

Meso Assembly



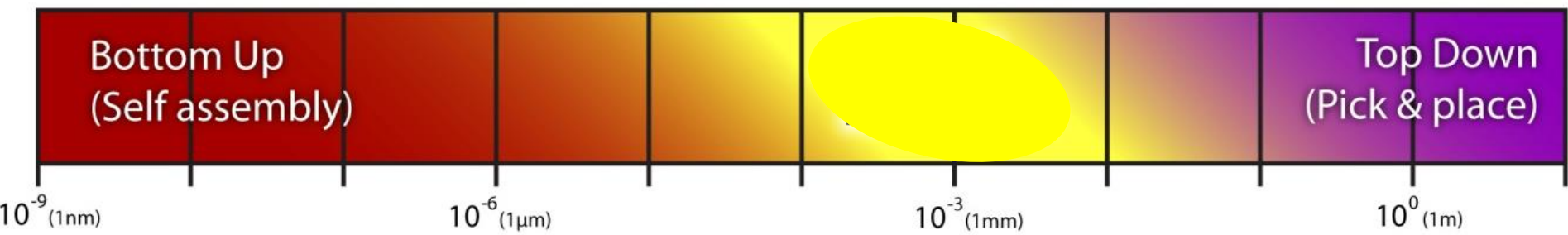
**Hod Lipson, Rob MacCurdy, Apoorva.
Jonathan Hiller, Cheryl Perich, Nick Cheney**
Cornell University



Cornell
University



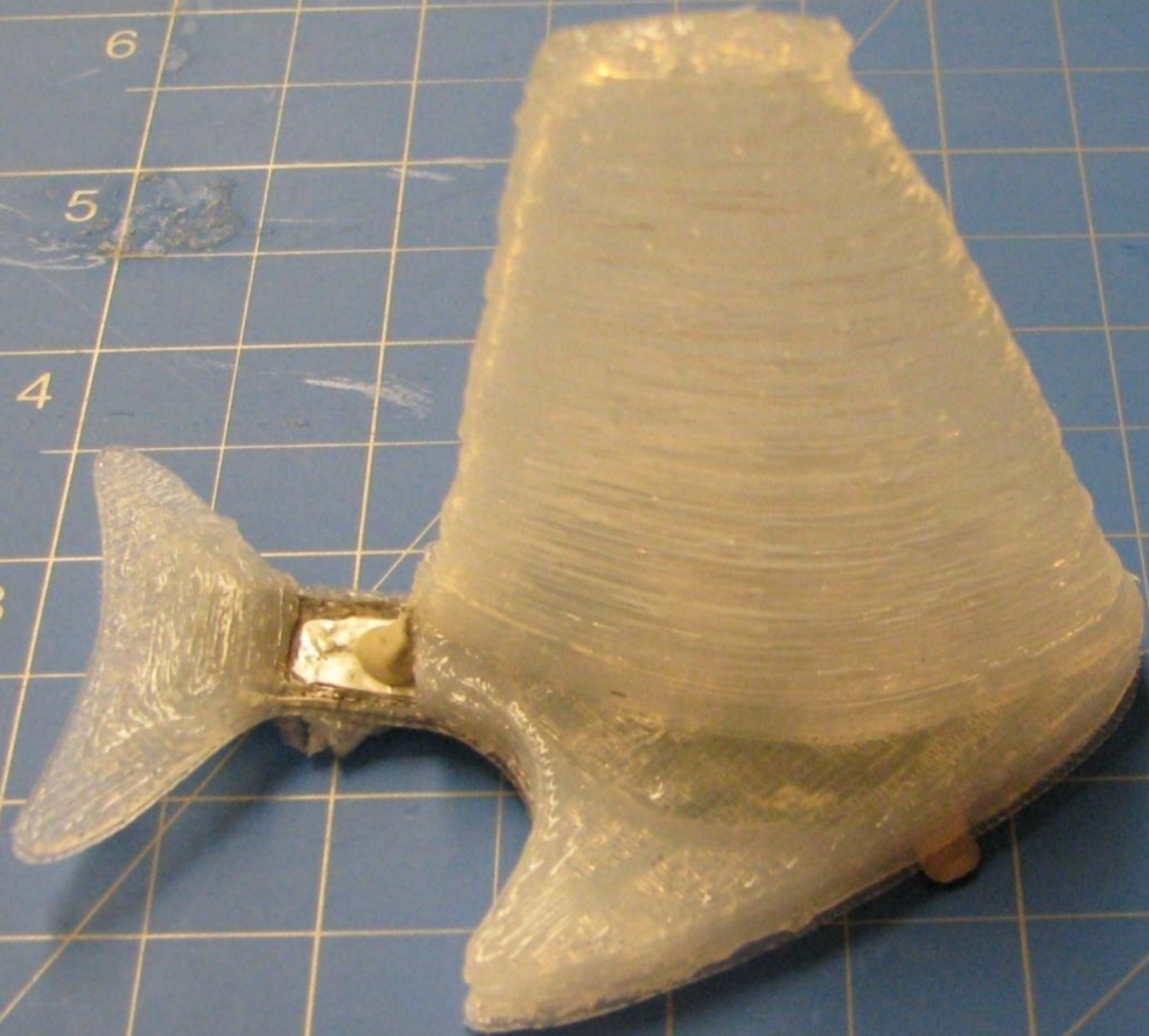
Creative
Machines



Printable Robots



Lipson & Pollack (1999)



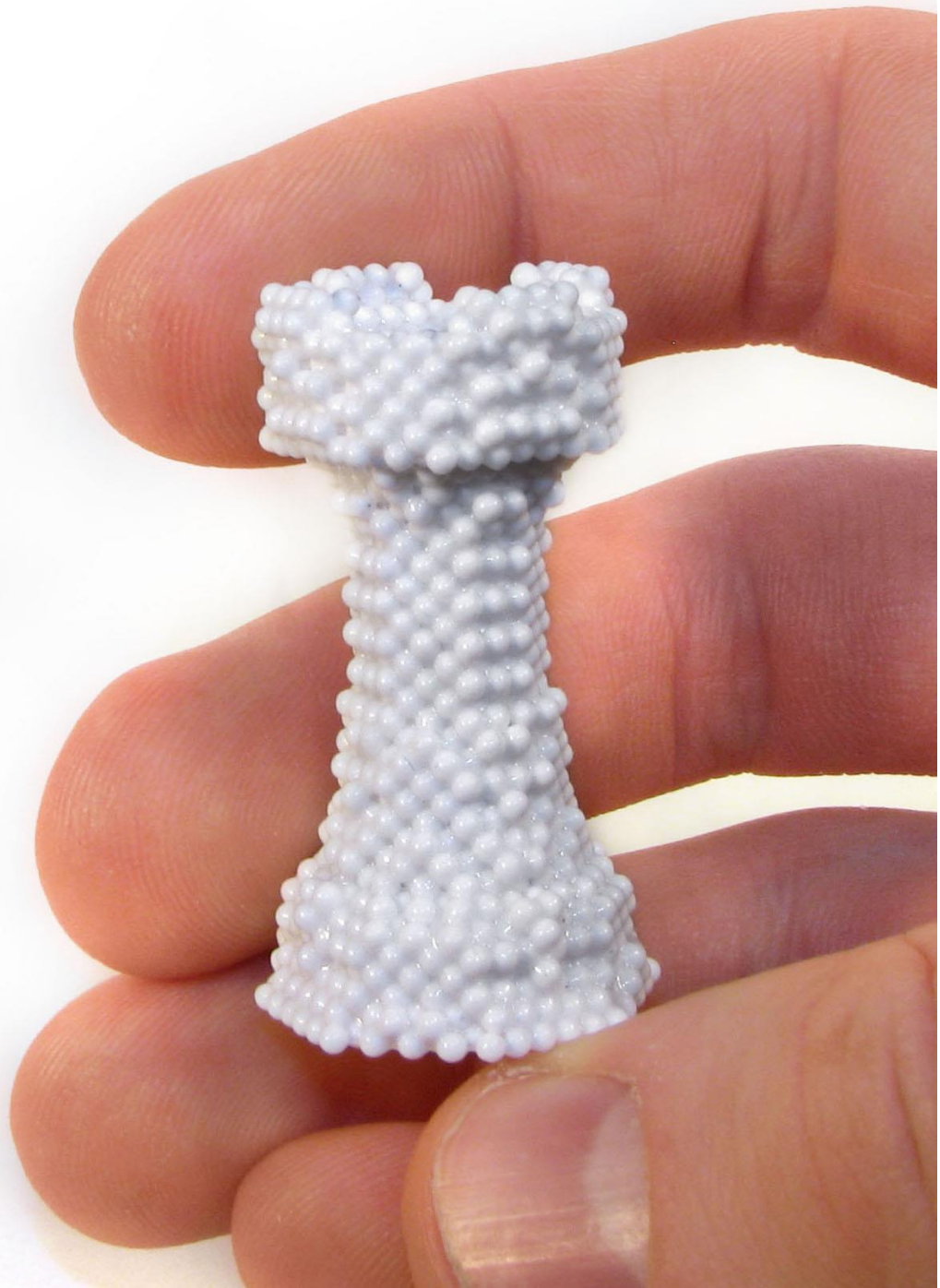
Evan Malone



Neil Gershenfeld (2005): Digital Materials

Physical voxels




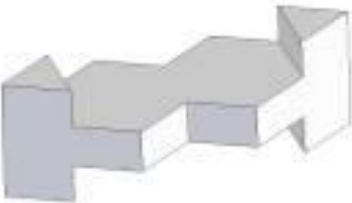
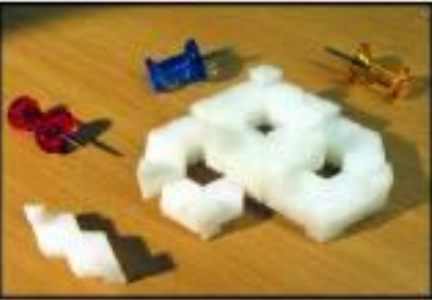

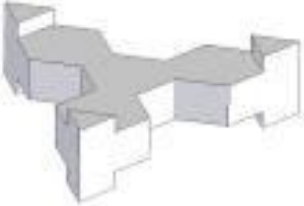


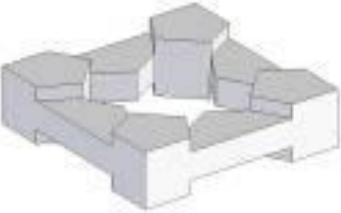


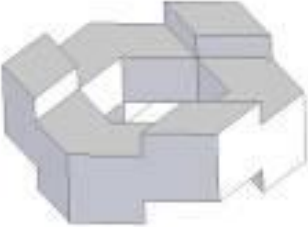



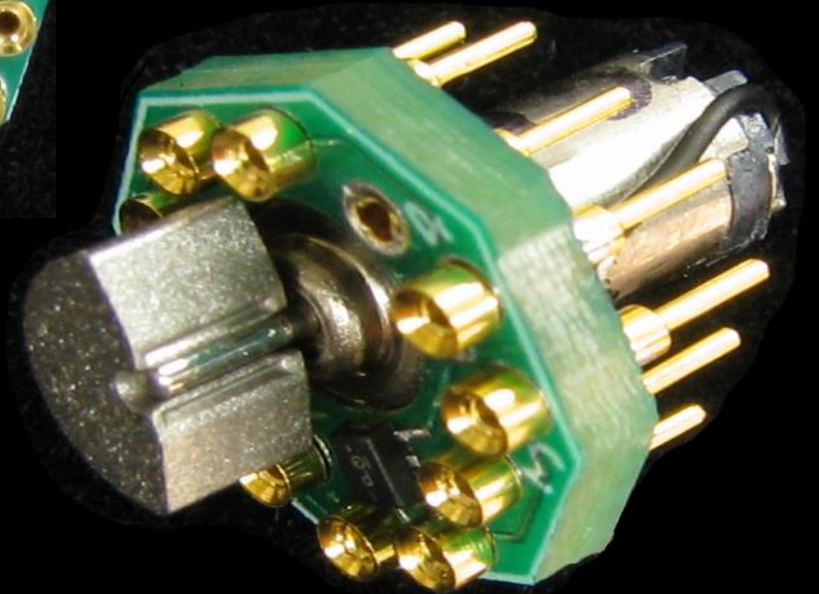
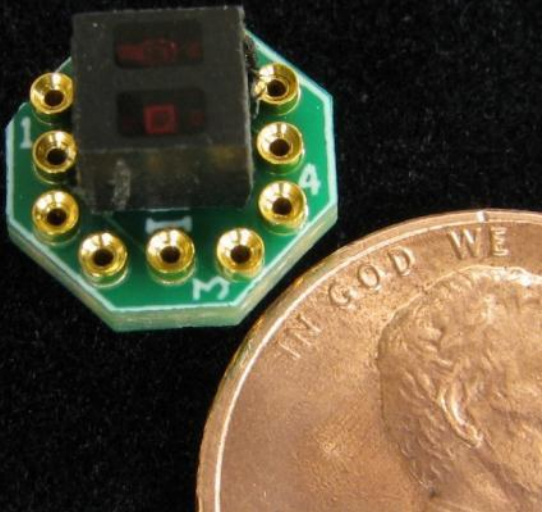
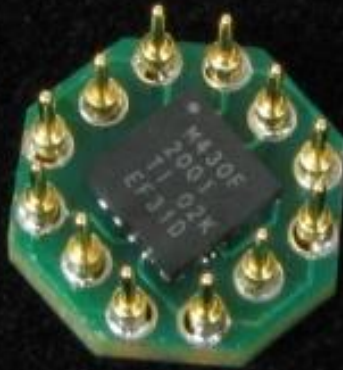
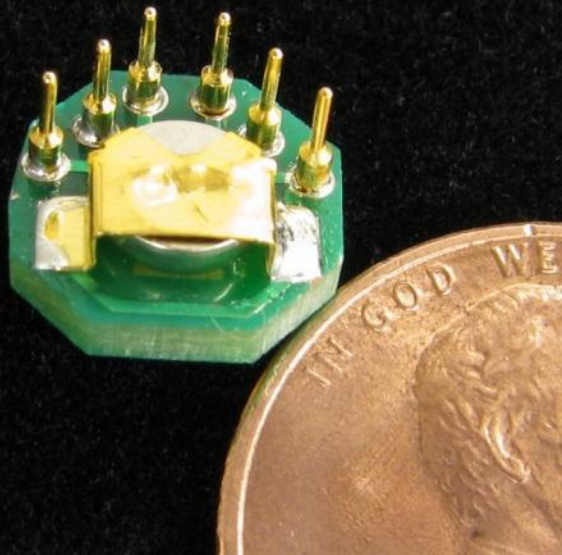


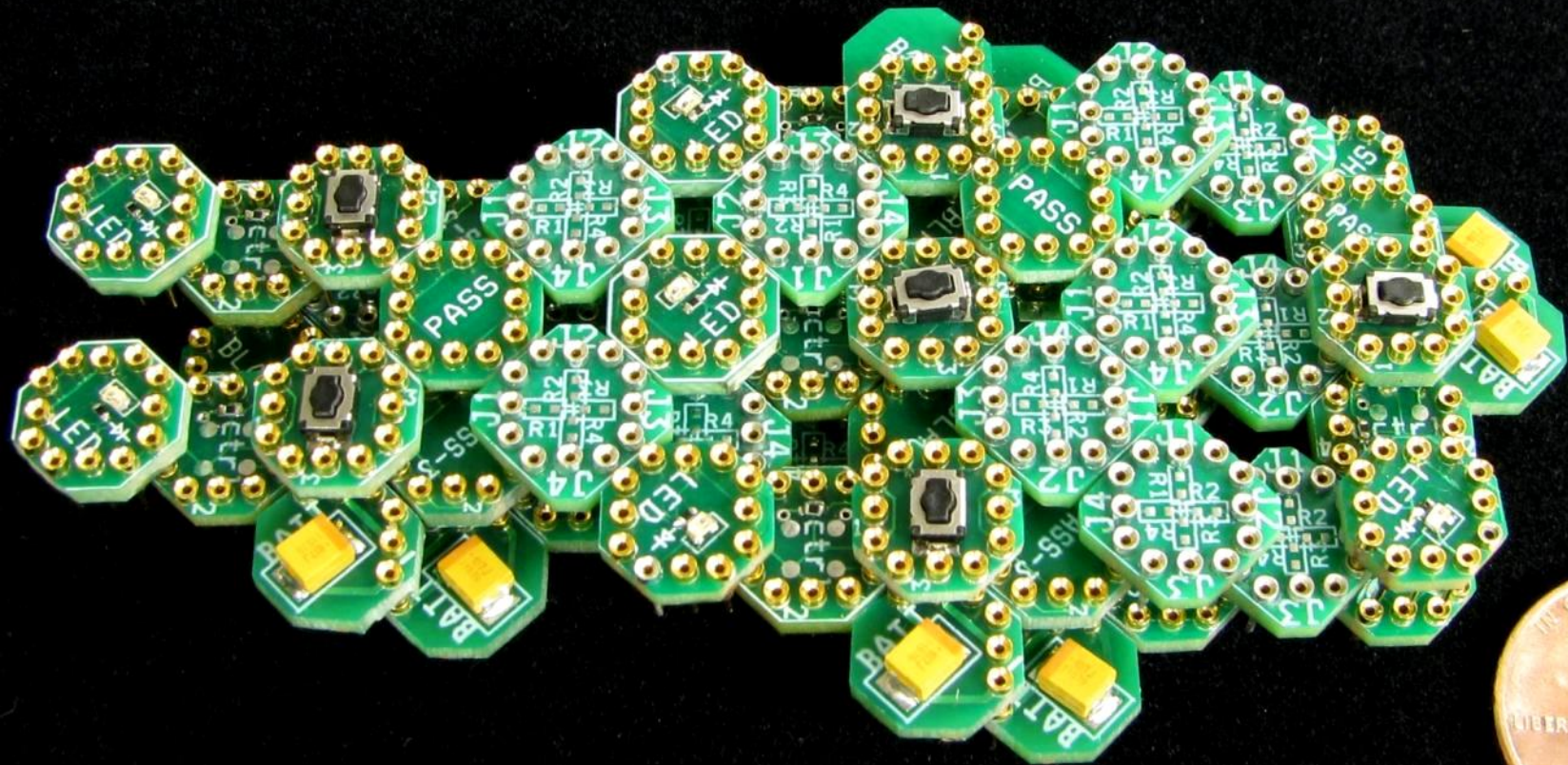
Rob MacCurdy

Challenges

- Voxel design and fabrication
- Assembling millions of voxels
- Designing machines using voxels

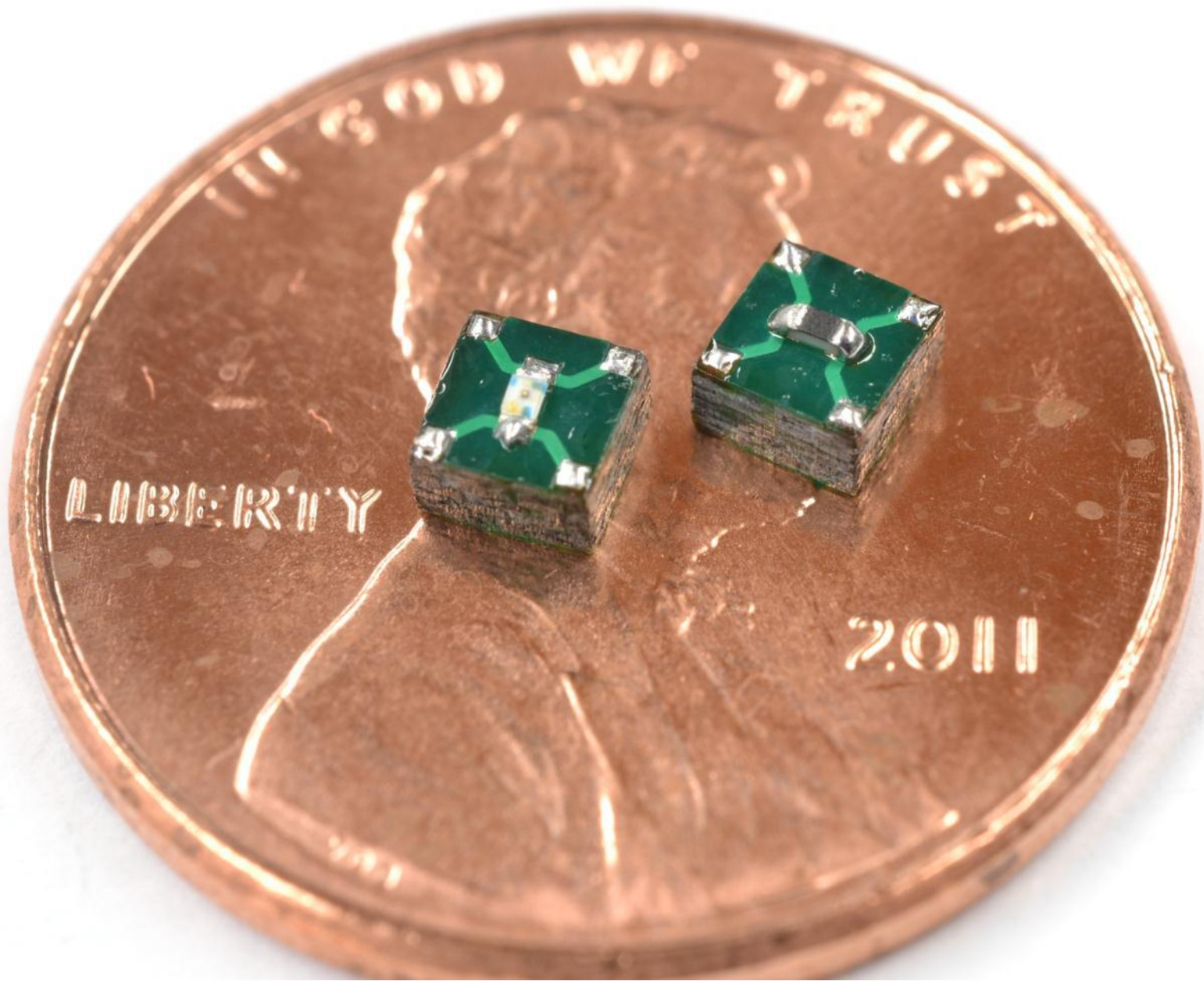
Basic Shape	Interlocking Geometry	Assembled Material
		
		
		
		





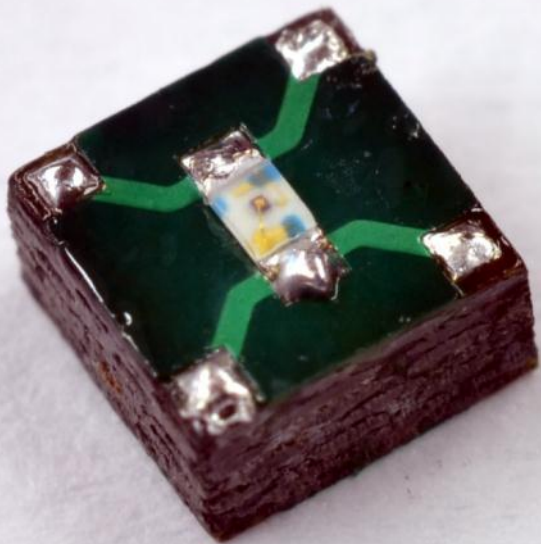
Rob MacCurdy

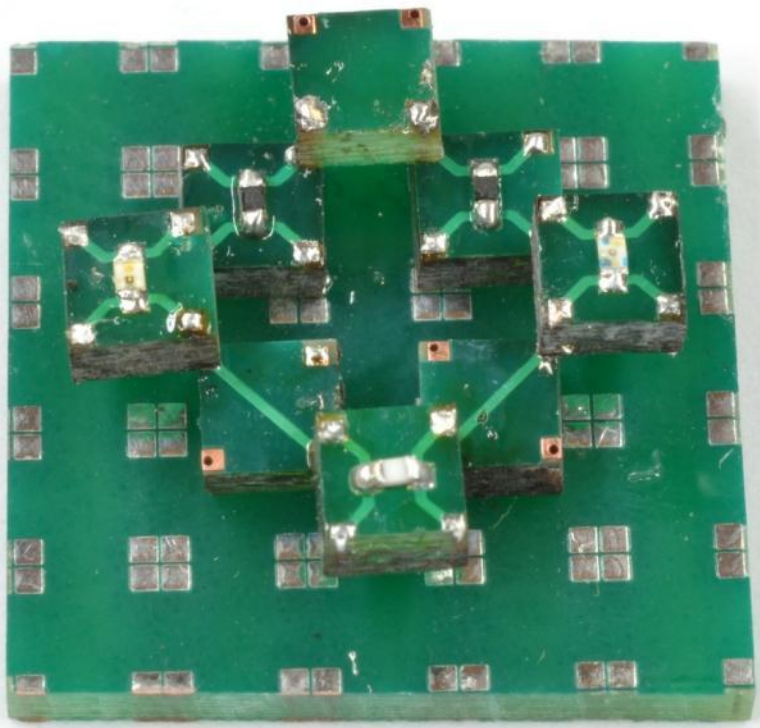


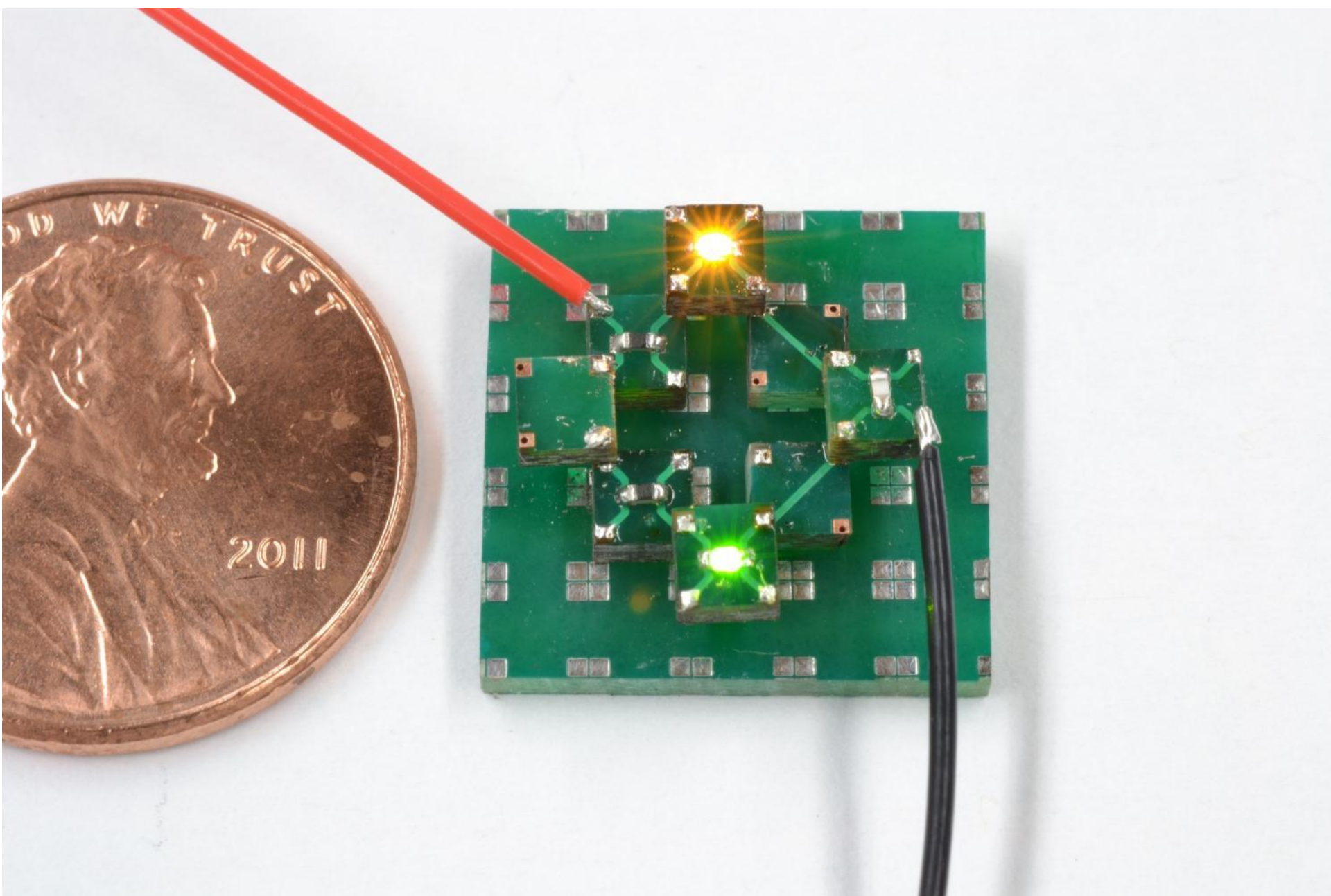


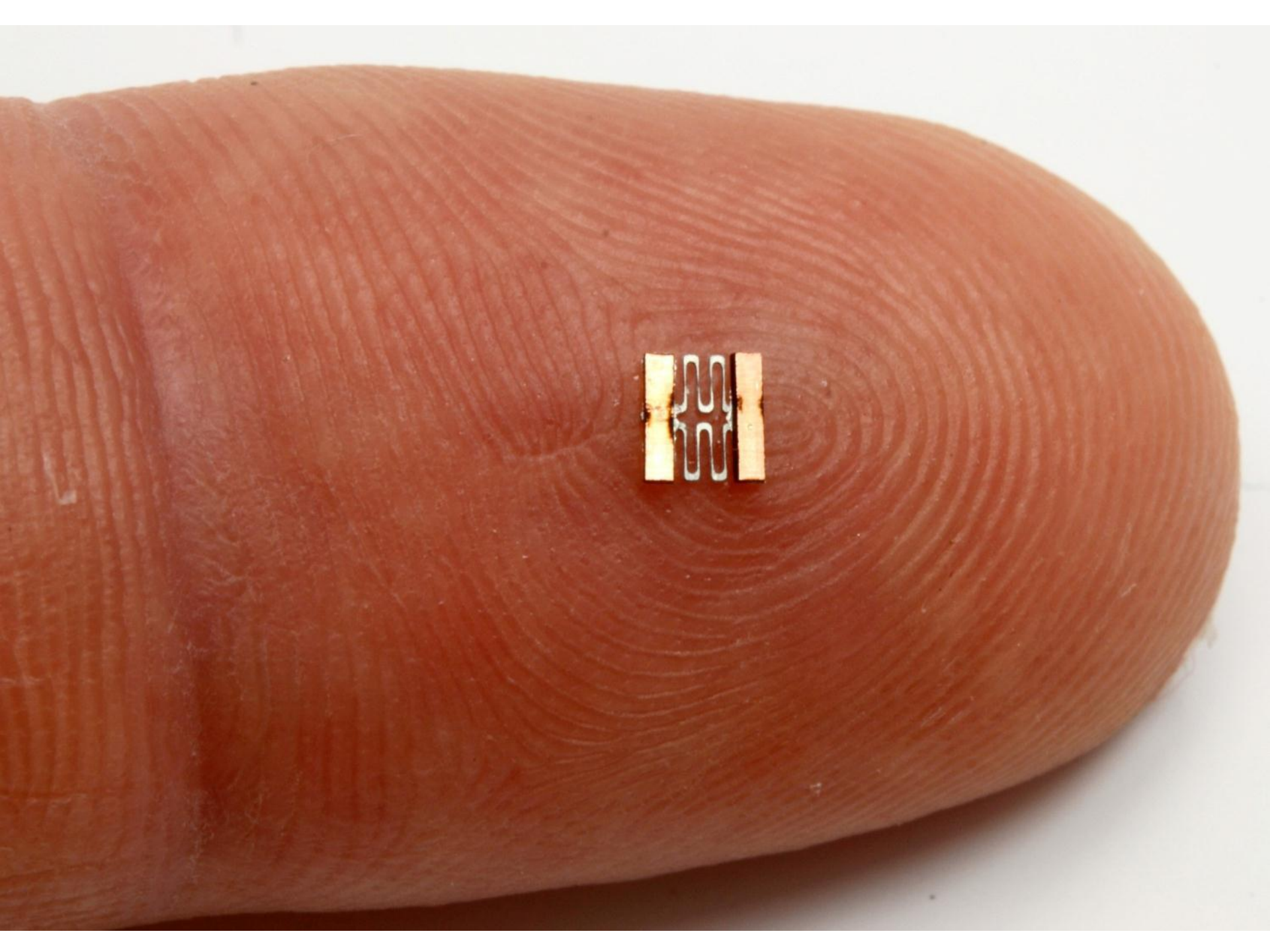
LIBERTY

2011









500µm

100 µm

WD = 6.1 mm

Aperture Size = 30.00 µm

Signal A = SE2

Date : 24 Jul 2009

Mag = 410 X

EHT = 1.50 kV

Pixel Size = 855.1 nm

Signal B = InLens

Time : 11:51:07

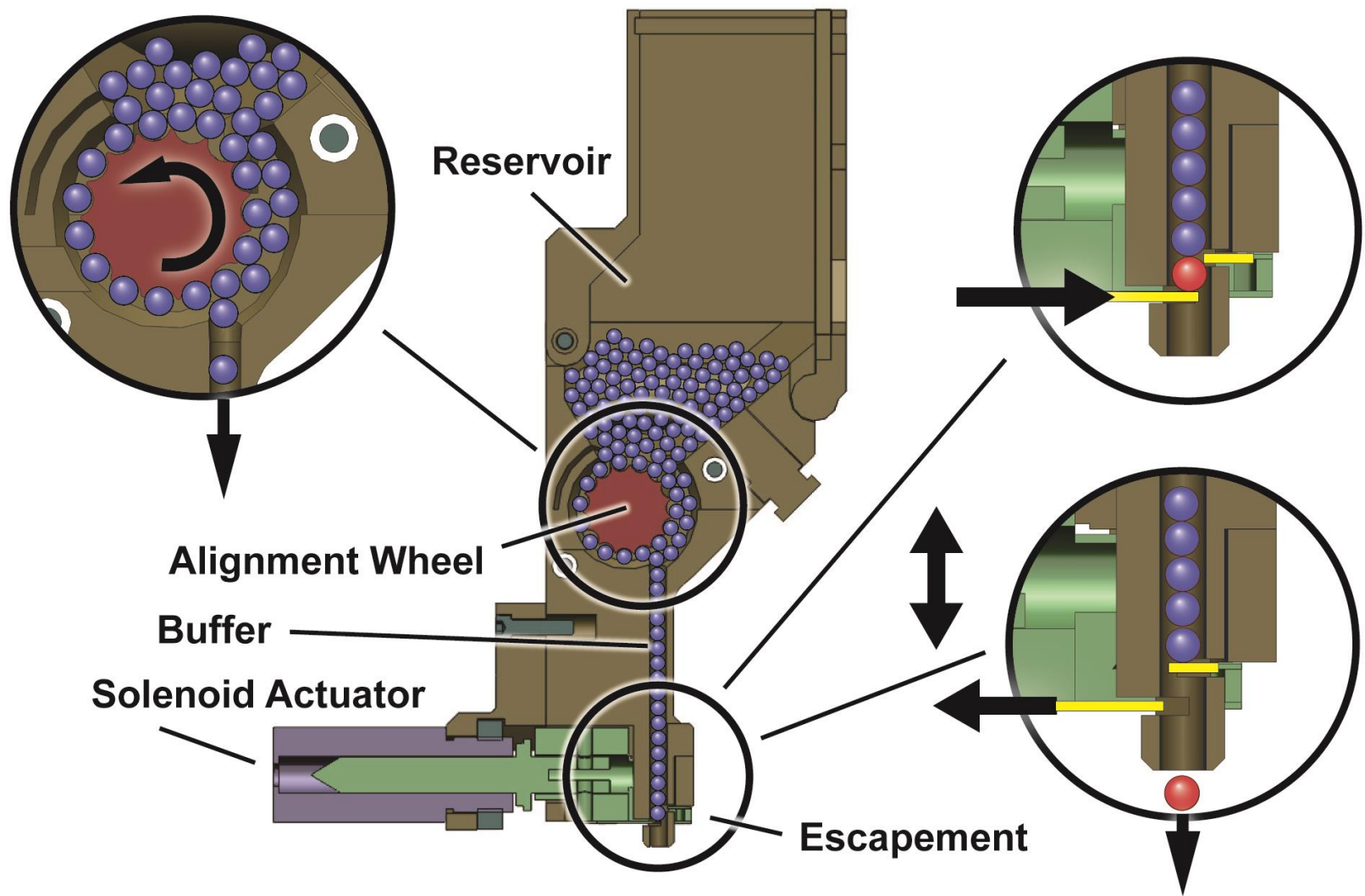
CNF

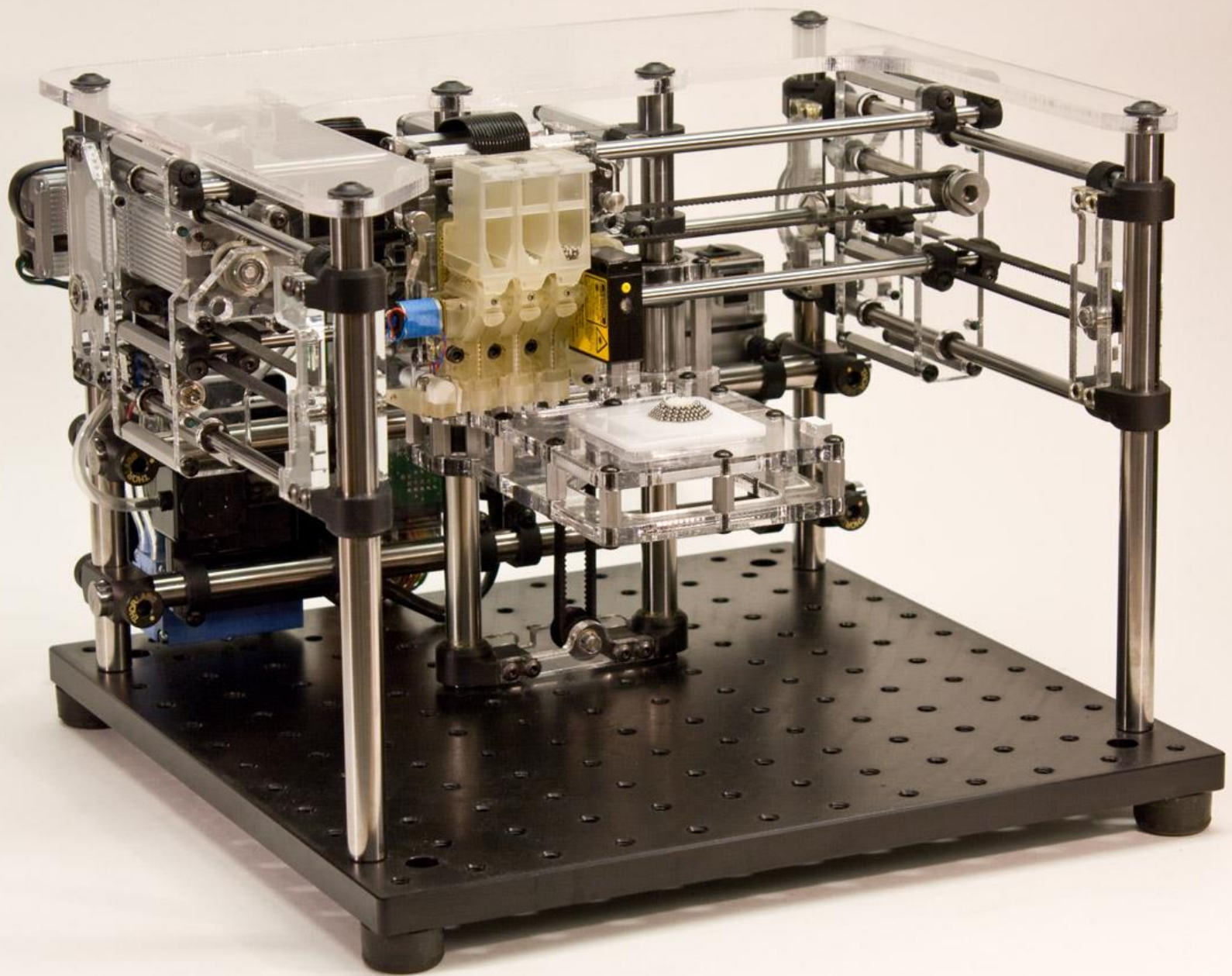


Joseph Miller

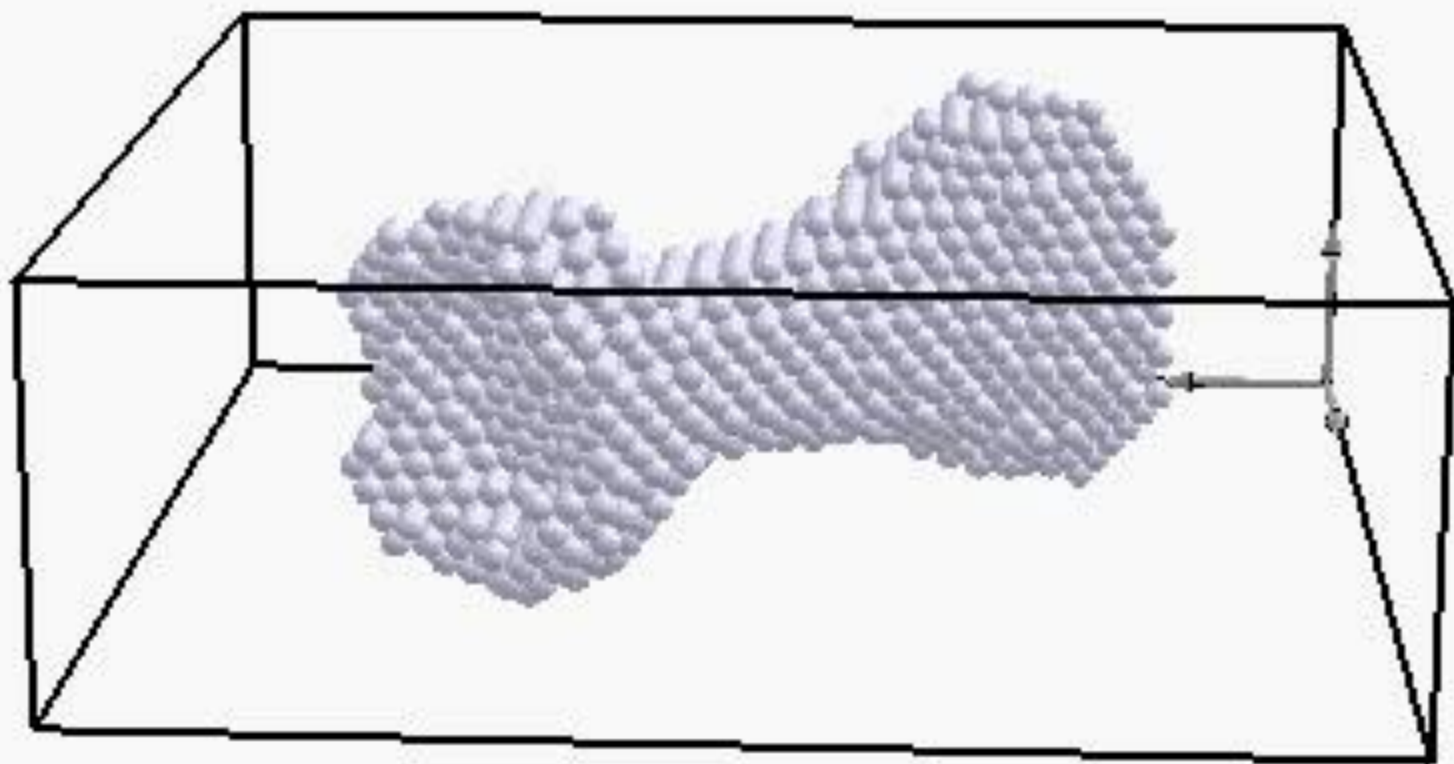
Pick & Place?

- 20cm object
- $1000 \times 1000 \times 1000 = 1\text{B}$ voxels
- 1 sec
- \rightarrow 30 Years

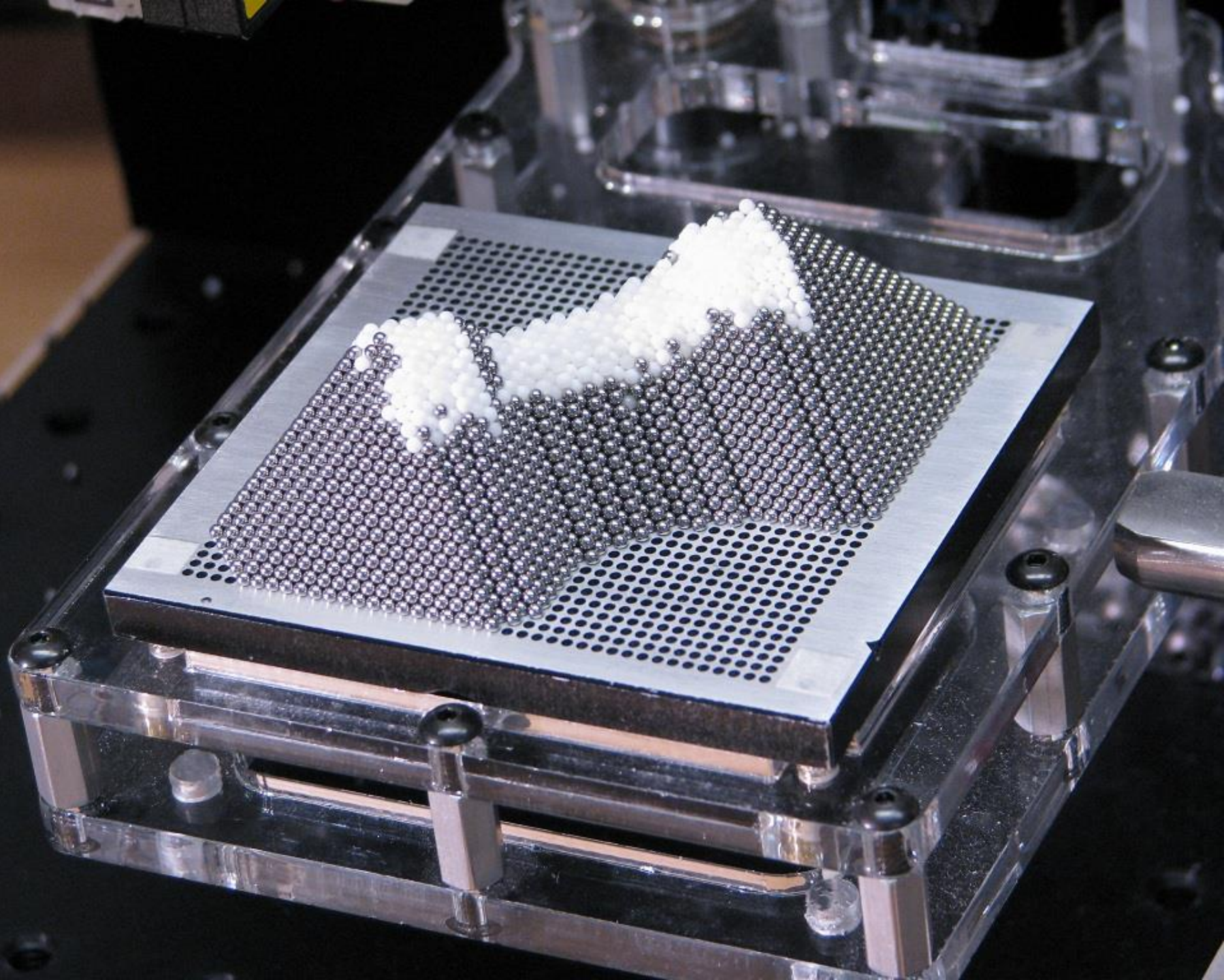


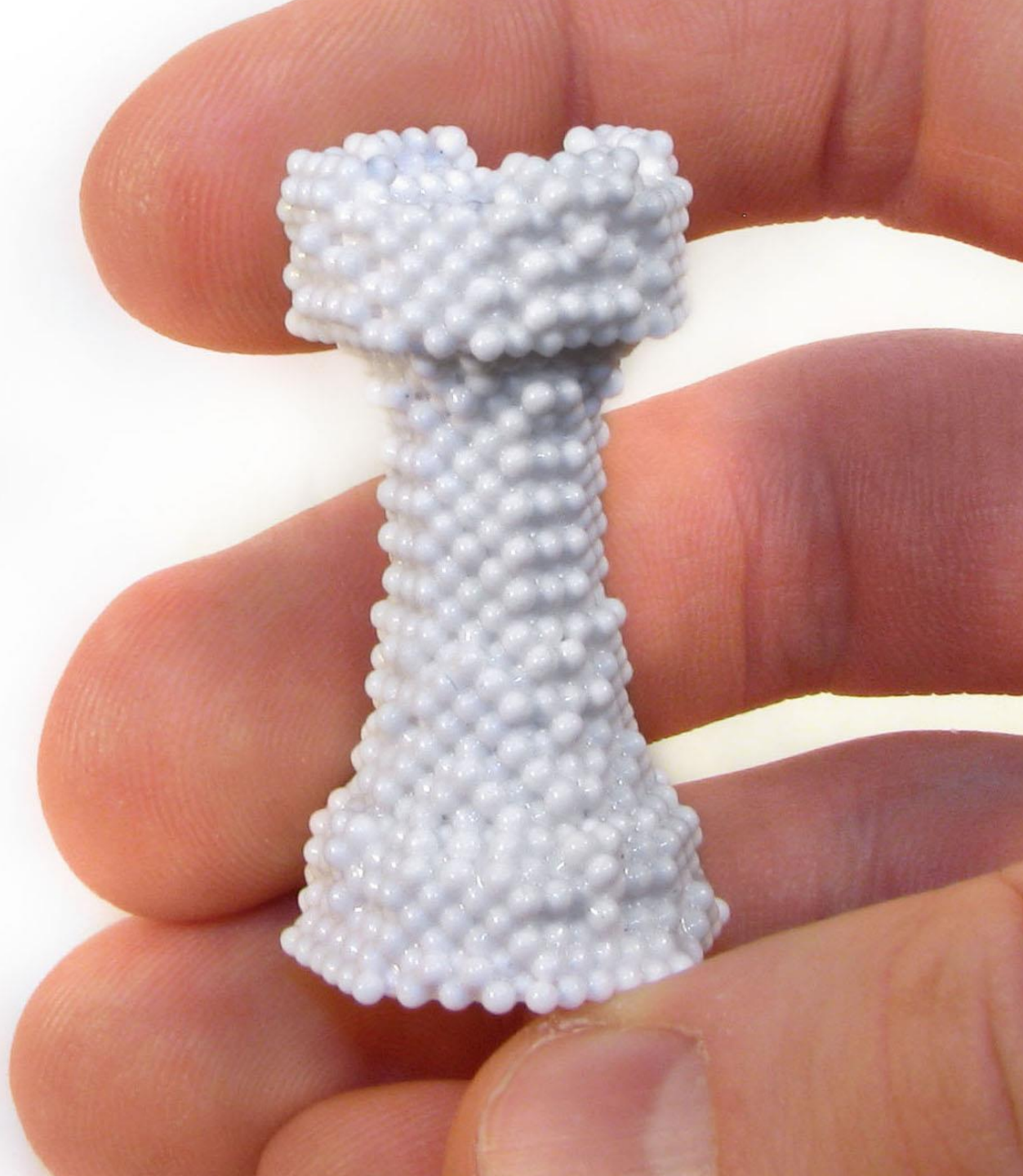


Desired object:



2400 voxel rook

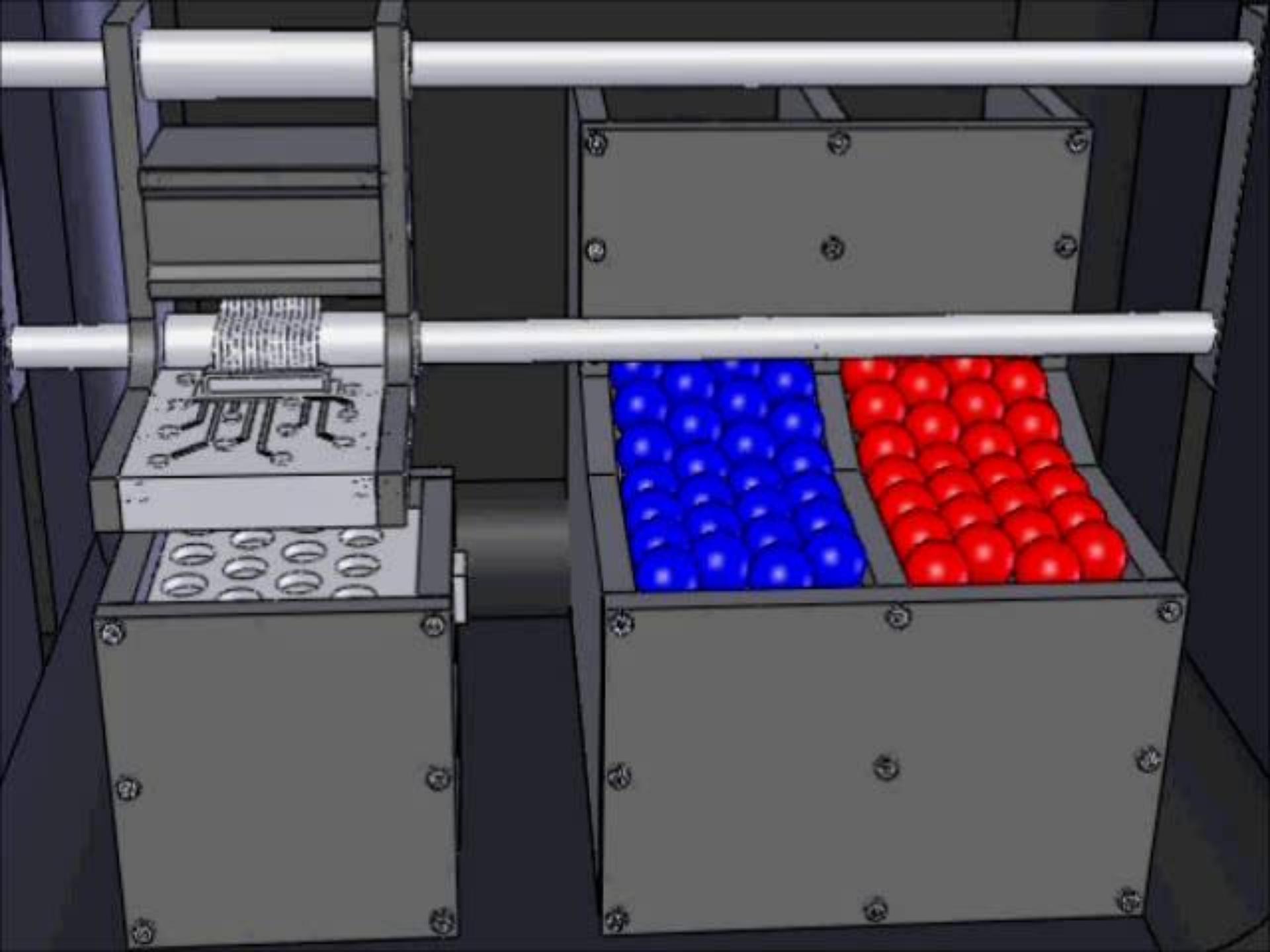


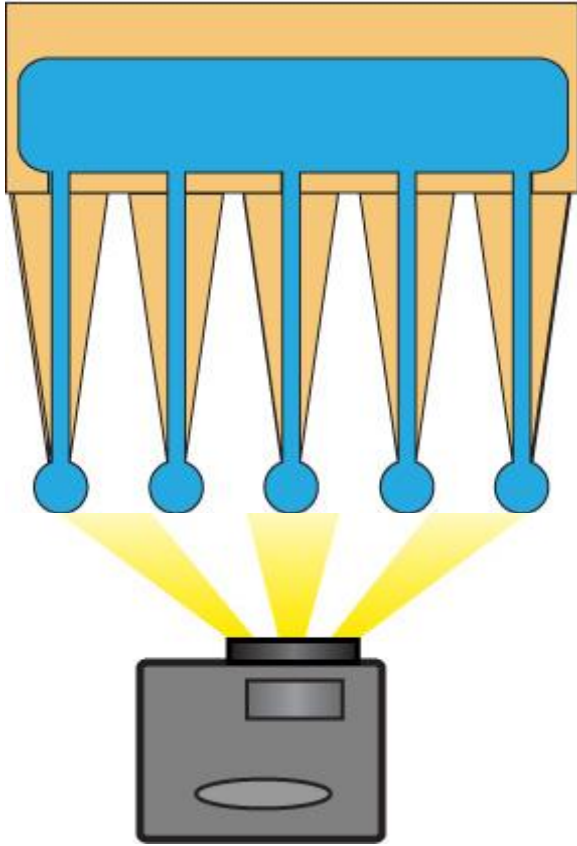


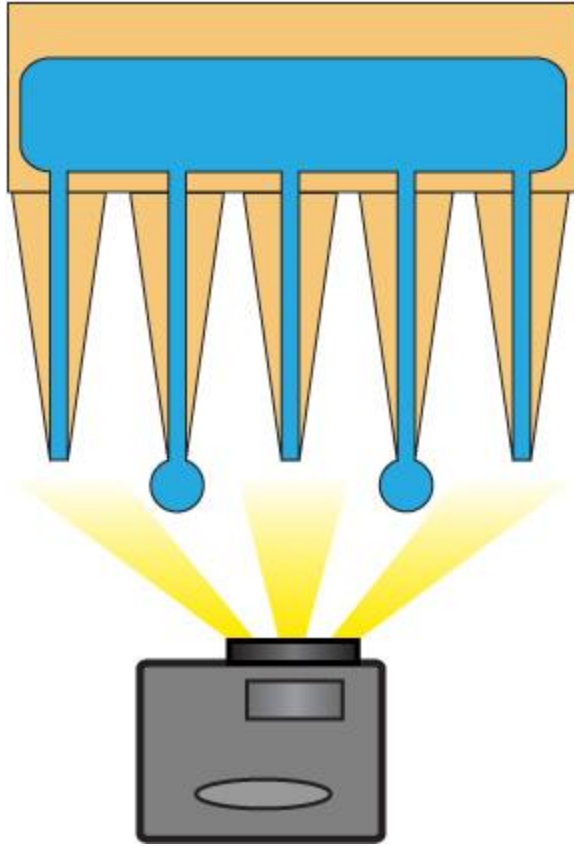
Jonathan Hiller

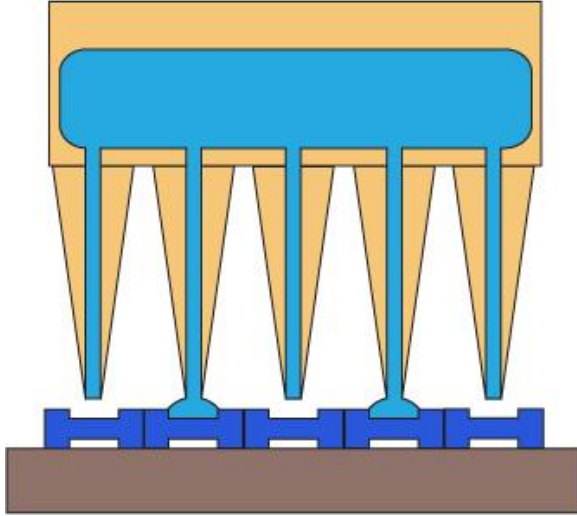


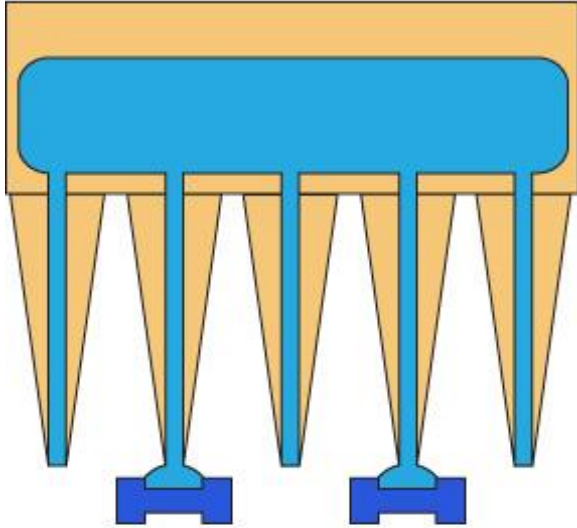
Jonathan Hiller

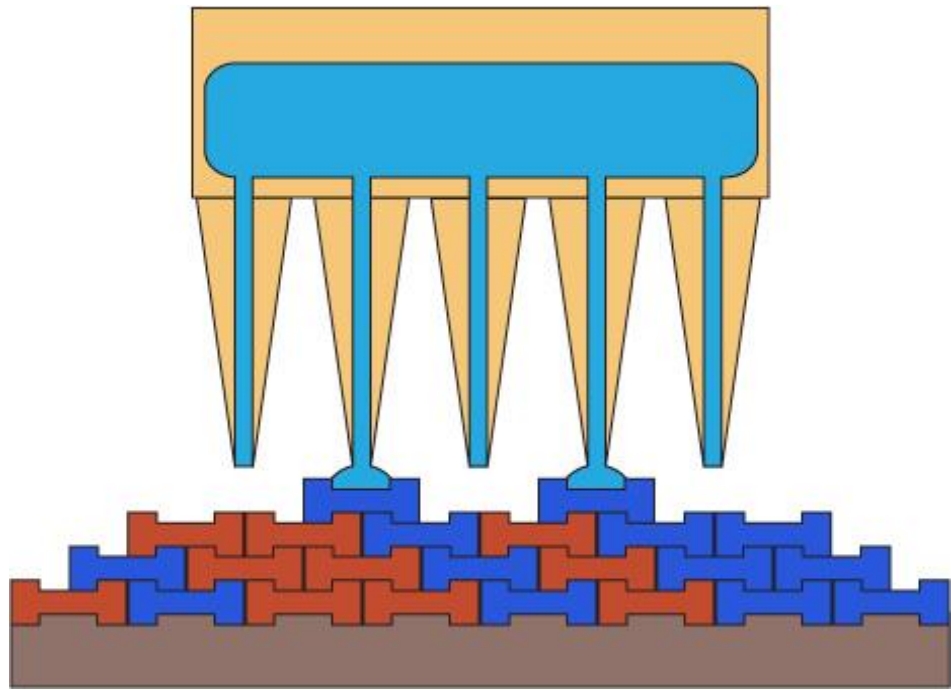










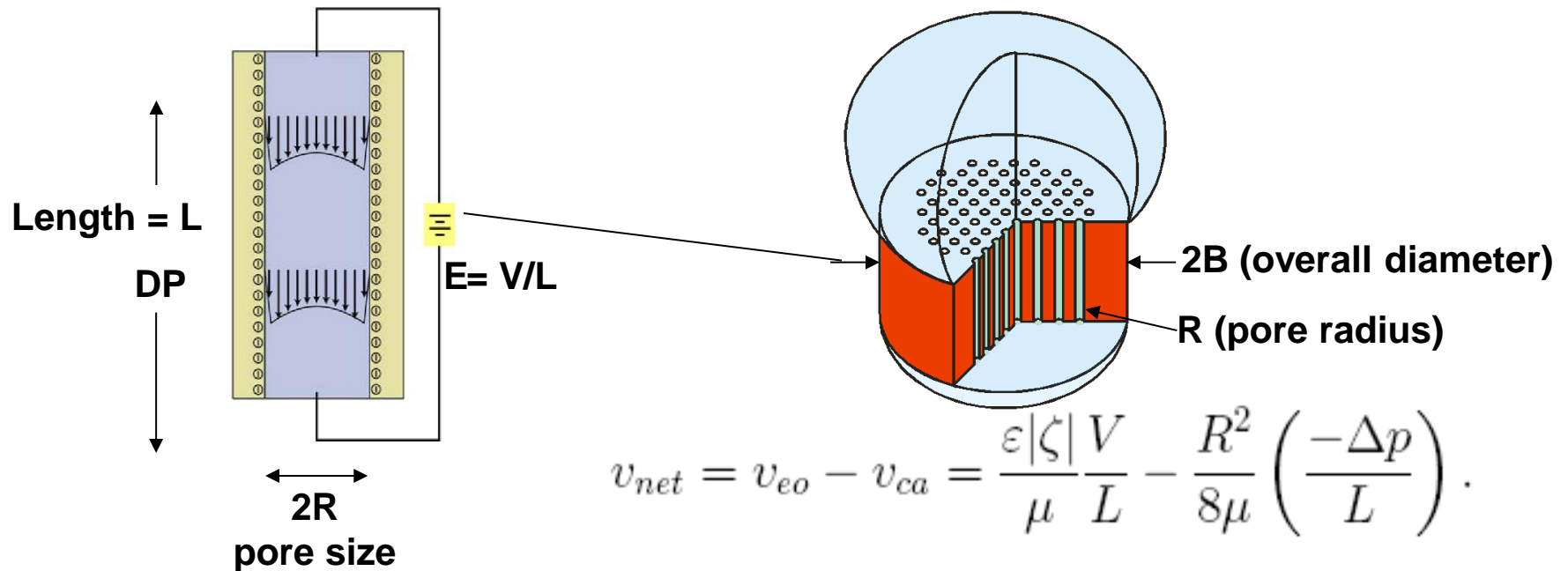




1cm

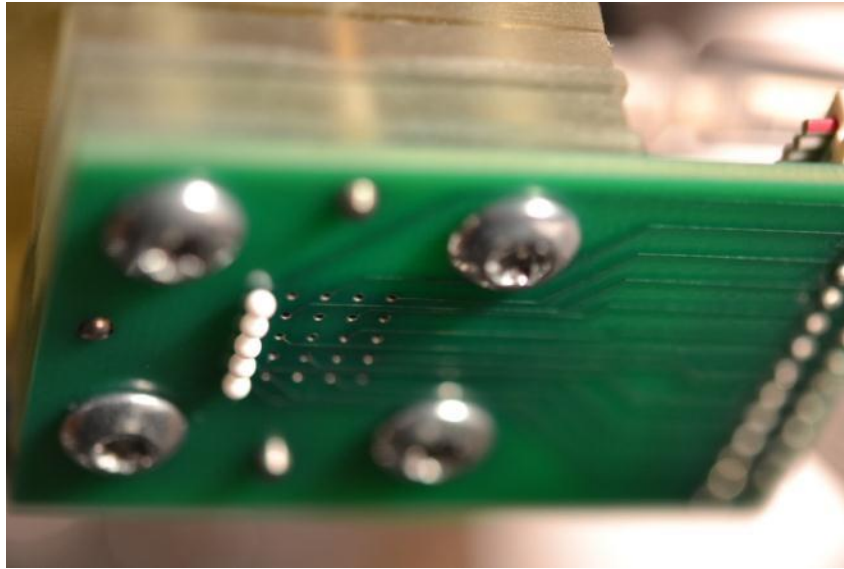


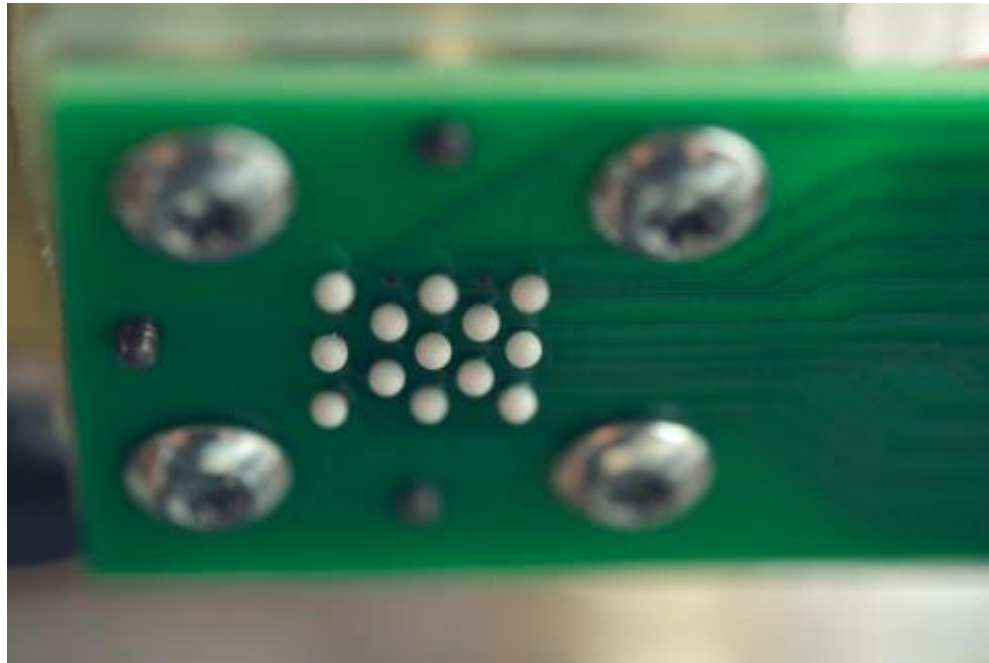
Electro-osmosis Pump



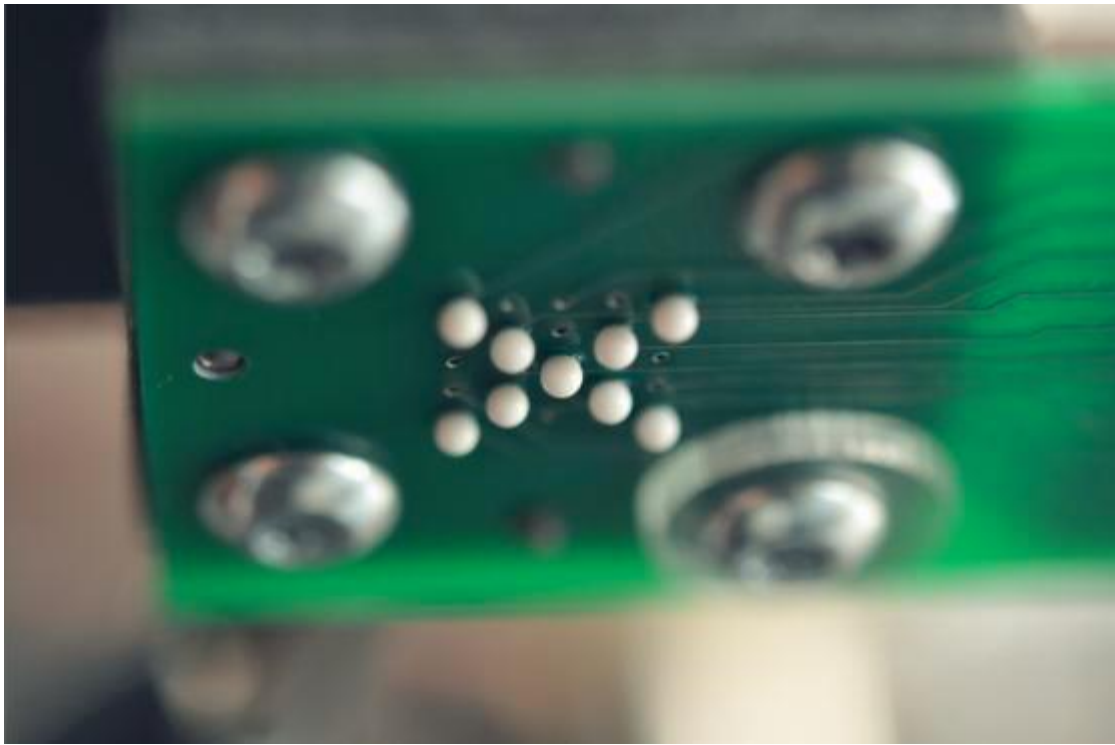
$$v_{net} = v_{eo} - v_{ca} = \frac{\epsilon |\zeta| V}{\mu L} - \frac{R^2}{8\mu} \left(\frac{-\Delta p}{L} \right).$$

Smoluchowski

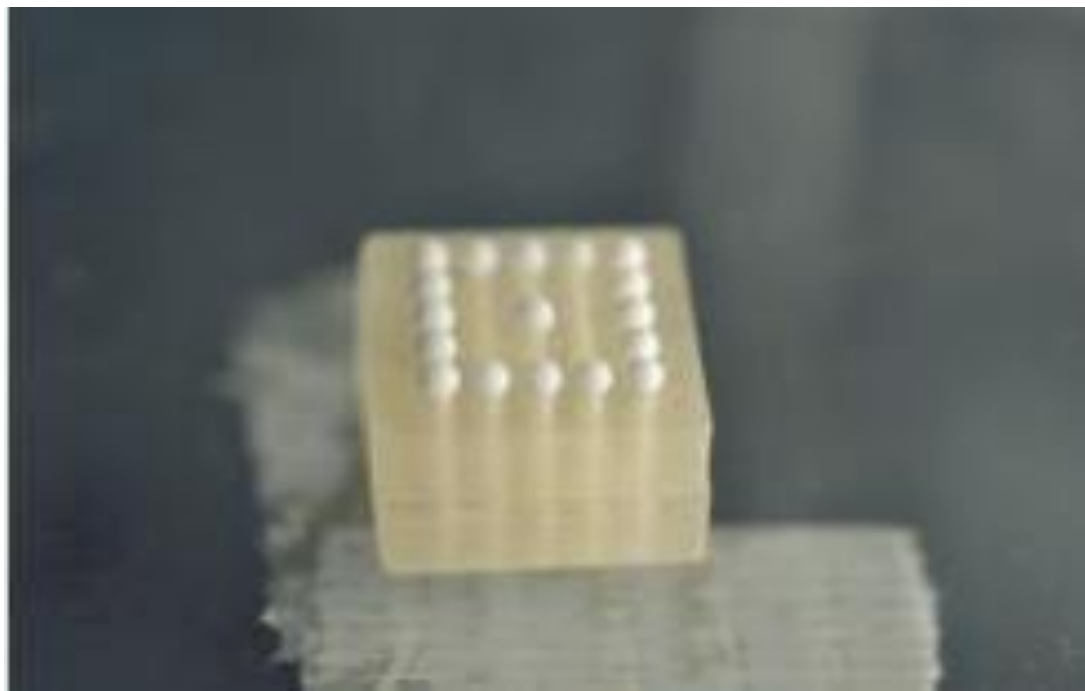


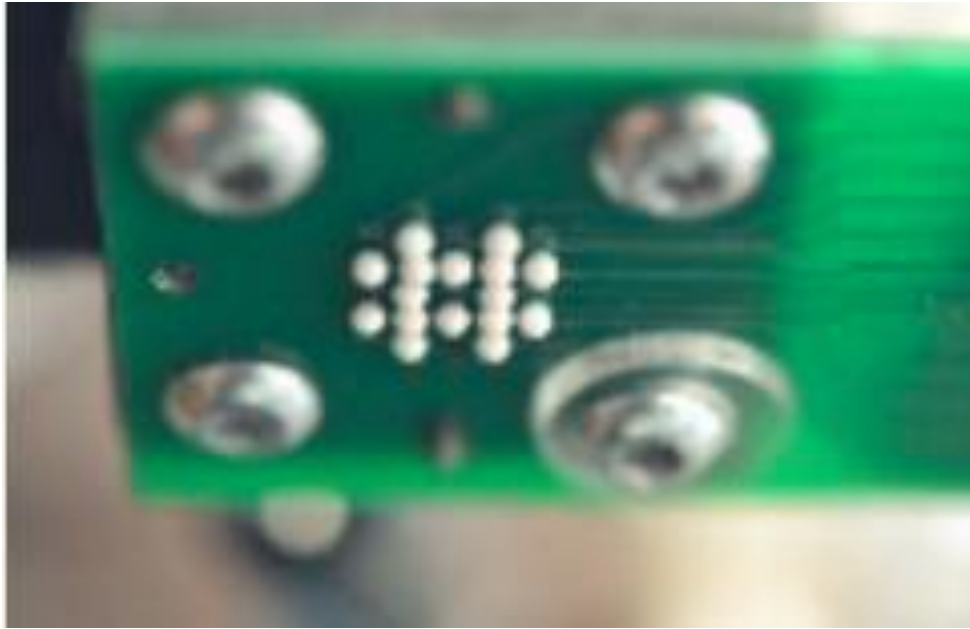


Cheryl Perich

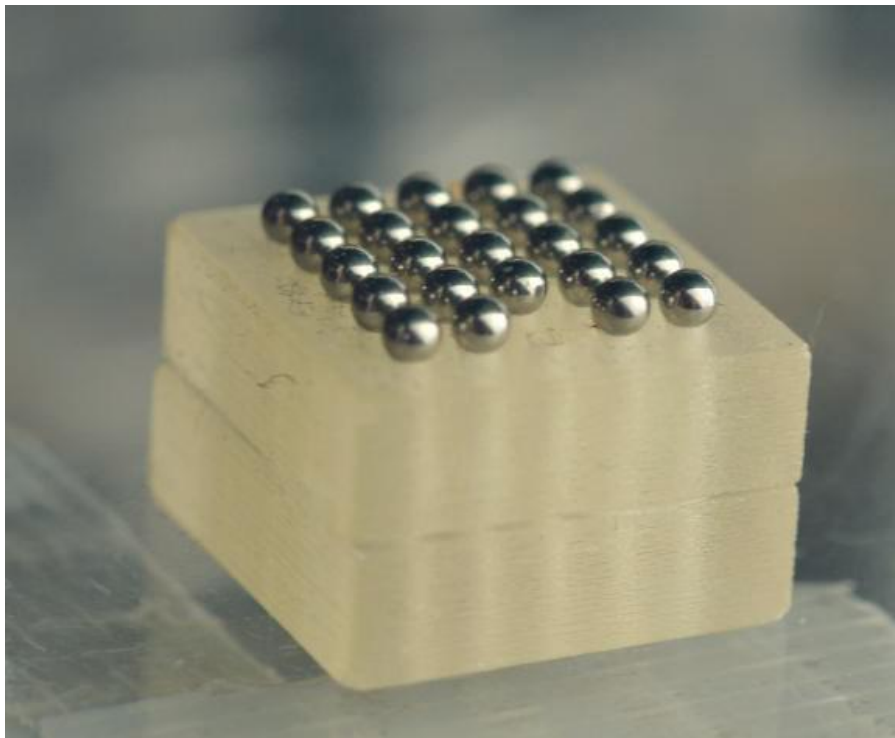
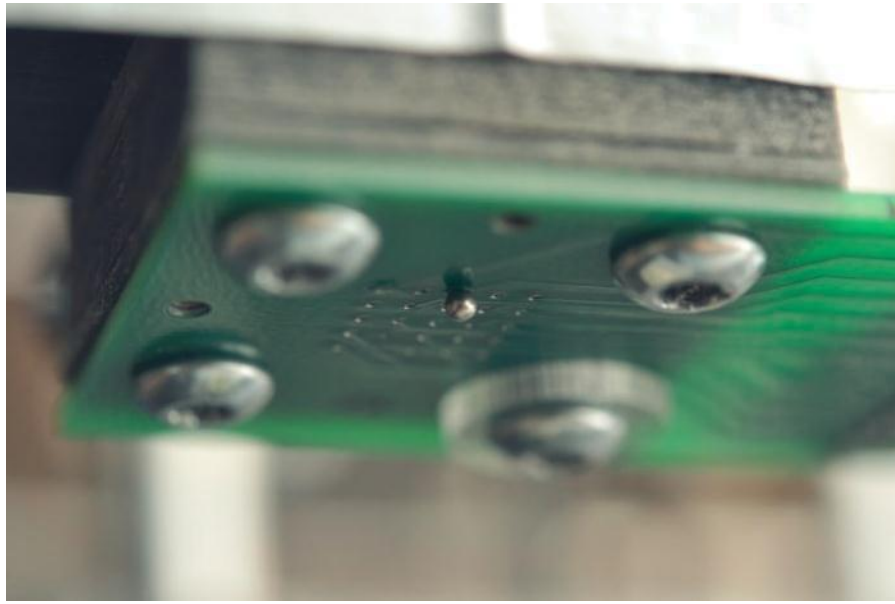


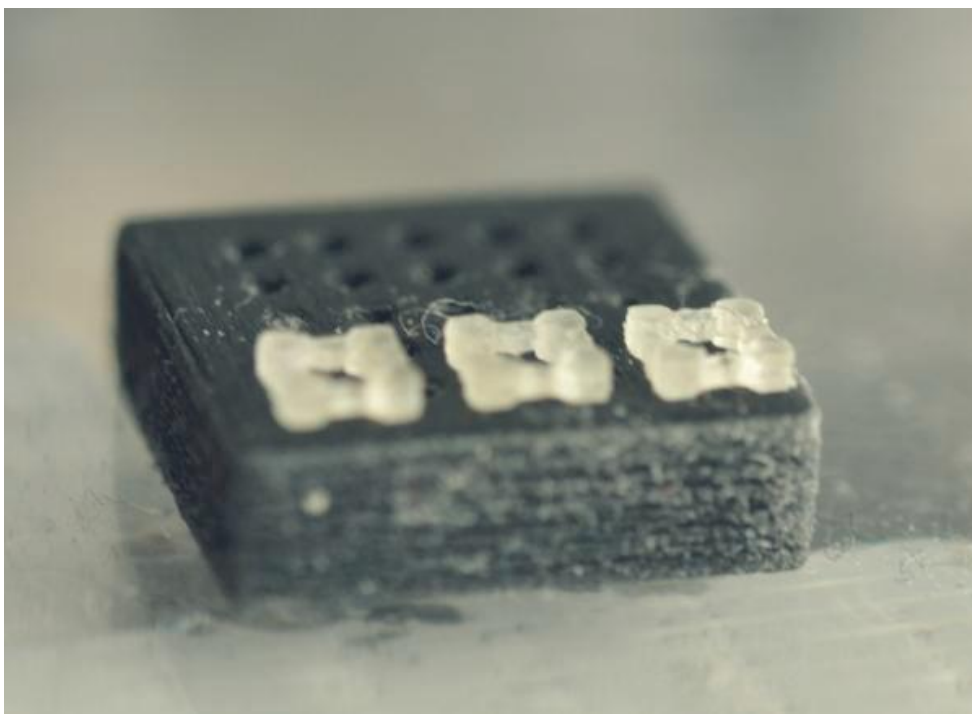
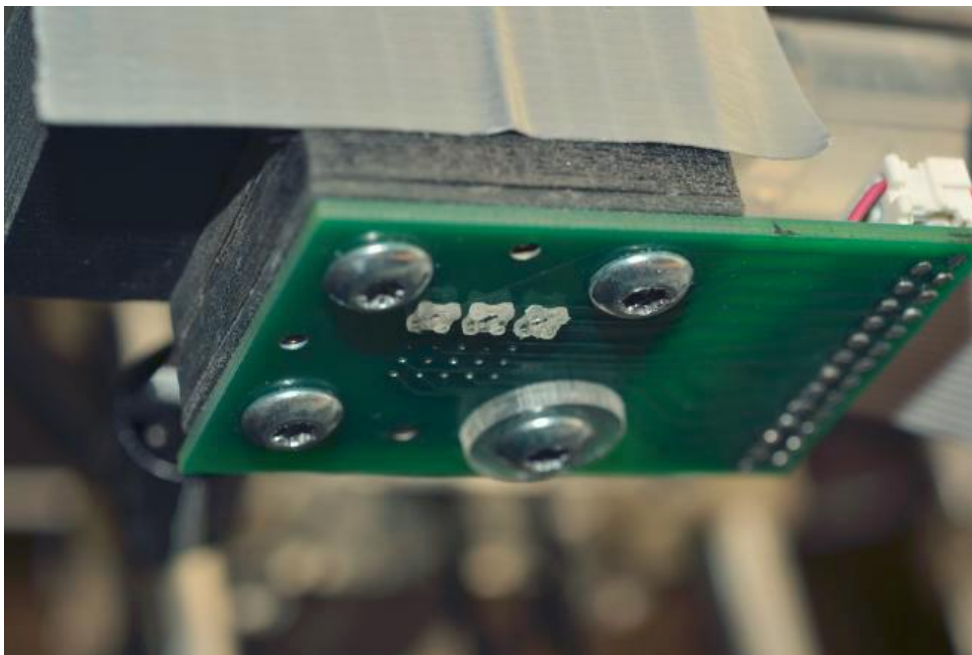
Cheryl Perich

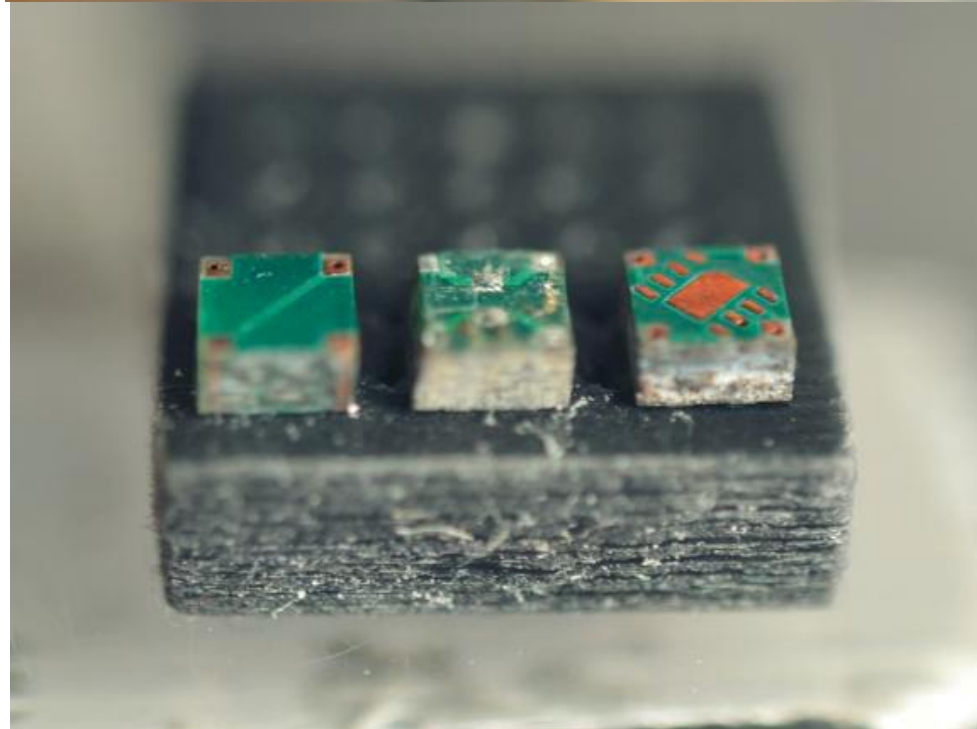
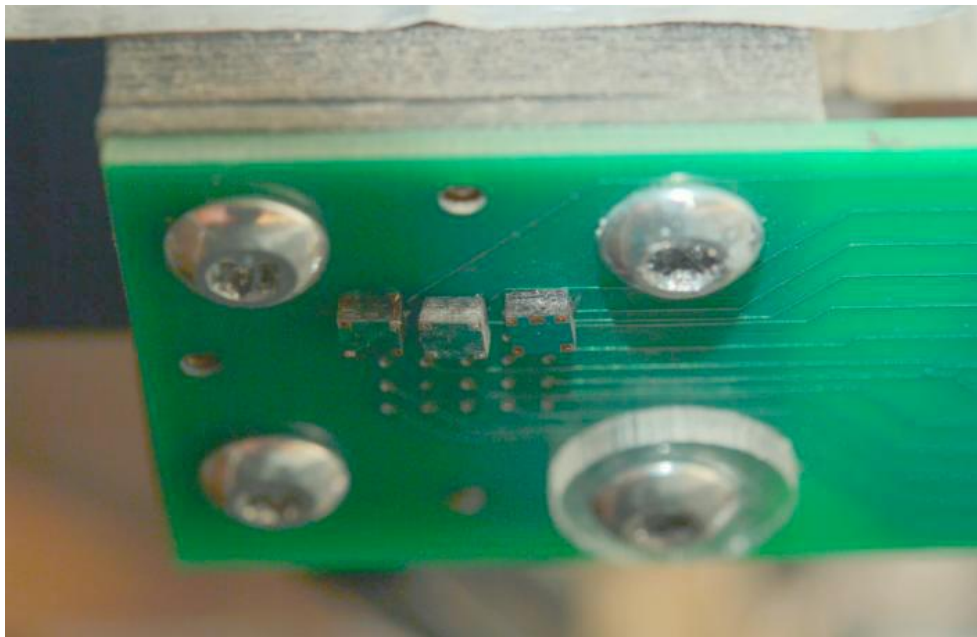


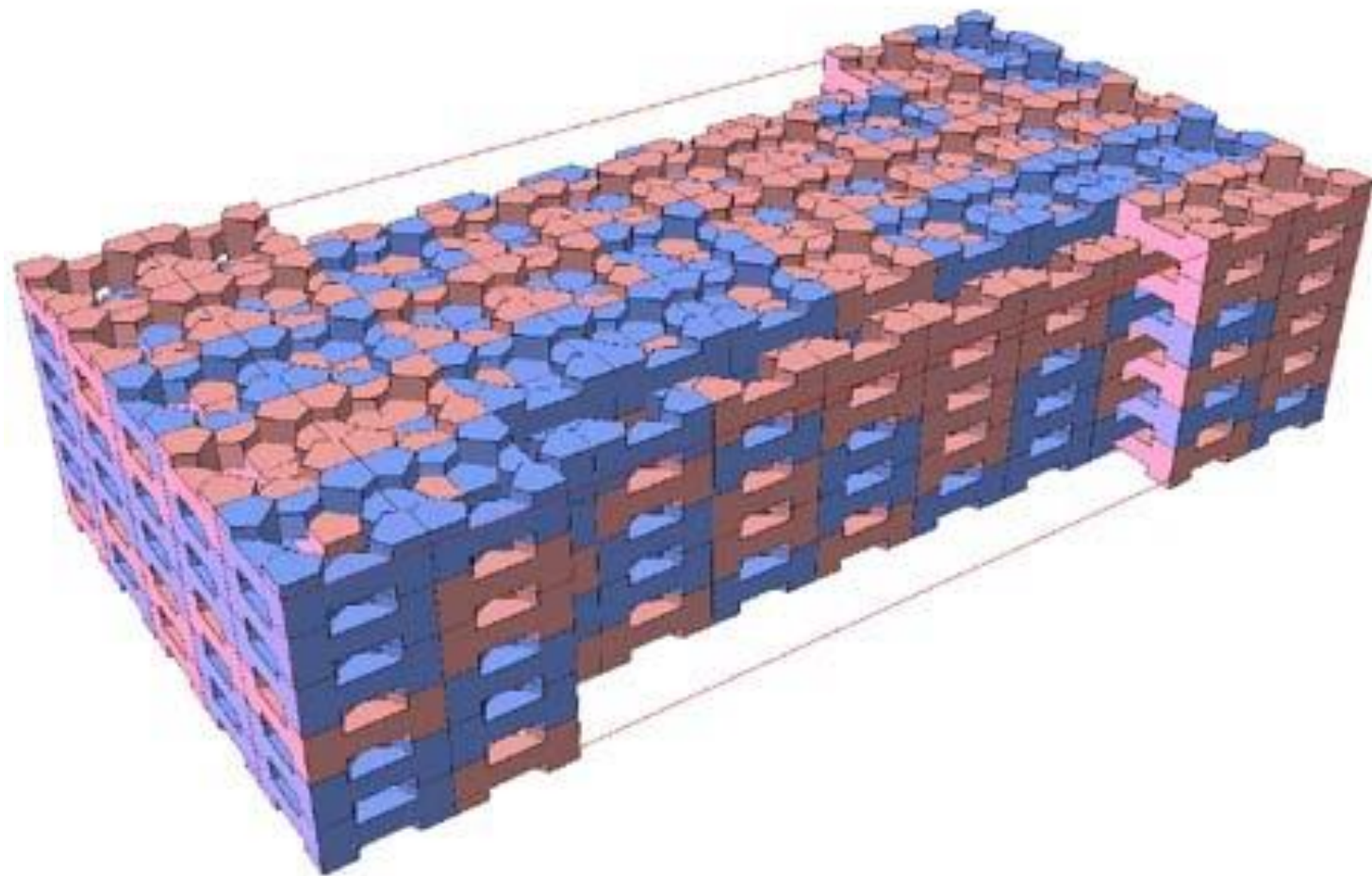


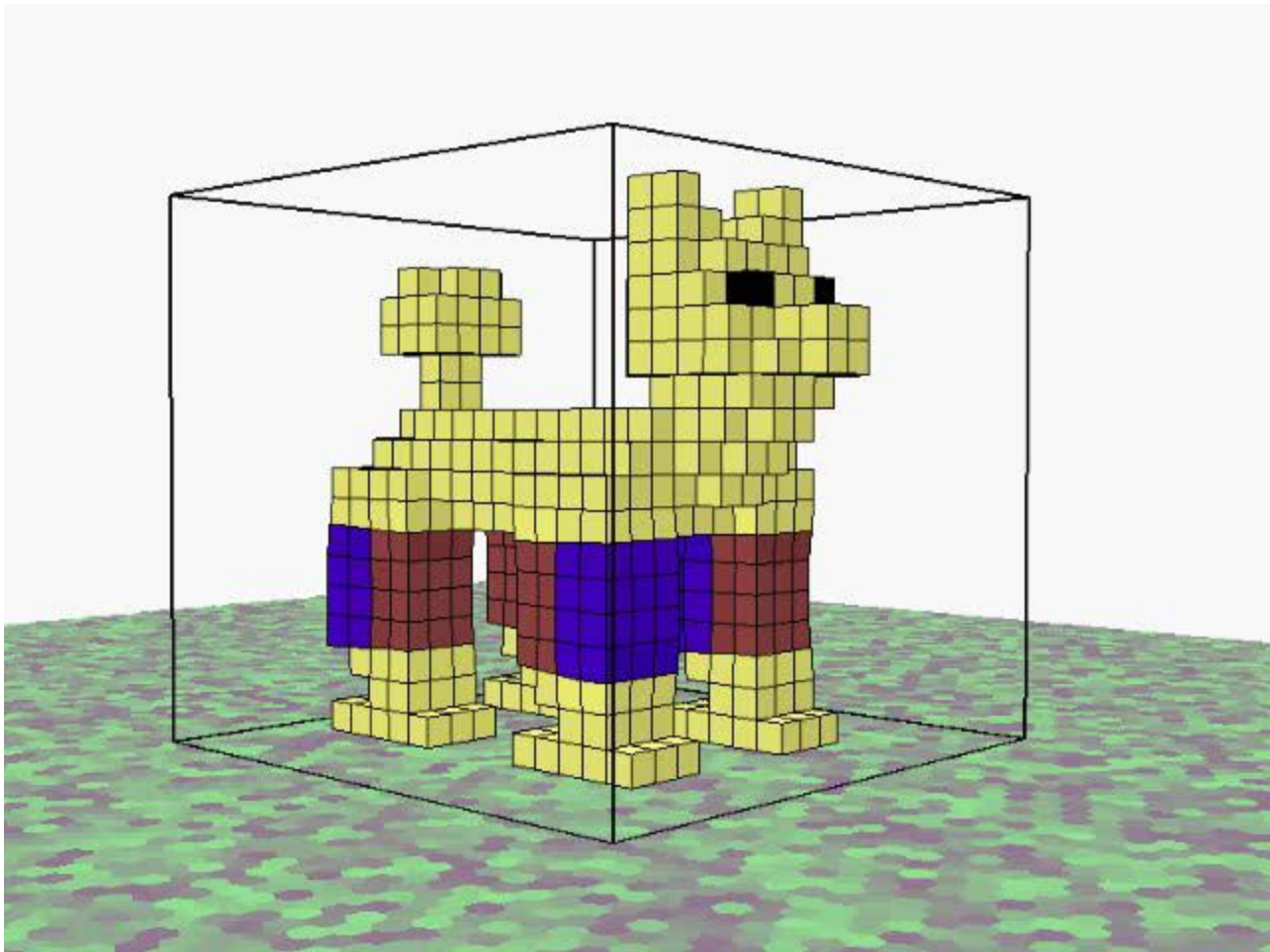
Cheryl Perich





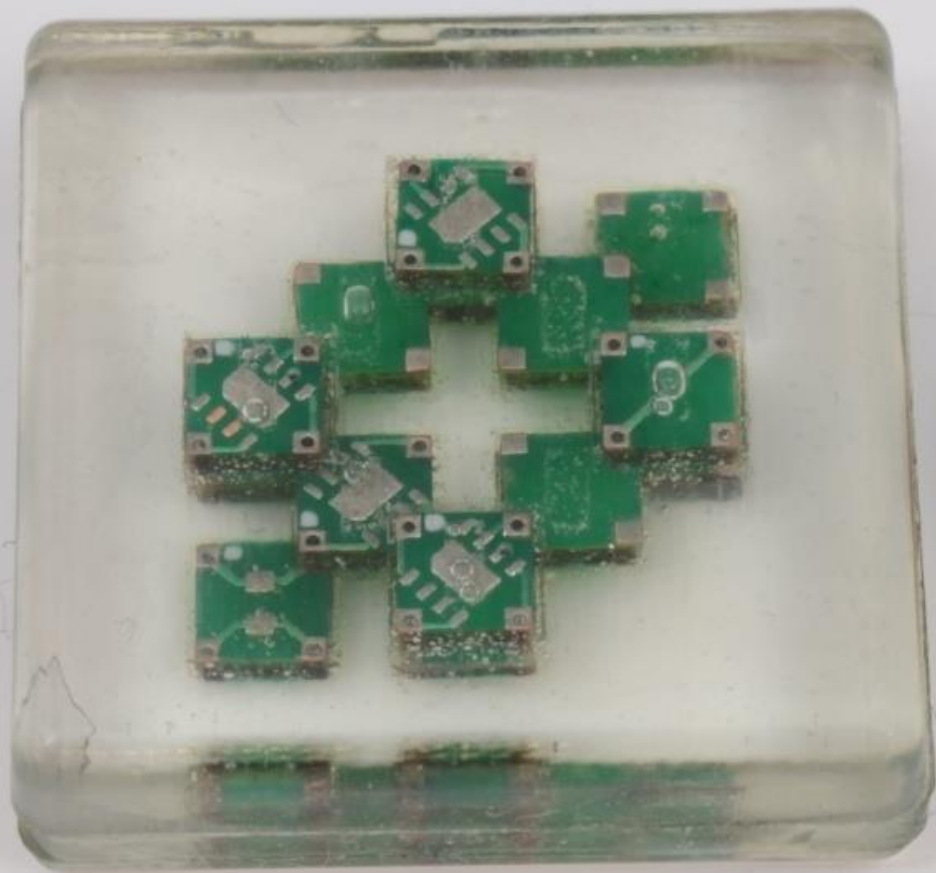




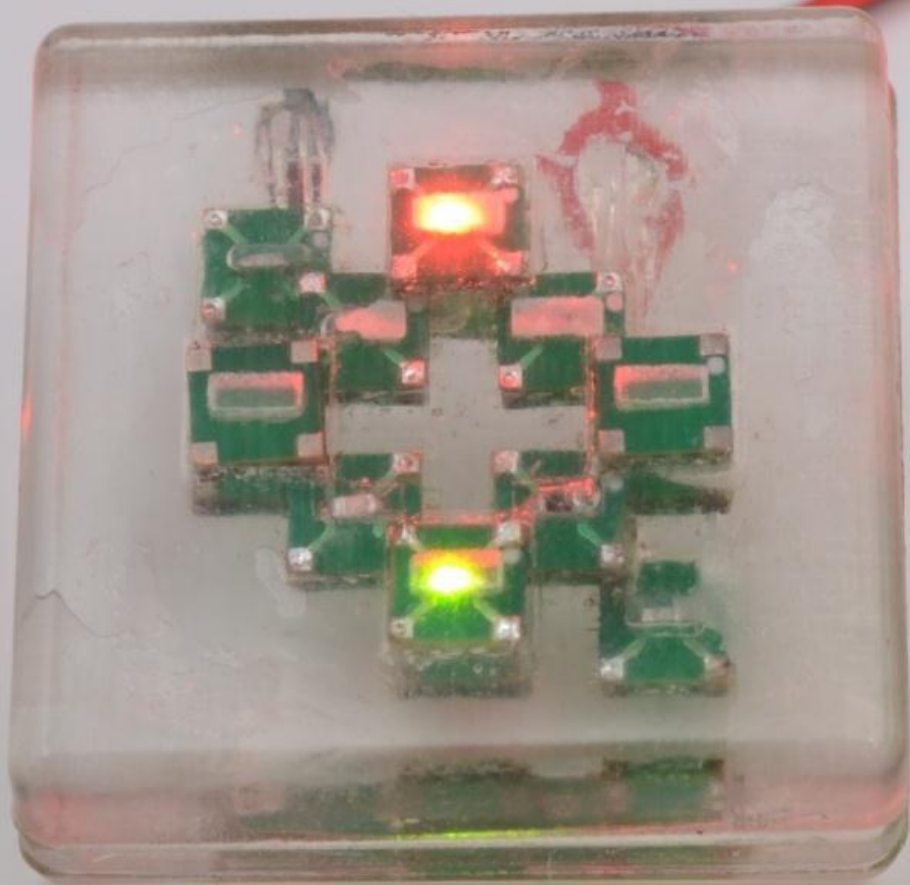






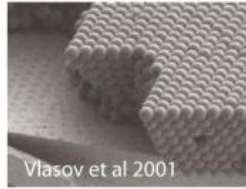


Rob MacCurdy

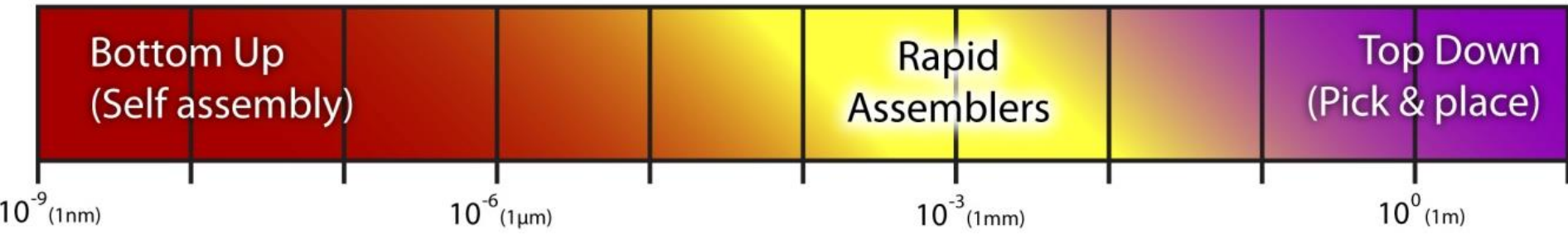


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mesoscale
assembly gap





Cheryl Perich



Jonathan Hiller



Rob McCurdy

