ID: 446 Fabrication of Micropillar Sheet for Cell Culture Dish

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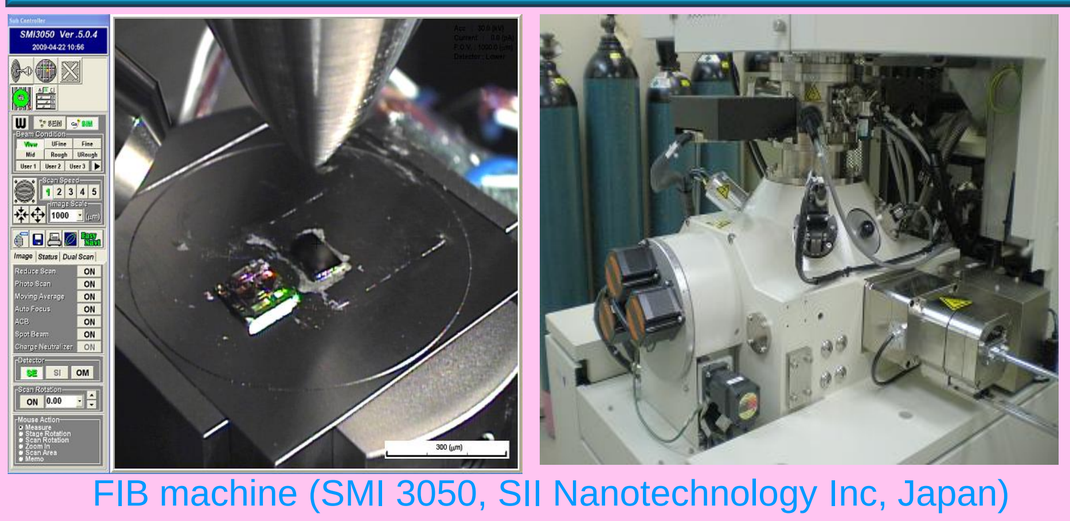
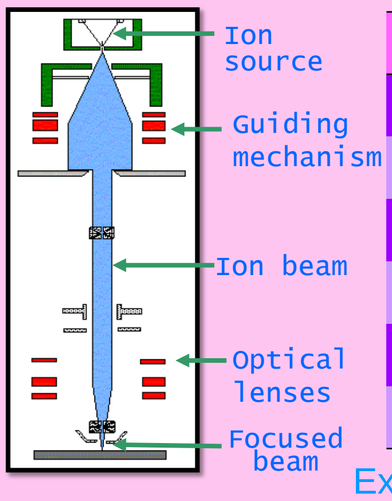
RESEARCH BACKGROUND

Cell culture is one of the major tools in life sciences. Conventionally, cells are placed in a flat petri dish made of glass or plastic. It is used to monitor cells behavior under controlled conditions. As the cells are strongly adhered to petri dish, an additional process of trypsinization is applied to remove the cells from the dish. Alternatively, by using micropillar sheet, the contact surface between the cells and the pillars is smaller than traditional two dimensional petri dish. Cells were found to grow in a different way on the micropillars because of these differences in adherence to the support materials. The micropillars structure enables the cells to be removed without any additional process where the cultured cells can be collected simply by pipetting. However, it remains a challenge to fabricate high aspect ratio metallic or polymeric micropillar sheets of about 1 µm or less of the micropillar diameters. This research presents the fabrication process using focused ion beam (FIB) a maskless sputtering technique for the fabrication of micropillar sheet to be used in cell culture dish. Micropore sheet on metallic materials is also machined using FIB sputtering which can be used as a master microtool for the mass production of polymer micropillar sheets by micro/nano hot embossing. The typical diameter of the micropillars is 1 µm with 3-10 aspect ratio. This FIB based process is direct, easy to fabricate, and less expensive compared to LIGA (lithography, electroplating and molding) and lithography based techniques as reported.

METHODOLOGY

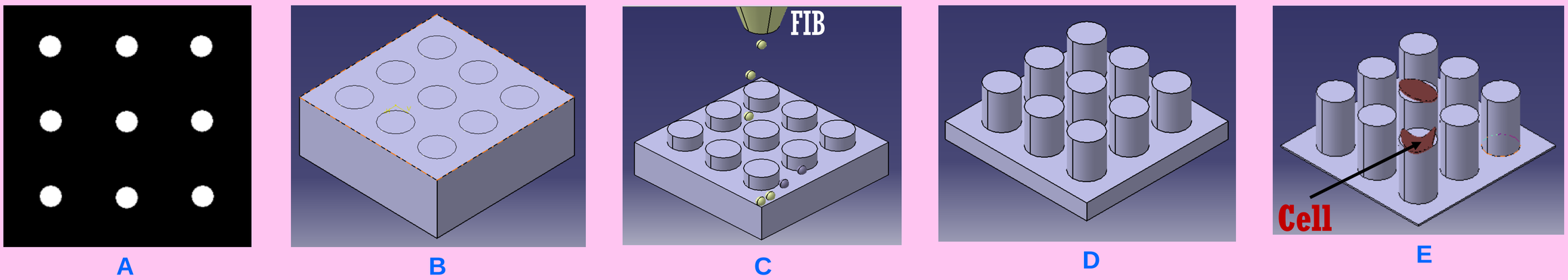


FIB machine (SMI 3050, SII Nanotechnology Inc, Japan)



Parameters	Values
Acceleration voltage (keV)	20
Dwell time (µs)	15
Depth (µm)	5
Ion source	Gallium
Working condition	Vacuum
Substrate material	Silicon wafer

Experimental conditions for micropillar array fabrications

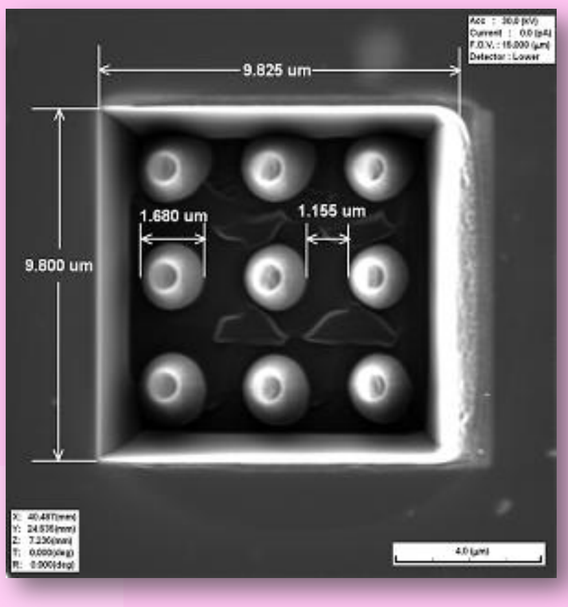


A B C D E

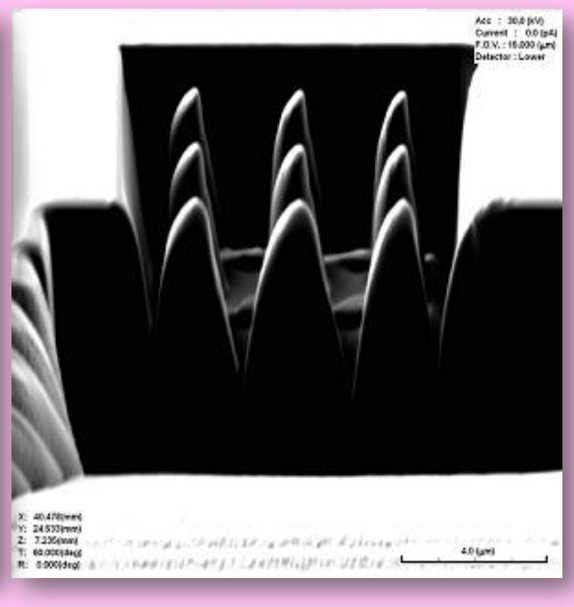
A : Micropillar profile in bitmap format
B : Silicon wafer substrate
C : FIB micromachining of silicon wafer layer by layer
D : Partially machined micropillar array
E : Cell cultured on micropillar sheet

Figure: Schematic and Not to Scale

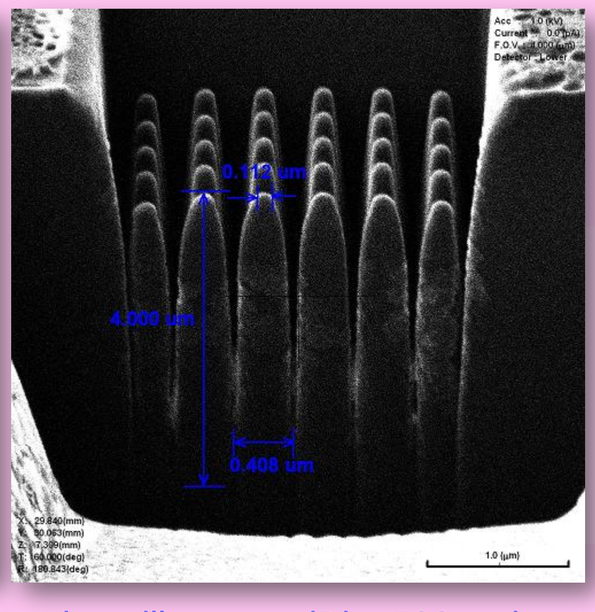
RESULTS



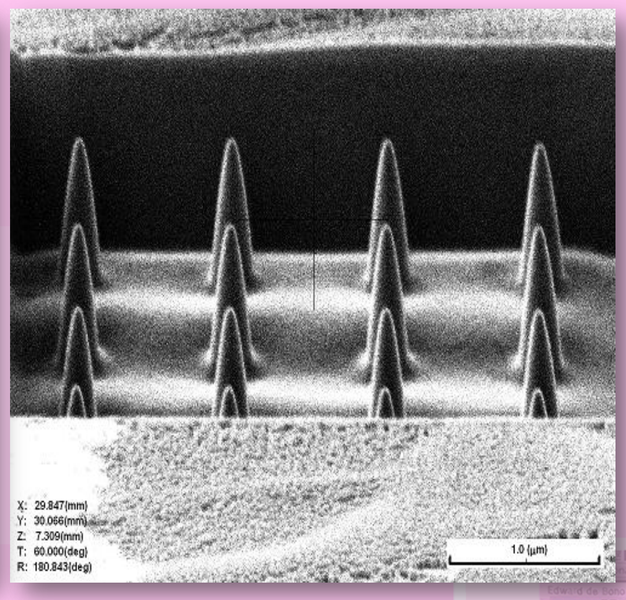
Top view of micropillar array



Micropillar array (Dia: 1700 nm)



Micropillar array (Dia: 500 nm)



Micropillar array (Dia: 300 nm)

CONCLUSIONS

- Micro/nano pillar arrays were fabricated successfully using FIB micromachining
- The range of diameter varies from 300 nm to 1700 nm with 3-10 of aspect ratio
- This FIB method is simpler , cheaper and superior compared to lithography based techniques
- Micro/nano pillar arrays are used in cell culture dish for easy and efficient culture of cells without trypsinization as used in traditional petri dish cell culture.

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