Microfluidics InnovationHub

Microfluidic Chip Manufacturing

Manufacturing Methode	Soft Lithographie	3D Printing	NI-/Photo- Lithography	Hot Embossing
Production Volume	Prototyping	Prototyping, small batch (1-1k)	Small batch, Medium batch (10-10k)	Small batch, medium batch (10-10k)
Material Compliancy	PDMS, photoresists	Photopolymer resins & thermoplastics e.g. PLA, ABS, PP	Photopolymers on glass, silicon, polymers and flexible substrates like PET, PC, PS etc.	Thermoplastic polymers (such as COP/COC, PMMA, PC, etc.)
Precision & Feature Size	High; micrometers	Moderate; tens of micrometers	Very-/ High; micrometers to sub-micrometers	Very high, micrometers to sub-micrometers
Cycle Time	24 h	Varies widely	seconds to minutes	1 min - 1 h
Product Cost	High for low volume; cost increases with scale	Low for prototyping, higher for production	Medium	Medium for prototypes and small batches, higer for series production
Surface Quality	Smooth, can vary with master mold	Can be rough, post-processing often needed	Very smooth	Very smooth (depending on mould/stamp)
Reproducibility	High, dependent on master mold quality	Moderate; can be influenced by printer resolution	High	High
Lead Time	Short, DIY	Short for prototypes; longer for production due to printing time	Short	Moderate; depents on mould/stamp manufacture

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Manufacturing Methode	Injection Molding	Roll-to-Roll EC	Roll-to-Roll UV-NIL
Production Volume	Medium batch, high batch (1k - 100 mio)	High batch (100k - 100 mio)	High batch (100k - 100 mio)
Material Compliancy	Thermoplastics like COP/COC, PP, PS, PMMA, PET, PC	Thermoplastic polymer films like PS, COP/COC, PMMA, PC, PET	Photopolymers on flexible substrates like PET, PC, PS, etc.
Precision & Feature Size	High; micrometers to sub-micrometers	High; micrometers to sub-micrometers	High; micrometers to sub-micrometers
Cycle Time	10sec - 2 min	Very short	Very short
Cost Effectiveness	High initial cost, but very low per-part cost	Very cost effective at scale or special offer	Very cost effective at scale or special offer
Surface Quality	Very smooth, dependent on mold	Consistent, can vary with substrate and process	Consistent, can vary with substrate and process
Reproducibility	Very high with proper mold design & process optimization	High, with continuous process optimization	High, with continuous process optimization
Lead Time	Long initial (mold design), very short thereafter	Long initial setup, very short thereafter	Long initial setup, very short thereafter

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Manufacturing Methode	Micro Milling	Wet Etching	Laser Ablation
Production Volume	Prototyping, small batch (1-5k)	Small to medium batch	Small to medium batch
Material Compliancy	Metals, polymers, ceramics	Glass, silicon, quartz	Glass, metals, polymers, ceramics
Precision & Feature Size	Moderate to high; tens of micrometers	High; nanometers to micrometers	High; sub-micrometers to micrometers
Cycle Time	varies widely depenting on size and feature size (resolution)	Long	Medium to long
Cost Effectiveness	moderate for prototyping, less for production	Moderate; less for bulk processing	Moderate; no mold required but operational cost can be high
Surface Quality	Can be rough, often requires post-processing	Smooth, isotropic or anisotropic depending on etching process	Smooth to rough, depending on material and laser parameters
Reproducibility	Moderate; depends on tool wear and precision	High, with controlled process conditions	High, with precise control of laser parameters
Lead Time	Moderate; quick for prototypes but longer for production setup	Moderate; extensive process development time	Short for prototyping, longer for scaling up due to sequential process