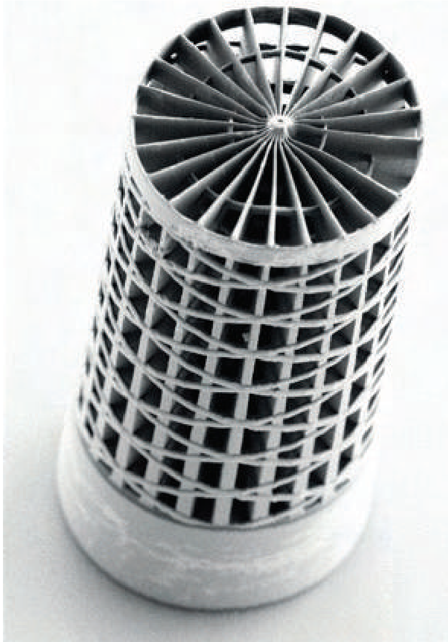
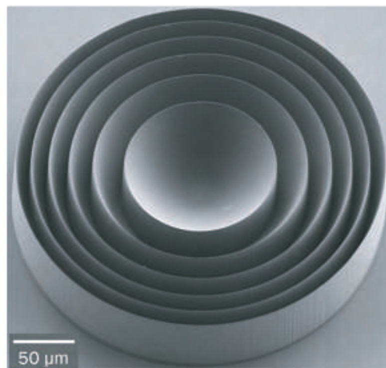


figure: 3.3
Test pattern "3D Siemens Star"

figure: 3.4
Multi - lens array



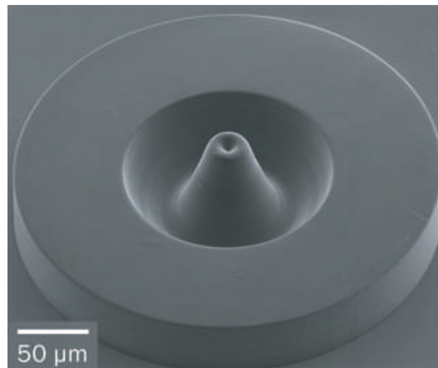
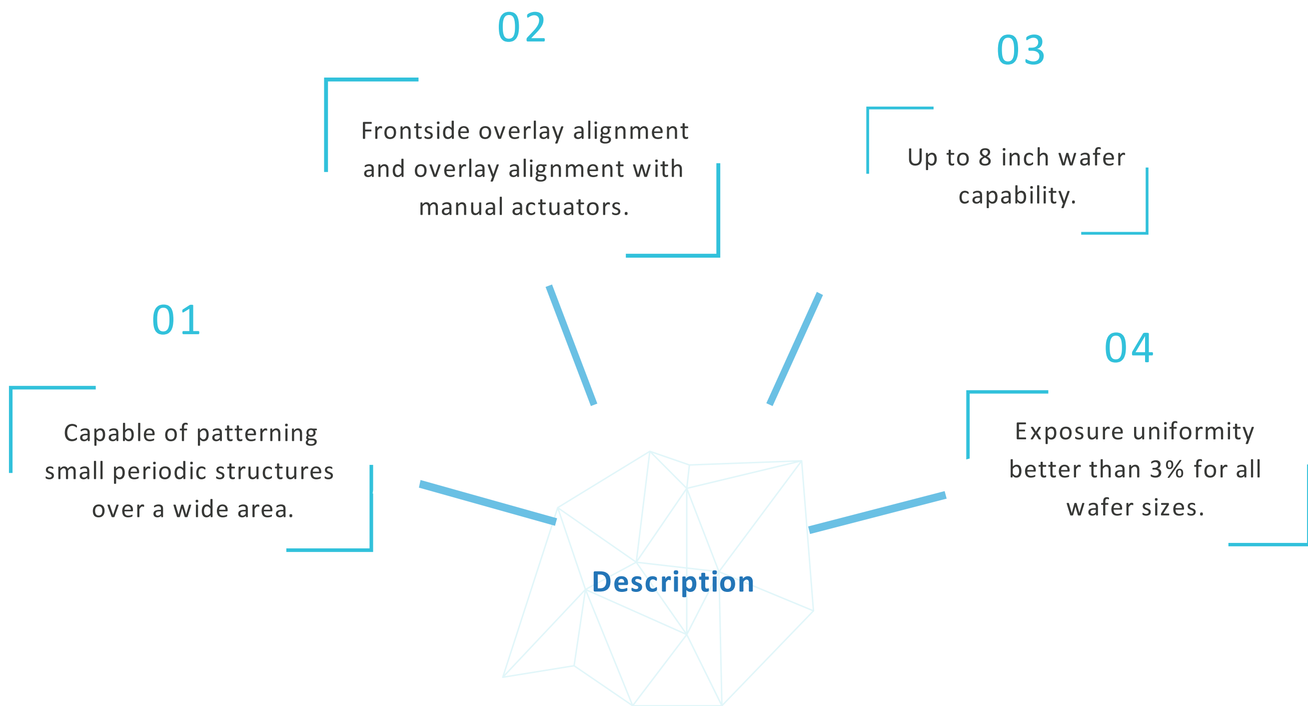


figure: 3.5
Phase corrector plates / "correction glasses" for imperfect Beryllium compound refractive lenses

EUV Laser Interference Lithography



Specifications

Tool	Technology	Minimum Feature Size
Phable R200	Displacement Talbot Lithography	60 nm

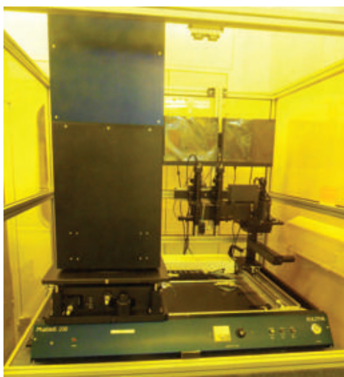


figure: 4.1
Phable R200

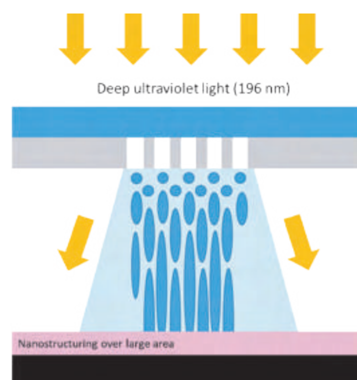
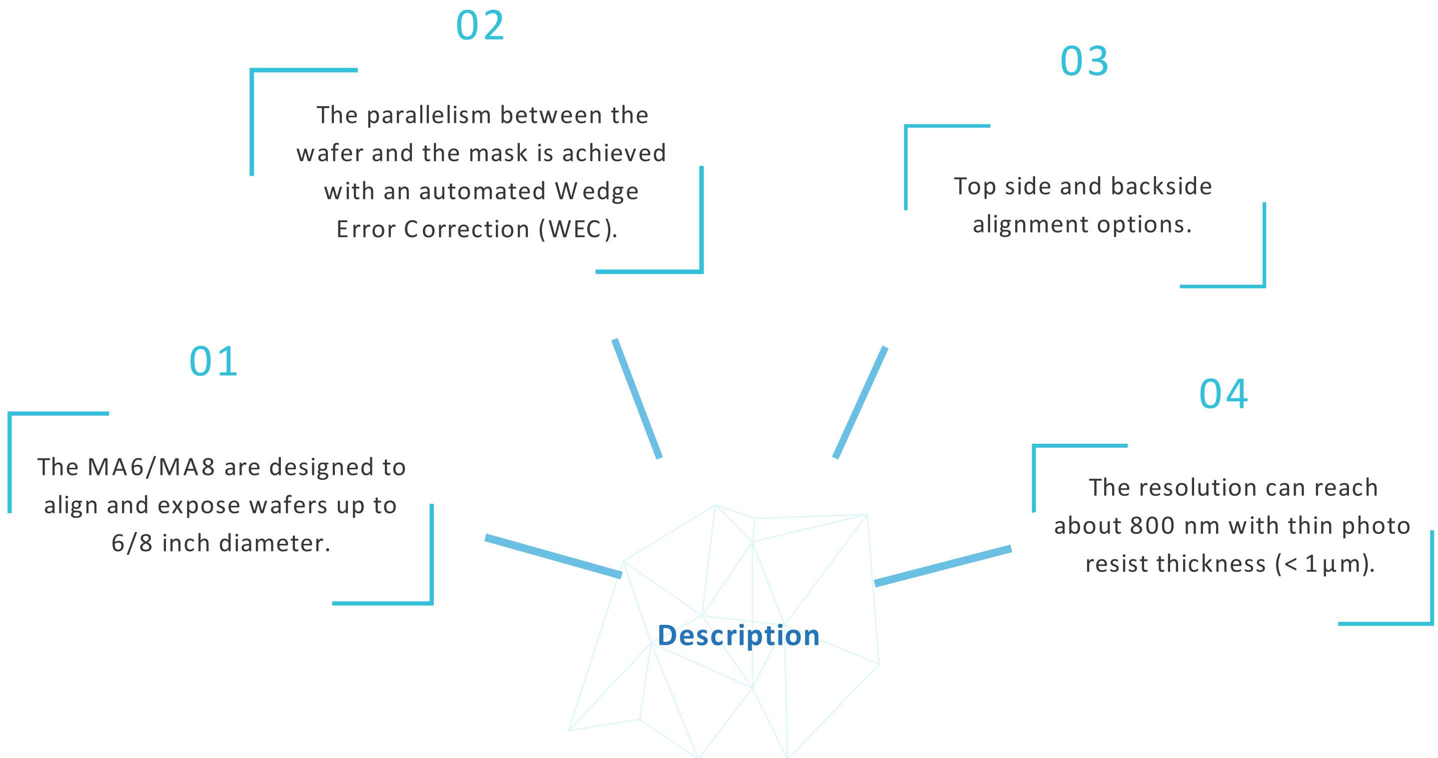


figure: 4.2
Talbot lithography

UV Lithography - Mask Aligners



Specifications

Tool	Technology	Wavelength
SUSS MA8-BA6	200 mm Mask Aligner	405 and 365 nm
SUSS MA6-BA6	150 mm Mask Aligner	405 and 365 nm

Applications

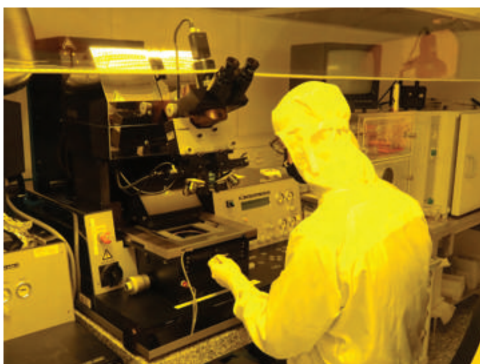
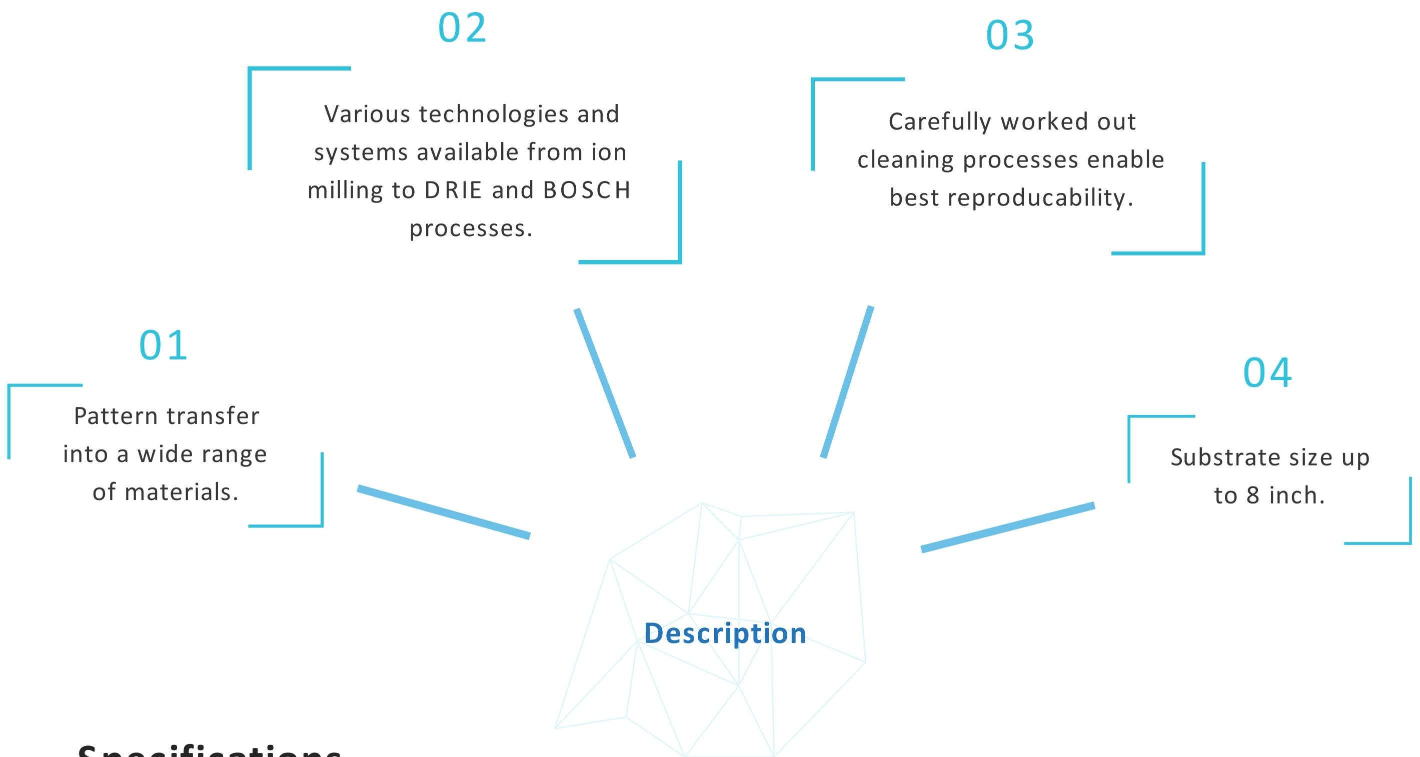


figure: 5.1
SUSS MA6-BA6

figure: 5.2
Membrane wafer

Etching



Specifications

Tool	Technology	Process Gases	Substrate Capacity
Sentech SI500	ICP RIE	Cl_2, BCl_3, O_2, Ar, SF_6	6" wafer or mask
Oxford Plasma Lab 100	ICP RIE	CHF_3, CF_4, C_4F_8, Ar, O_2	6" wafer or mask
Oxford Plasma Lab 100	ICP DRIE	SF_6 (fast), C_4F_8 (fast), O_2, CHF_3, Ar, SF_6, N_2	4" wafer
Oxford IonFab 300Plus	Ion milling	Ar	4" wafer
SPTS Rapier Omega LPX	DRIE BOSCH	SF_6, C_4F_8, O_2, Ar, N_2	up to 8" mask

figure: 6.1
Wet Chemistry Area

figure: 6.2
SPTS Rapier Omega LPX

figure: 6.3
Oxford PlasmaLab 100

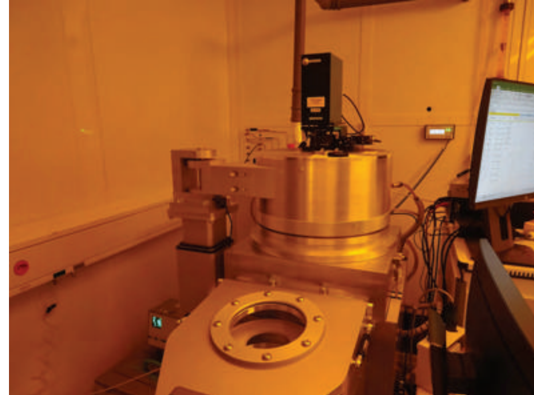


figure: 6.4
Sentech SI500

Applications

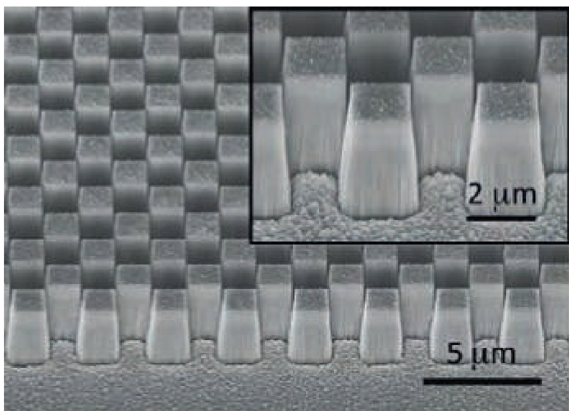


figure: 6.5
Diamond checkboard grating

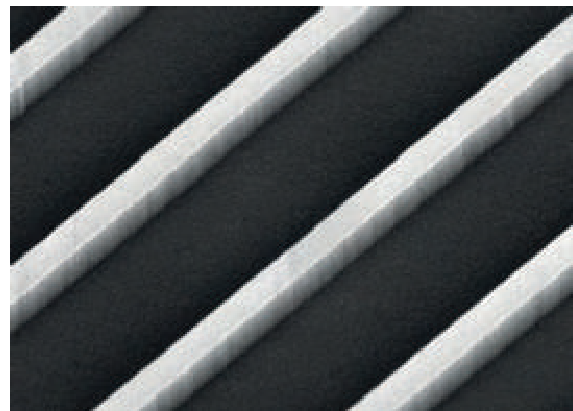
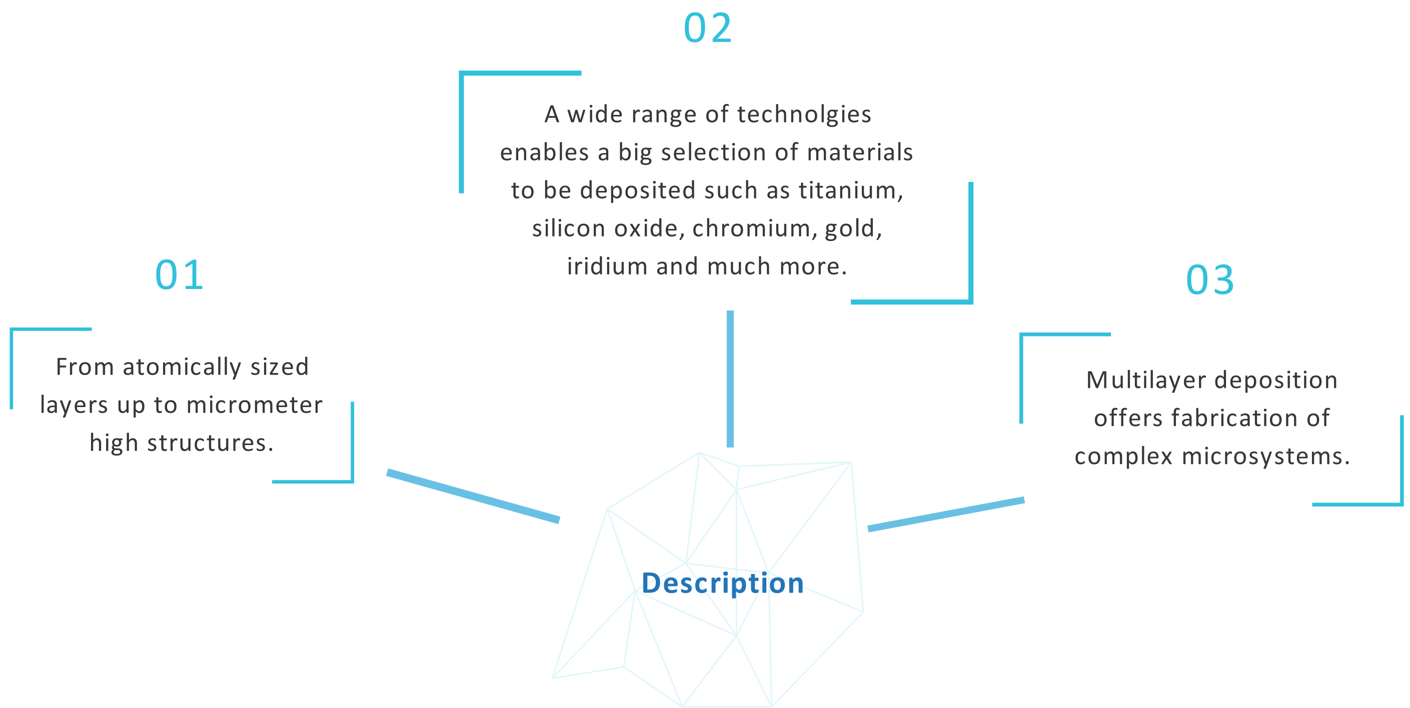


figure: 6.6
SiO_2 grating (p=500nm)

Deposition



Specifications

Tool	Technology	Deposition Targets
Balzers BAE250	Thermal Evaporation	Cr, Au, Ag, Al, Cu, NiFe, Ni, Fe, Ti, Mg
LEICA EM SCD500	Sputtercoating	Cr, Mo, AuPd, W
LEICA EM ACE600	Sputtercoating	Cr, Carbon thread
UNIVEX	Ebeam Evaporation	Ag, Al, Si, Ti, CeO_2, Co, Cr, Au, Fe, Mn, Mo, Nb, Ni, Permalloy, Pd, Al_2O_3, SiO_2, Pt, Cu, Ge, SiO, Sn
Oxford Plasmalab 80	Plasma enhanced chemical vapor deposition	SiN, SiO_2
Evatec BAKUNI	Physical Vapor Deposition	Cr, SiC, Ru, Al, AlSi 1%, Al_2O_3, Ni, Fe, Au, Cu, Ge, V, Pd, Pt, Mo, Co, Ag, SiO_2, Si
STEED	Oxidation	SiO, SiN
Picosun R200	Atomic Layer Deposition	In, Ir
TIPSI	380x560mm sputtercoater with reactive gas (N_2, O_2)	Most solid materials
Leybold Z600	50x200mm sputtercoater with reactive gas (N_2, O_2)	Most solid materials
Plating Baths	Galvanic Plating	Au, Ni

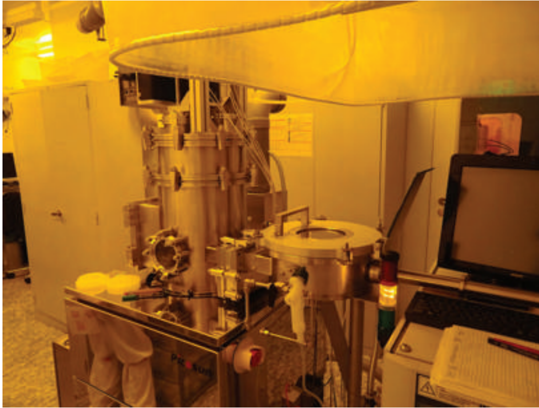


figure: 7.1
Picosun R200

figure: 7.2
Oxford PlasmaLab 80 PECVD

Applications

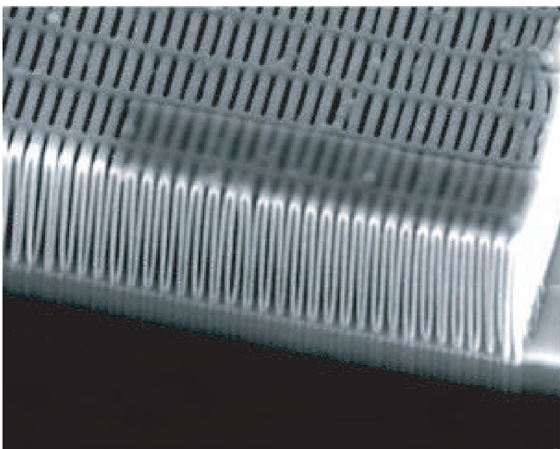
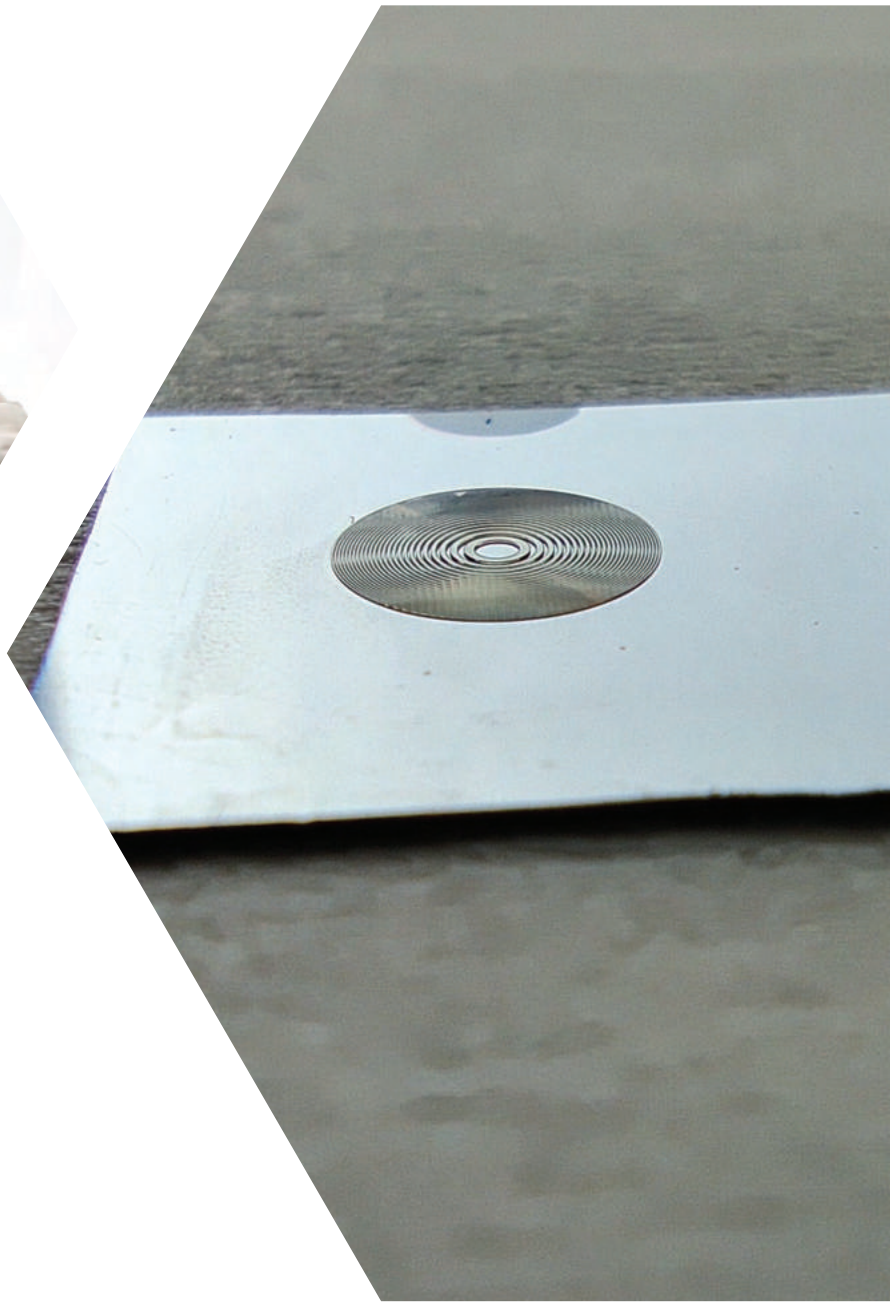


figure: 7.3
FIB cross-section of 25 nm wide, 550 nm high Ir zone plate

figure: 7.4
Tilted view (30°) of the zone plate with a height of 1430 nm. Due to geometric distortion, the actual height is twice the measured height



Forschungsstr. 111
ODRA/113
CH-5232 Villigen - PSI

+41 56 310 55 97

info@xrnanotech.ch