

Materials List for:

A Microfluidic Platform for Precision Small-volume Sample Processing and Its Use to Size Separate Biological Particles with an Acoustic Microdevice

Erika J. Fong^{1,2}, Chao Huang¹, Julie Hamilton¹, William J. Benett¹, Mihail Bora¹, Alison Burklund¹, Thomas R. Metz¹, Maxim Shusteff¹

¹Materials Engineering Division, Lawrence Livermore National Laboratory

²Department of Biomedical Engineering, Boston University

Correspondence to: Maxim Shusteff at shusteff1@llnl.gov

URL: <https://www.jove.com/video/53051>

DOI: [doi:10.3791/53051](https://doi.org/10.3791/53051)

Materials

Name	Company	Catalog Number	Comments
Materials required for Steps 1-3: Device Design, Fabrication and Assembly			
Double Sided Polished Silicon Wafer	Silicon Quest International, Inc. San Jose, CA, USA	100 mm <100> prime wafer	1-20 ohm-cm, 495 ± 25 µm Double-side polished
Glass Wafer	Bullen Ultrasonics, Eaton, OH, USA	100 mmx0.5 mm Boro	
Photoresist, AZ 1518	MicroChemicals GmbH, Ulm, Germany	AZ 1518	Photoresist used to adhere wafer to blank wafer for DRIE etching
Photoresist, AZ 4620	MicroChemicals GmbH, Ulm, Germany	AZ 4620	Photoresist to define fluidic and via mask patterns
DRIE plasma etcher	STPS, Newport, NP, United Kingdom	Multiplex Advance Oxide Etch (AOE) ICP system	
Wafer Bonder	Electronic Visions Group, St. Florian am Inn, Austria	EVG 501	
Dicing saw	Kulicke & Soffa Industries, Singapore	K&S 982	
Epoxy kit	Epoxy Technology, Billerica, MA, USA	EPO-TEK 301	Epoxy used to couple piezo and microfluidic chip
PZT piezoceramic	Piezo Systems, Woburn, MA, USA	PSI-5A4E	37.5 × 10 × 0.5 mm
28 AWG Kynar-insulated solid wire	Squires Electronics, Cornelius, OR, USA	UL1422	
2-part silver epoxy	MG Chemicals, Surrey, BC, Canada	8331	Conductive adhesive for attaching wire leads to PZT
L-edit	Tanner EDA, Monrovia, CA, USA	Ledit v15.1 64-bit	CAD software for mask layout
Materials required for Step 4: Characterization of Acoustic Focusing Performance			
Dual Pump	Harvard Apparatus, Holliston, MA, USA	PHD ULTRA Series, 703007	
5 ml syringes	Becton-Dickinson, Franklin Lakes, NJ, USA	309646	
Luer to Threaded port adapter	IDEX, Oak Harbor, WA, USA	P-659	Connects syringe to tubing
Union	IDEX, Oak Harbor, WA, USA	P-623	Connects world to chip connections to fluoropolymer tubing. Can also use webbed
Ferrule 1/4-28 flat bottom	IDEX, Oak Harbor, WA, USA	P-200	Used with nut to make connections between tubing and syringe, flow sensors and world to chip hardware
Nut 1/4-28 flat bottom	IDEX, Oak Harbor, WA, USA	P-202	Used with ferrule to make connections between tubing and syringe, flow sensors and world to chip hardware

1/16" OD Fluoropolymer tubing	IDEX, Oak Harbor, WA, USA	1912L	Tubing to connect syringe pumps to world to chip connections. Tubing size is not critical during clibration steps (.01-.03" ID typically used, other suitable part numbers: 1907L, 1902L).
Small ID fluoropolymer tubing	IDEX, Oak Harbor, WA, USA	1476-20	Used for Flow restrictors: 0.006" ID, 1/16" OD FEP
PEEK tubing			Connects from chip to fluoropolymer tubing.
Cooling fan	Multicomp, Leeds, England	MC19663	
Function Generator	Agilent, Santa Clara, CA, USA	33220A	
RF amplifier	ENI, Rochester, NY	325 LA	Must be able to amplify signals from <1 V in the range of 1-2 MHz to 25 V _{pp} to the piezo.
CCD Camera	Photometrics, Tucson, AZ, USA	CoolSnap HQ	
Inverted Microscope	Zeiss, Oberkochen, Germany	Axiovert S100	
FITC filter set	Chroma Tech, VT, USA	SP101	
Objective, 10X	Zeiss, Oberkochen, Germany	ACHROPLAN	
Oscilloscope	Tektronix, Beaverton, OR, USA	TDS3014B	To monitor voltage output by RF amplifier
MatLab	Mathworks, Natick, MA, USA	R2014a	
Driver interface software to integrate Photometrics camera with LabVIEW	R Cubed Software, Lawrenceville, NJ, USA	SITK	
Tween 20	Sigma Aldrich, St. Lousi, MO, USA	P9416	
Dragon Green Fluorescent 5.76 or 7.32 μm Beads	Bangs Laboratory, IN, USA	FS06F	
Additional materials required for Step 5: Automated Separation			
Multiport valves	VICI, Houston, TX, USA	C25Z-3180EUHA	In the current configuration 4 valves are needed
Flow Sensors	Sensirion, Westlake Village, CA, USA	SLI-1000	
Fluoropolymer tubing, .01 and .03" ID	IDEX, Oak Harbor, WA, USA	1902L and 1912L	High purity PFA preferred
Nut	VICI, Houston, TX, USA	ZN1PK-10	Used with ferrule to make connections between tubing and valves. Alternative part numbers: MZN1PK-10, LZN1PK-10
Ferrule	VICI, Houston, TX, USA	ZGF1PK-10	Used with nut to make connections between tubing and valves.
LabVIEW	National Instruments, Austin, TX, USA	LabVIEW Professional Development system	Laboratory Automation Software
PBS	Teknova, Hollister, CA, USA	P0200	
Raji Cells	ATTC, Manassas, VA, USA	CCL86	
Boa Cells			Kindly provided by the DeRisi Laboratory at UCSF
GGV			Kindly provided by the DeRisi Laboratory at UCSF
DENV			Kindly provided by Jose Pena at LLNL
Coulter Counter Z2	Beckman Coulter, Brea, CA, USA	Z2	
Hemacytometer	Fisher Scientific, Waltman, MA, USA	0267151B	