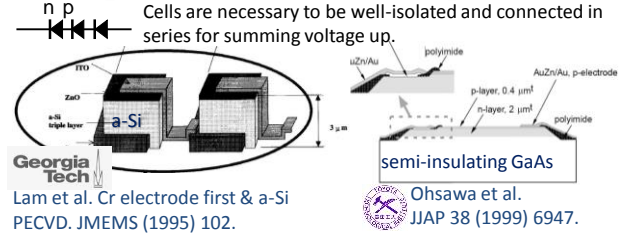


Micro-Power Source of Si Photo Cells Connected across Vertical Sidewalls for Light Receiving and High Voltage Generation

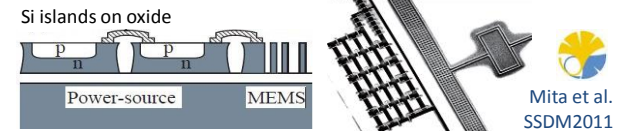


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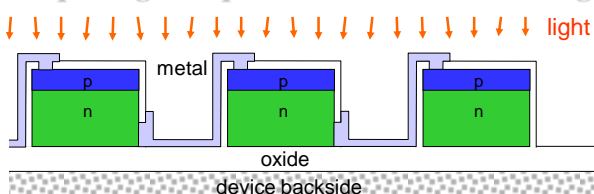
Micro-power sources based on photo cell



c-Si is rather difficult material for getting good isolation



Proposing c-Si photo cells with 3D wiring



If 3D metal wiring is possible at the last step of fabrication, high-temp. oxide isolation film can be used. SiO_2 film realizes good isolation and voltage summing.

Wiring using vertical sidewall will be the best design for minimizing shadow area.

Vertical side walls are still challenging



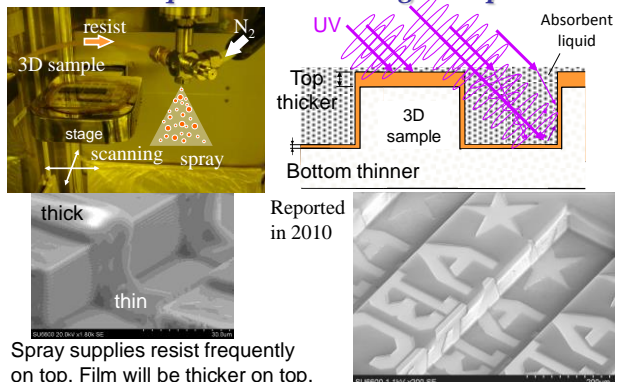
Vertical side walls



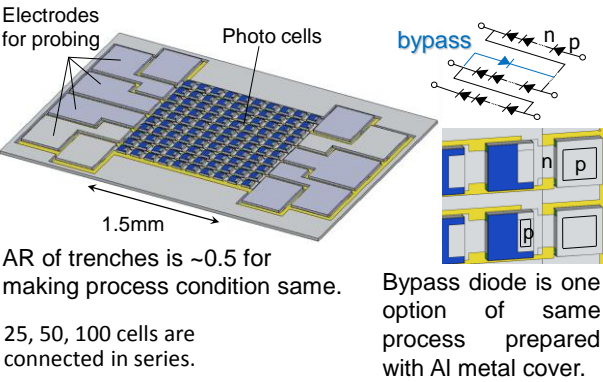
Aim

- Realizing micro-power source of c-Si photo cells connected in series with 3D wiring over vertical sidewall.
- Driving electrostatic micromirror using the realized micro-power source.

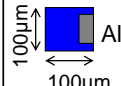
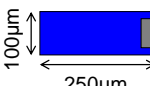
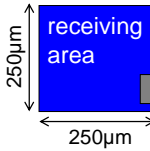
Processing for 3D wiring: resist spraying & absorbent liquid immersion angled exposure



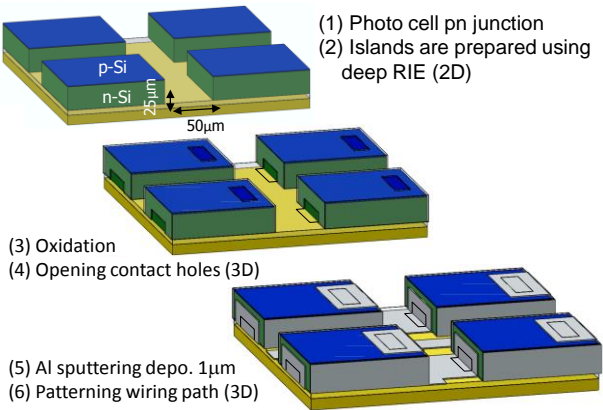
Design of photo cell array



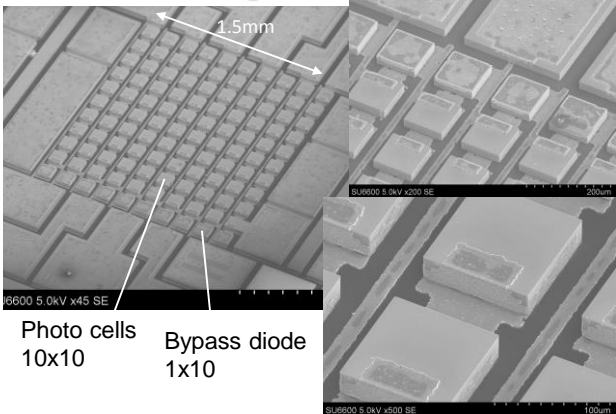
Design of individual photo cells

Design #	1	2	3
Cells in array	10x10	5x10	5x5
Cell size [μm^2]	 100um 100um	 100um 250um	 250um 250um
Al area [μm^2]	35x70		
Effective area [%]	75	90	96

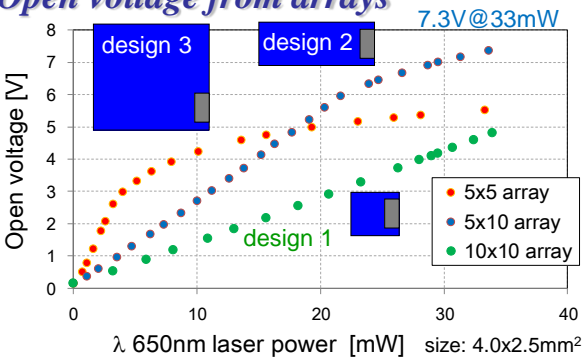
3D fabrication process



Fabricated 3D power source

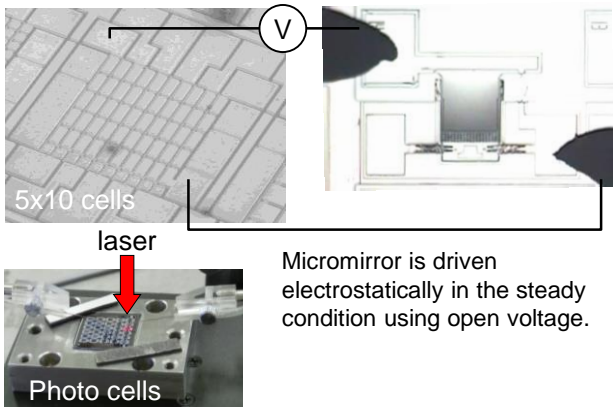


Open voltage from arrays

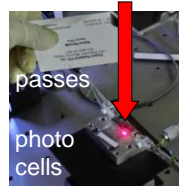
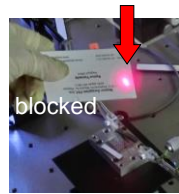
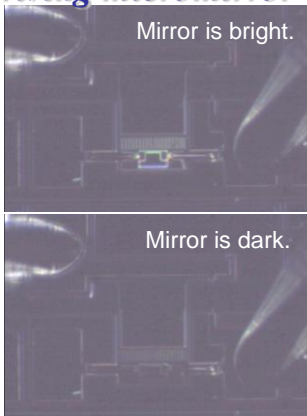


Larger effective area increases voltage with lower power. Number of cells is for increasing voltage after saturation.

Micro-power source for driving micromirror



Driving micromirror



V_{output} is set at 7.0V.

Conclusion

- Micro-power source based on crystalline Si photo cell islands is fabricated using thermally grown SiO_2 isolation film.
- 100, 50, and 25 cells are connected in series using 3D wiring over vertical side wall minimizing shadow area.
- Under red laser illumination, open voltage of 7.3V is confirmed from 50 cells.
- Electrostatic micromirror is driven applying the voltage obtained from micro-power source.