Electronic Supplementary Material (ESI) for Lab on a Chip.

Supplementary Information for

Cascaded filter deterministic lateral displacement microchips for isolation and molecular analysis of circulating tumor cells and fusion cells

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S1. Measurement of critical separation size in deterministic lateral displacement (DLD) structures.

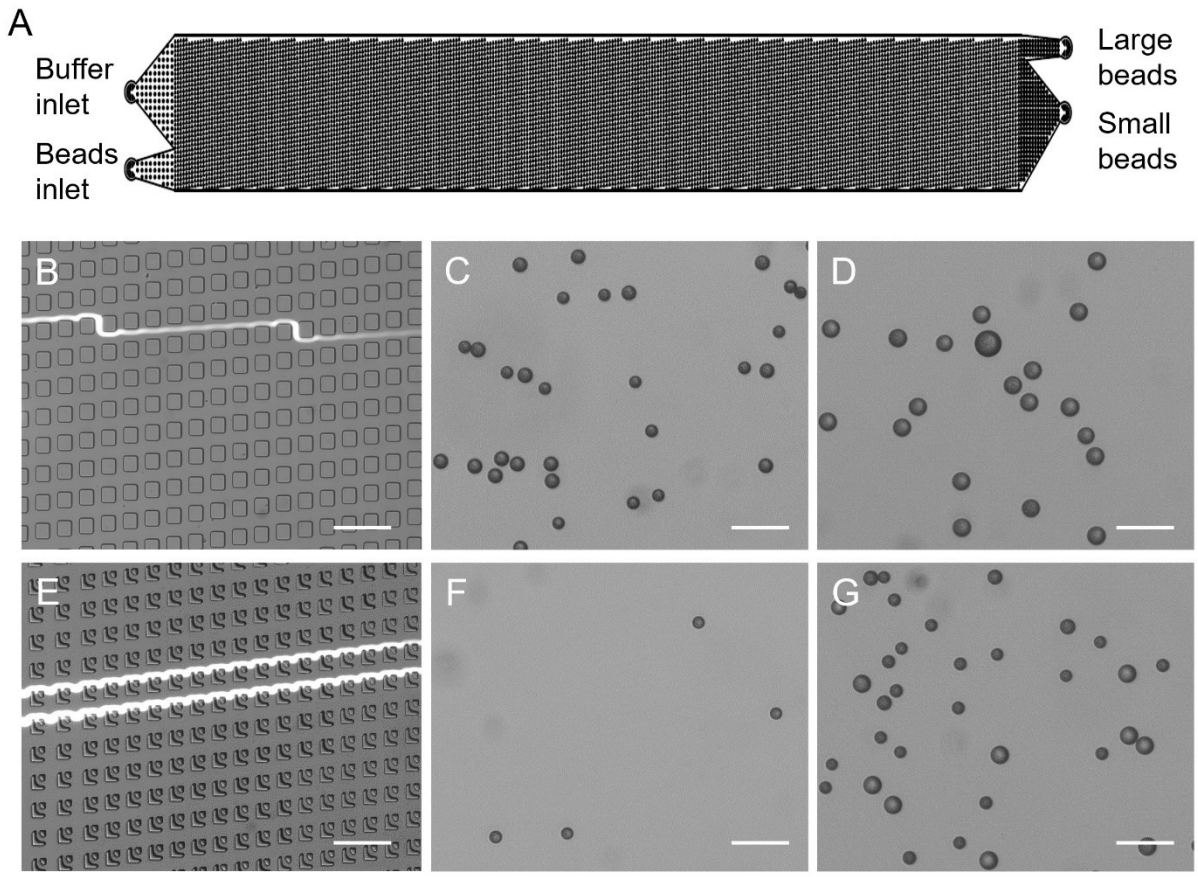

Fig. S1. The performance of microbeads separation in rectangular micro-post chip and filter-DLD chip. (A) Schematic chip design with two inlets and two outlets. (B) Zigzag mode movement of 12 µm fluorescent microbeads in the rectangular micro-post chip. Scale bar, 150 µm. (C-D) Images of collected small beads (C) and large beads (D) from the two outlets of the rectangular micro-post chip. The diameter range of input beads is from 9 µm to 18 µm. Scale bar, 50 µm. (E) Bumping mode movement of 12 µm fluorescent microbeads in the filter-DLD chip. Scale bar, 150 µm. (F-G) Images of collected small beads (F) and large beads (G) from the two outlets of the filter-DLD chip. The diameter range of input beads is from 9 µm to 18 µm. Scale bar, 50 µm. From the collected microbeads, the critical sizes (D_c) of filter-DLD and rectangular micro-post DLD were estimated to be around 10 µm and 15 µm, respectively.

S2. Schematic chip designs of deterministic lateral displacement (DLD) structures.

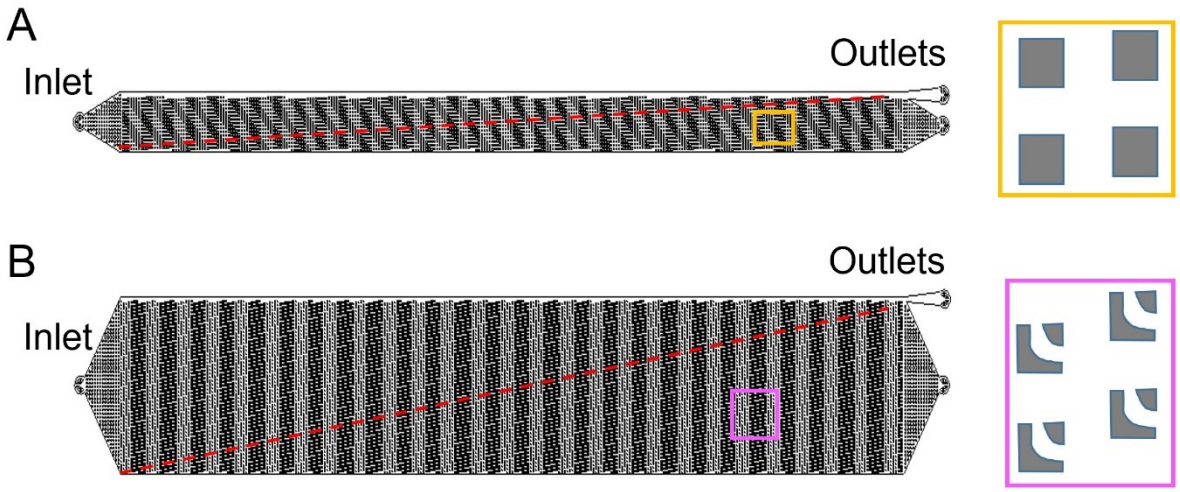

Fig. S2. Schematic chip designs of deterministic lateral displacement (DLD) structures. (A) Rectangular micro-post DLD design, (B) Filter-DLD design. The two structures have the same micro-post side length, gap width, and critical separation size (D_c). Red dotted lines indicate inclination angles of micro-posts.

S3. Evaluation of white blood cells removal rate.

Healthy blood samples	Count of retained WBCs from CTCs outlet (WBCs number in 1 mL blood)
#1	47 WBCs/mL
#2	79 WBCs/mL
#3	134 WBCs/mL
#4	213 WBCs/mL
#5	232 WBCs/mL

Table S1. Count of recovered white blood cells (WBCs) in healthy blood samples.

S4. Evaluation of CTCs from NSCLC patient samples.

Characteristic	Evaluable patients, n=35	CTC prevalence in 91 blood samples		
		CTCs=0, n(%)	1≦CTCs<5, n(%)	CTCs≧5, n(%)
Age, years				
Average	61	N/A	N/A	N/A
Range	27-89	N/A	N/A	N/A
Gender				
Male	15	N/A	N/A	N/A
Female	20	N/A	N/A	N/A
Tumor histology				
AC	23	11(18%)	15(24%)	36(58%)
SCC	12	1(3%)	13(45%)	15(52%)
Disease status				
SD	N/A	12(23%)	24(45%)	17(32%)
PD	N/A	1(3%)	3(8%)	34(89%)

Abbreviations: NSCLC, non-small-cell lung cancer; AC, adenocarcinoma; SCC, squamous cell carcinoma; SD, stable disease; PD, progressive disease; N/A, not applicable.

Table S2. Demographics of 35 stage IV NSCLC patients and CTCs prevalence in 91 blood samples.

Details of Supplementary Videos

Movie S1. Passage of blood cells through filter deterministic lateral displacement structures.

Movie S2. Passage of a 12 μm microbead in filter-DLD and rectangular micro-post DLD structures.

Movie S3. Passage of cells with different sizes in filter-DLD and rectangular micro-post DLD structures.