Electronic Supplementary Information

Ultra-High-Aspect-Orthogonal and Tunable Three Dimensional Polymeric Nanochannel Stack Array for BioMEMS Applications

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Visual verification of connection of PNSA structure. A PNSA was fabricated and a fluores cent dye, FSS (Fluorescein Sodium Salt), was filled in the structure. On the inverted microsco pe, the connection was visually confirmed by moving the microscope stage as shown in Figur e S1 (See supporting video). While the stage was traveling 1.5 cm, the fluorescent signal fro m PNSA (O(100) nm opening) was continuously observed without any disconnection, confir ming the connection of 10^4~10^5 aspect ratio nanochannel. The size of nanochannel was sough t to be larger since the fluorescent signal diffused into the PDMS bulk.

Electrical verification of connection of PNSA structure. If the PNSA was disconnected in t he middle, the ionic current level should be zero or much less than a calculation. As shown in Figure S2, the ionic currents with 100 mM KCl through PNSA of 1cm and 3 cm were plotted. It showed that the conductivity was inversely proportional to the length of PNSA. In such cas

e, the total cross-sectional area of PNSA was ~200 μm^2 (~1 μm^2 X 200 where "200" is the nu mber of connected triangular nanochannels in PNSA). We measured the ionic current through a microchannel (the cross-sectional area was 15 μm X 100 μm = 1,500 μm^2 with the same len gth of PNSA and 100 mM KCl) as ~800 nA at 3 V. While the ionic current through PNSA of 1 cm length should be ~106 nA by the simple comparison of cross-sectional area, we obtaine d the value as ~90 nA experimentally. Those calculated and experimental current values coul d be regarded as approximately the same, considering the small variation of the cross-section al area of PNSA and the experimental measurement error. These two experiments clearly de monstrated that the channel structure connected all along the entire length of PNSA.

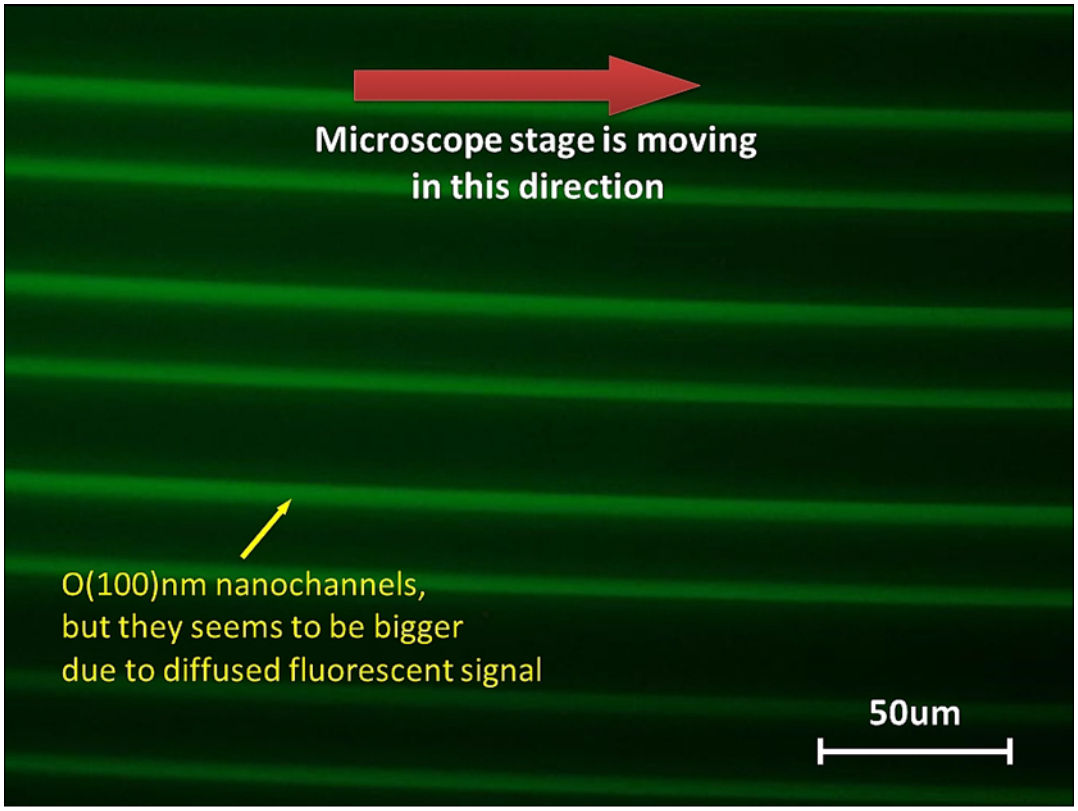
Microscope stage is moving
in this direction
O(100)nm nanochannels,
but they seems to be bigger
due to diffused fluorescent signal
50um

Figure S1

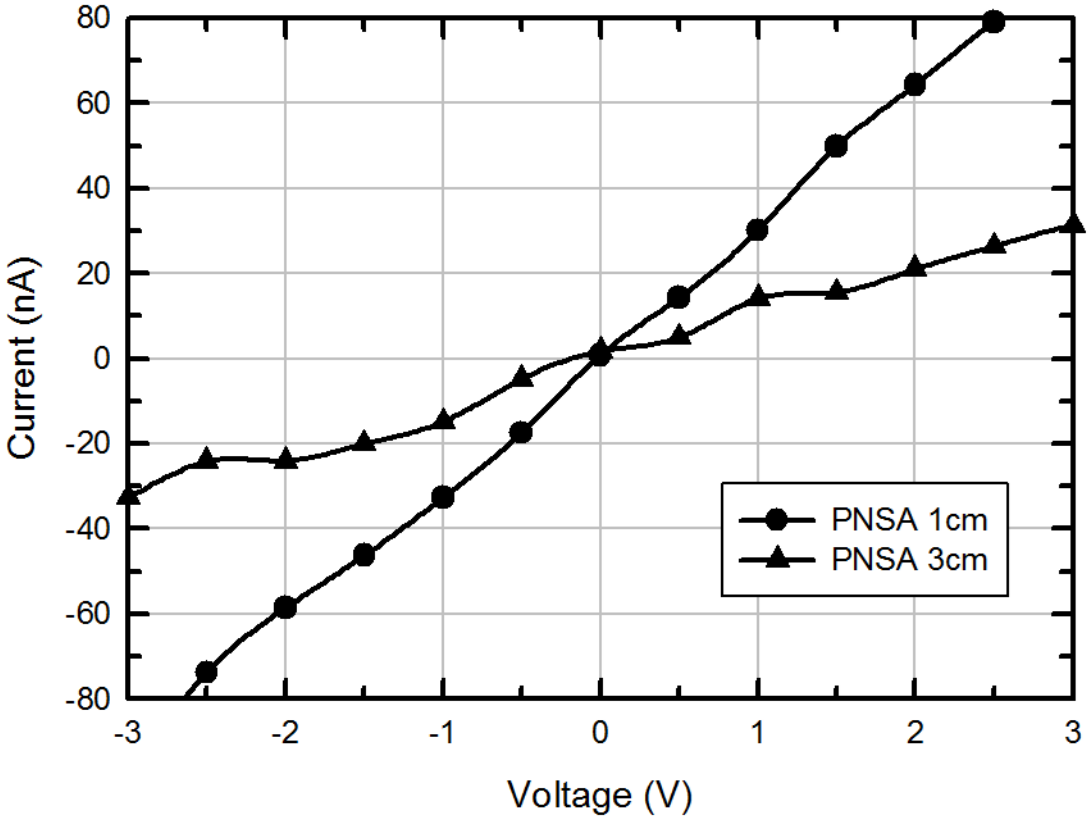
Current (nA)
Voltage (V)
PNSA 1cm
PNSA 3cm
80
60
40
20
0
-20
-40
-60
-80
-3
-2
-1
0
1
2
3

Figure S2