

Table I: Fabrication processes used for refractive x-ray lenses and materials that are used with each fabrication process.

Fabrication Method	Shape	Materials and Citation	Comments
Drilled cylindrical holes	1D cylinder	Al, ¹ Be, BN, pyrolytic graphite, PTFE, PMMA, polycarbonate, POM, polyamide, ² and (C ₂ H ₄) _n ³	—
	1D ⊥ 1D	Al, ¹ Be, PTFE ²	
Pressed 2D lenses	2D paraboloid	Al, ⁴ Be, ⁵ Li ⁶	—
	2D spherical	Mylar, Kapton, ⁷ Be, ⁸ PMMA ⁹	
Pressed 1D grooves	1D parabola	Al, Be, ¹⁰ Ni, ^{11–13} Fe ¹¹	
Bubble injection	2D	Glycerol, ¹⁴ epoxy, ^{14,15}	Inside glass capillary
Immersed spheres	2D	Water ¹⁶	
UV-light polymerization	2D	Shape-memory polymer ¹⁷	—
Photoanodic etching	2D parabolic pit	Si ¹⁸	Tiny aperture (5μm)
Lithography and dry etching	Planar 1D	Si ^{19–22}	100-μm-deep possible
	—	pcCVD C* ²³ B, pyrolytic graphite ²⁴	Prototypes
	—	Ge, ²⁵ Quartz glass ²⁶	—
	Planar 1D ⊥ 1D	Si ²⁷	100-μm-deep interdigitated assembly
Deep x-ray lithography	1D ⊥ 1D	PMMA, PTFE ²⁸	—
	Planar 1D	SU-8 ^{29, 30}	
	2D (1D at ± 45°)	PMMA, SU-8 ²⁹	
LIGA	Planar 1D	Ni ³²	Using SU-8 and PMMA photoresists
	2D (1D at ± 45°)	Ni ³²	
Lift-off and plasma etching	Planar 1D	pc C* ³³	—
Atomic layer deposition	Planar 1D	Al ₂ O ₃ ³⁴	Constant width lamella
Si mold, electroplating and polymer injection molding	Planar 1D	Polyethylene ³⁵	1D Si structure inverted by Ni plating, serving as mold
CVD deposition into prefabricated Si molds	Planar 1D	Nano- and microcrystalline C* ^{36–38}	—
Laser ablation	1D cutting	Glassy carbon, ³⁹ scCVD C* ^{40,41} pcCVD C* ^{42,43}	Pico- and femtosecond systems
	1D shaping	scHPHT C* ⁴⁴	
	2D shaping	scHPHT C* ^{45,46} scCVD C* ⁴⁷	

Note: PMMA (also named Plexiglas, Acrylite, Lucite) is a transparent thermoplastic and a positive photoresist; SU-8 is an epoxy-based negative photoresist; quartz glass (SiO₂) is amorphous and has a density similar to Si.