

## Microfabrication of Polymer for Microfluidics

Solidification Process	Material	Master	Reference
UV polymerization	Polyurethane-methacrylate	PDMS mold from etched silicon	Kuo, J. S., et al., "Microfabricating High-Aspect-Ratio Structures in Polyurethane-Methacrylate (PUMA) Disposable Microfluidic Devices," <i>Lab on a Chip</i> , Vol. 9, 2009, pp. 1951–1956.
UV polymerization	Perfluoropolyether	Photomask upon glass	Willis, P. A., et al., "Monolithic Photolithographically Patterned Fluorocur PFPE Membrane Valves and Pumps for In Situ Planetary Exploration," <i>Lab on a Chip</i> , Vol. 8, No. 8, 2008, pp. 1024–1026.
UV polymerization	Hydrogel	PDMS/glass cartridge	Beebe, D. J., et al., "Functional Hydrogel Structures for Autonomous Flow Control Inside Microfluidic Channels," <i>Nature</i> , Vol. 404, No. 6778, 2000, pp. 588–590.
UV laser irradiation	SU-8	(direct-write)	Yu, H., et al., "Building Embedded Microchannels Using a Single Layered SU-8, and Determining Young's Modulus Using a Laser Acoustic Technique," <i>Journal of Micromechanics and Microengineering</i> , Vol. 14, No. 11, 2004, pp. 1576–1584.
Proton beam irradiation	SU-8	(direct-write)	Tay, F. E. H., et al., "Novel Micro-Machining Method for the Fabrication of Thick-Film SU-8 Embedded Micro-Channels," <i>Journal of Micromechanics and Microengineering</i> , Vol. 11, No. 1, 2001, pp. 27–32.
E-beam irradiation	SU-8	(direct-write)	Koller, D. M., et al., "Three-Dimensional SU-8 Sub-Micrometer Structuring by Electron Beam Lithography," <i>Microelectronic Engineering</i> , Vol. 85, No. 7, 2008, pp. 1639–1641.
Casting	PDMS	Reflow photoresist	Kim, Y. C., et al., "Microfluidic Biomechanical Device for Compressive Cell Stimulation and Lysis," <i>Sensors and Actuators B: Chemical</i> , Vol. 128, No. 1, 2007, pp. 108–116.
Casting	PDMS	Photopatterned SU-8	Natarajan, S., D. A. Chang-Yen, and B. K. Gale, "Large-Area, High-Aspect-Ratio SU-8 Molds for the Fabrication of PDMS Microfluidic Devices," <i>Journal of Micromechanics and Microengineering</i> , Vol. 18, No. 4, 2008, p. 045021.
Casting	PDMS	Evaporated Ti patterned by lift-off	Rust, M. J., S. Subramaniam, and C. H. Ahn, "Fabrication of Nanochannels with Microfluidic Interface Using PDMS Casting on Ti/Si Nanomold," <i>Nanotech 2005 Technical Proceedings</i> , 2005.
Casting	PDMS	Photopatterned SU-8 on Si	Zhu, Z., X. Wei, and K. Jiang, "A Net-Shape Fabrication Process of Alumina Micro-Components Using a Soft Lithography Technique," <i>Journal of Micromechanics and Microengineering</i> , Vol. 17, No. 2, 2007, pp. 193–198.
Replica molding + sintering	Aluminum oxide	PDMS	Armani, D. K., and C. Liu, "Microfabrication Technology for Polycaprolactone, a Biodegradable Polymer," <i>Journal of Micromechanics and Microengineering</i> , Vol. 10, No. 1, 2000, pp. 80–84.
Reflow molding	Polycaprolactone	Etched silicon	McCormick, R. M., et al., "Microchannel Electrophoretic Separations of DNA in Injection-Molded Plastic Substrates," <i>Analytical Chemistry</i> , Vol. 69, No. 14, 1997, pp. 2626–2630.
Injection molding	PMMA	Electroformed nickel from SU-8 mold	Chien, R. -D., "Micromolding of Biochip Devices Designed with Microchannels," <i>Sensors and Actuators A: Physical</i> , Vol. 128, No. 2, 2006, pp. 238–247.
Injection molding	PMMA	Electroformed nickel from SU-8 mold	Lippmann, J. M., E. J. Geiger, and A. P. Pisano, "Polymer Investment Molding: Method for Fabricating Hollow, Microscale Parts," <i>Sensors and Actuators A: Physical</i> , Vol. 134, No. 1, 2007, pp. 2–10.
Injection molding	COC	Etched silicon and sacrificial Al wire	Lucas, N., et al., "An Improved Method for Double-Sided Moulding of PDMS," <i>Journal of Micromechanics and Microengineering</i> , Vol. 18, No. 7, 2008, p. 075037.
Compression molding	PDMS	Photopatterned SU-8	Fredrickson, C. K., et al., "Effects of Fabrication Process Parameters on the Properties of Cyclic Olefin Copolymer Microfluidic Devices," <i>Journal of Microelectromechanical Systems</i> , Vol. 15, No. 5, 2006, pp. 1060–1068.
Compression molding	COC	Electroformed metal from Si master	Yeo, L. P., et al., "Micro-Fabrication of Polymeric Devices Using Hot Roller Embossing," <i>Microelectronic Engineering</i> , Vol. 86, No. 4-6, 2009, pp. 933–936.
Hot embossing	PMMA	Electroplated nickel roller	Stoyanov, I., et al., "Microfluidic Devices with Integrated Active Valves Based on Thermoplastic Elastomers," <i>Microelectronic Engineering</i> , Vol. 83, No. 4-9, 2006, pp. 1681–1683.
Hot embossing	Polyurethane	Machined brass	Chien, R. -D., "Micromolding of Biochip Devices Designed with Microchannels," <i>Sensors and Actuators A: Physical</i> , Vol. 128, No. 2, 2006, pp. 238–247.
Hot embossing	PMMA	Electroformed nickel from SU-8 mold	Juang, Y. -J., L. L. James, and K. W. Koelling, "Hot Embossing in Microfabrication. Part I: Experimental," <i>Polymer Engineering and Science</i> , Vol. 42, No. 3, 2002, pp. 539–550.
Hot embossing	Polycarbonate, polyvinyl butyral	Machined steel	Hansen, M., et al., "A Nanoimprinted Polymer Lab-on-a-Chip with Integrated Optics," <i>SPIE: The International Society for Optical Engineering</i> , Vol. 5872, 2005.
Nanoimprint lithography	COC	RIE silicon	Esch, M. B., et al., "Influence of Master Fabrication Techniques on the Characteristics of Embossed Microfluidic Channels," <i>Lab on a Chip</i> , Vol. 3, No. 2, 2003, pp. 121–127.
Nanoimprint lithography	COC	RIE silicon or photopatterned SU-8	Chou, S. Y., P. R. Krauss, and P. J. Renstrom, "Nanoimprint Lithography," <i>Journal of Vacuum Science &amp; Technology B: Microelectronics and Nanometer Structures</i> , Vol. 14, No. 6, 1996, pp. 4129–4133.
Nanoimprint lithography	PMMA	Silicon dioxide on Si	Dreuth, H., and C. Heiden, "Thermoplastic Structuring of Thin Polymer Films," <i>Sensors and Actuators, A: Physical</i> , Vol. 78, No. 2, 1999, pp. 198–204.
Thermoforming	PET	PVD metal or machined metal	Truckenmuller, R., et al., "Low-Cost Thermoforming of Micro Fluidic Analysis Chips," <i>Journal of Micromechanics and Microengineering</i> , Vol. 12, No. 4, 2002, pp. 375–379.
Thermoforming	Polystyrene	Machined brass	Chen, C. -S., et al., "Shrinky-Dink Microfluidics: 3D Polystyrene Chips," <i>Lab on a Chip</i> , Vol. 8, No. 4, pp. 622–624.
Thermoplastic shrinkage	Polystyrene	Mechanical scribing	Leech, P. W., "Hot Embossing of Cyclic Olefin Copolymers," <i>Journal of Micromechanics and Microengineering</i> , Vol. 19, No. 5, 2009, p. 055008.