Nanometer ROYGBIV Reflector Displays

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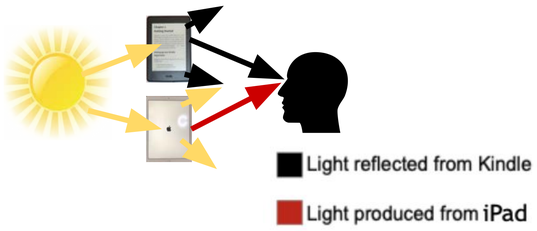
Background:

One major fallback of LCD screens is outdoor use in the sun. Even in the shade, a bright day makes it uncomfortable to use any phone or tablet. Kindle displays, however, do not have this problem and can be used in direct sunlight, without strain. These displays are only available in black and white, therefore we present a reflector display that emits color.



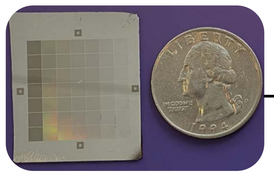
Introduction:

We present an array of actuators with nanometer precision that tune to a given wavelength of light.

Using:

- Surface Electrochemical actuators (SEAs)
- Platinum's flexibility
- 100 nm actuation gets us into visible light range

Creating:



A fabricated array of actuators

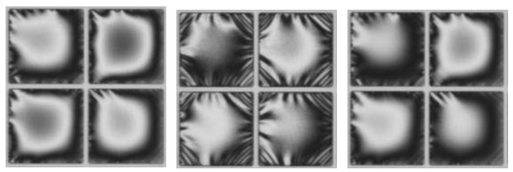
SEAs[1]:

- Small Size
- Low voltage
- Ideal for Microelectronics

Preliminary Research:

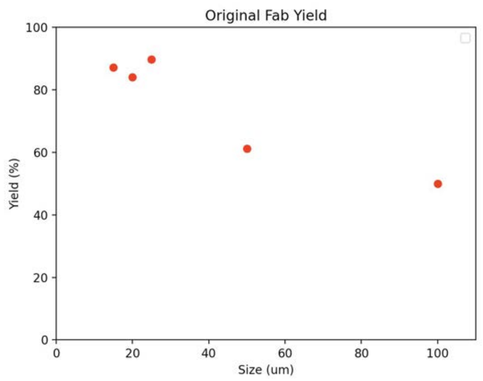
Voltage Probing:

When we apply a negative bias, in reference to solution, the platinum absorbs negative ions changing the surface stress causing bending.

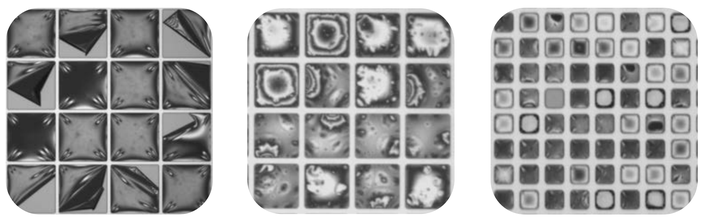


t = 0s t = 1s t = 3s

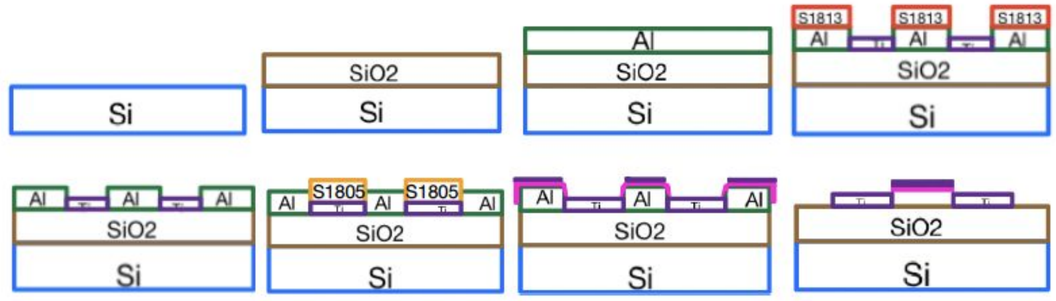
Interference fringes can infer shape



The original fabrication process produced pixel arrays that would rip during actuation producing inconsistent results.

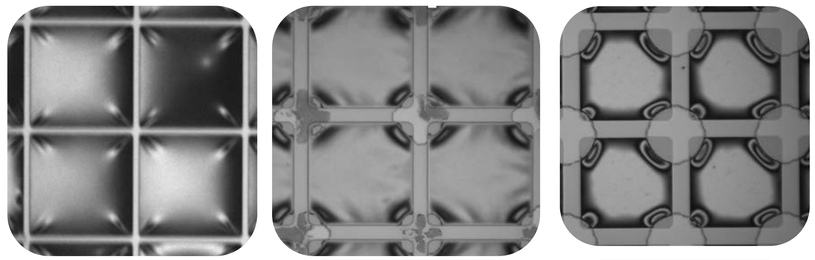


Fabrication:



The fabrication process has three main features: deposition, etching and liftoff. The end result is a layer of platinum above a gap, which can be controlled with voltage.

Pixel Redesign:



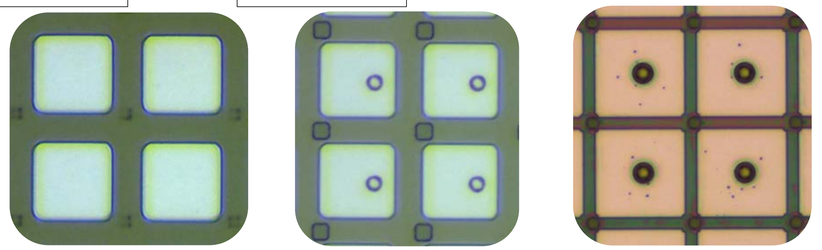
Original

Exposure: 95 mJ/cm^2

Exposure: 25 mJ/cm^2

To improve yield and reproducibility a design with corner cut-outs was made. In addition, lowering the exposure dosage enhanced features

A recipe change from photoresist S1805 to AZ3330 developed the center cut feature.



No features

No photoresist

Photoresist visible

Future Work: We will continue working on improving yield and reproducibility of the displays.

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Ref: [1]Miskin, M.Z., Cortese, A.J., Dorsey, K. *et al.* Electronically integrated, mass-manufactured, microscopic robots. *Nature* 584, 557–561 (2020). https://doi.org/10.1038/s41586-020-2626-9