

## Bright Ideas in Fiberoptics

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Enabling Next-Gen Microarray Fabrication

### High Density Low Cost Microfluidic Addressable Microwell Biochips

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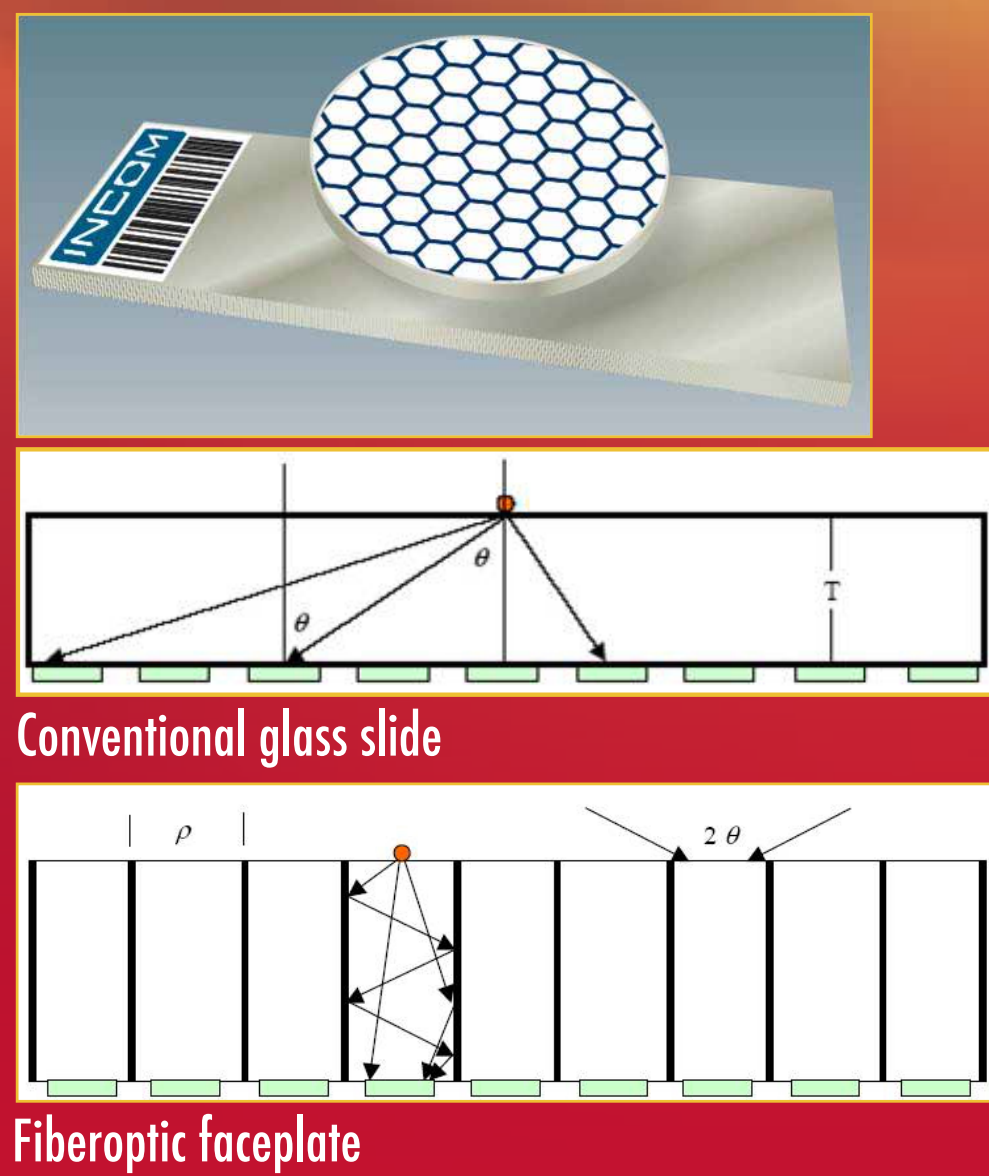
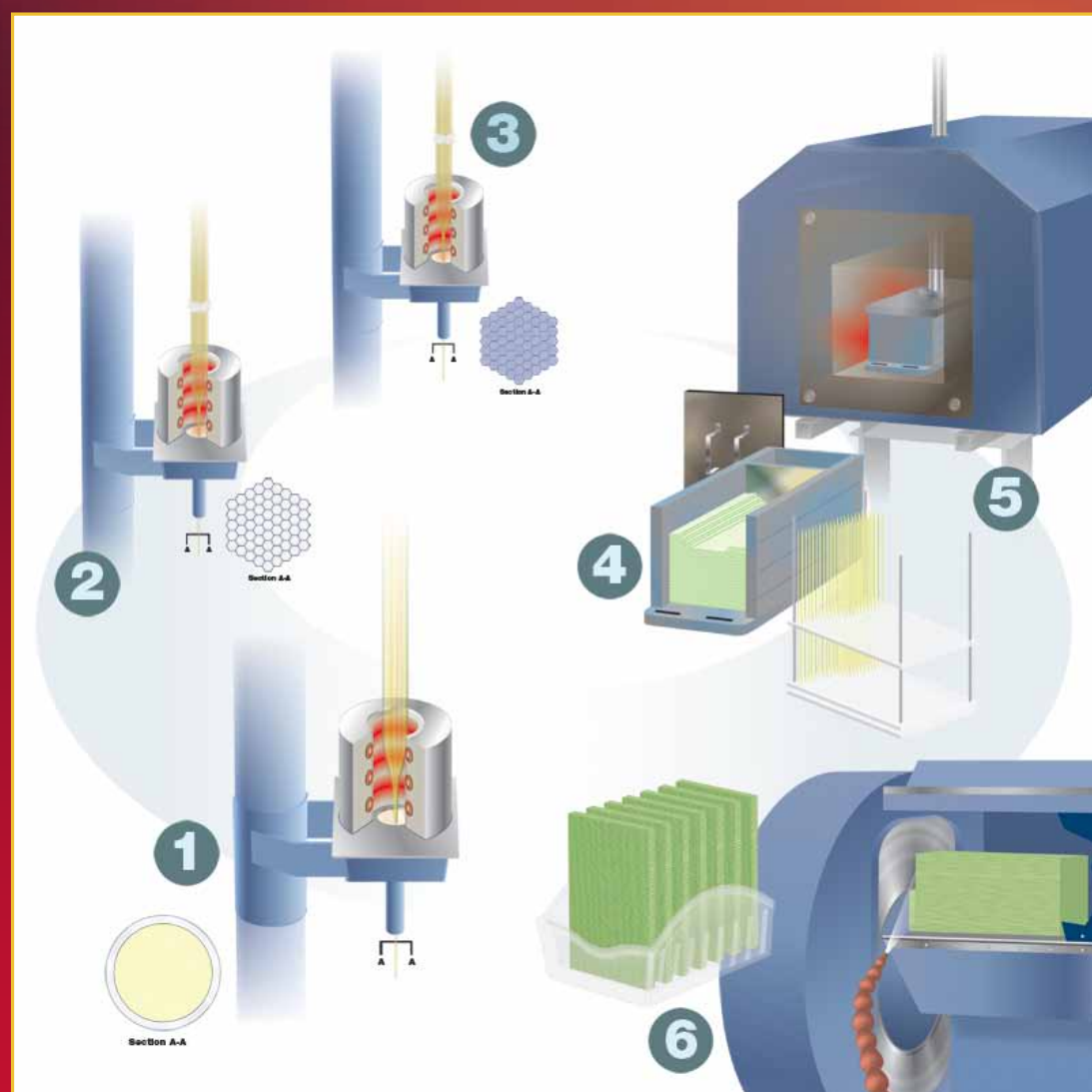
Fiber optic faceplates, chemically etched to form microwell arrays, have revolutionized high speed, diagnostic luminescent based assays including those used for genomic analysis. These disposable biochips have the advantage of enabling 'direct contact imaging', where light emitted within each

microwell transmits through the fiber optic substrate and couples directly into a CCD or CMOS detector without refractive loss. We now report a next generation product that incorporates patterned microwells formed from a photopatterned epoxy layer adhered to the glass fiber optic substrate.

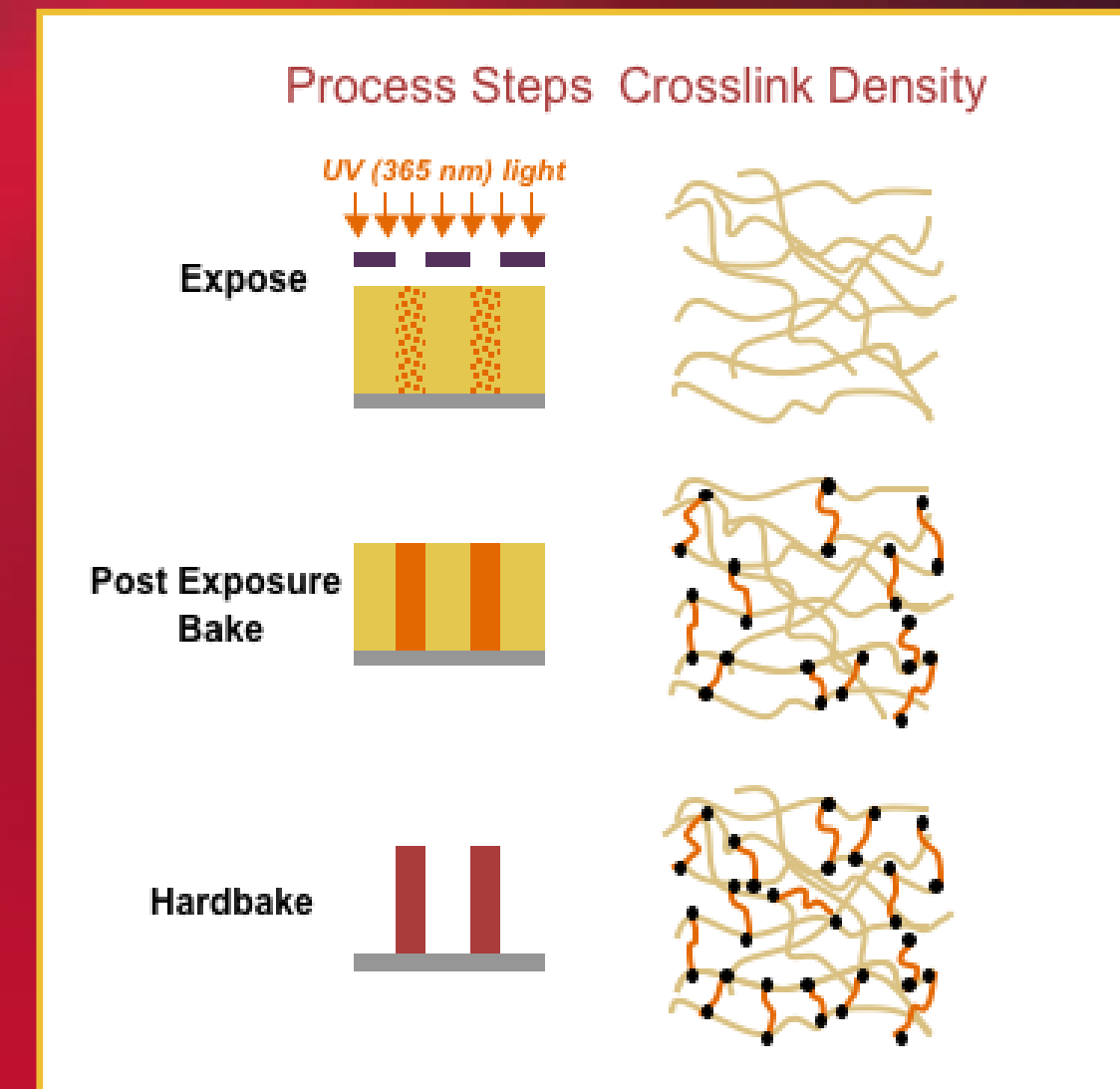
## Incom Fiber Optic Plate

## MicroChem SU-8 Magenta Resist

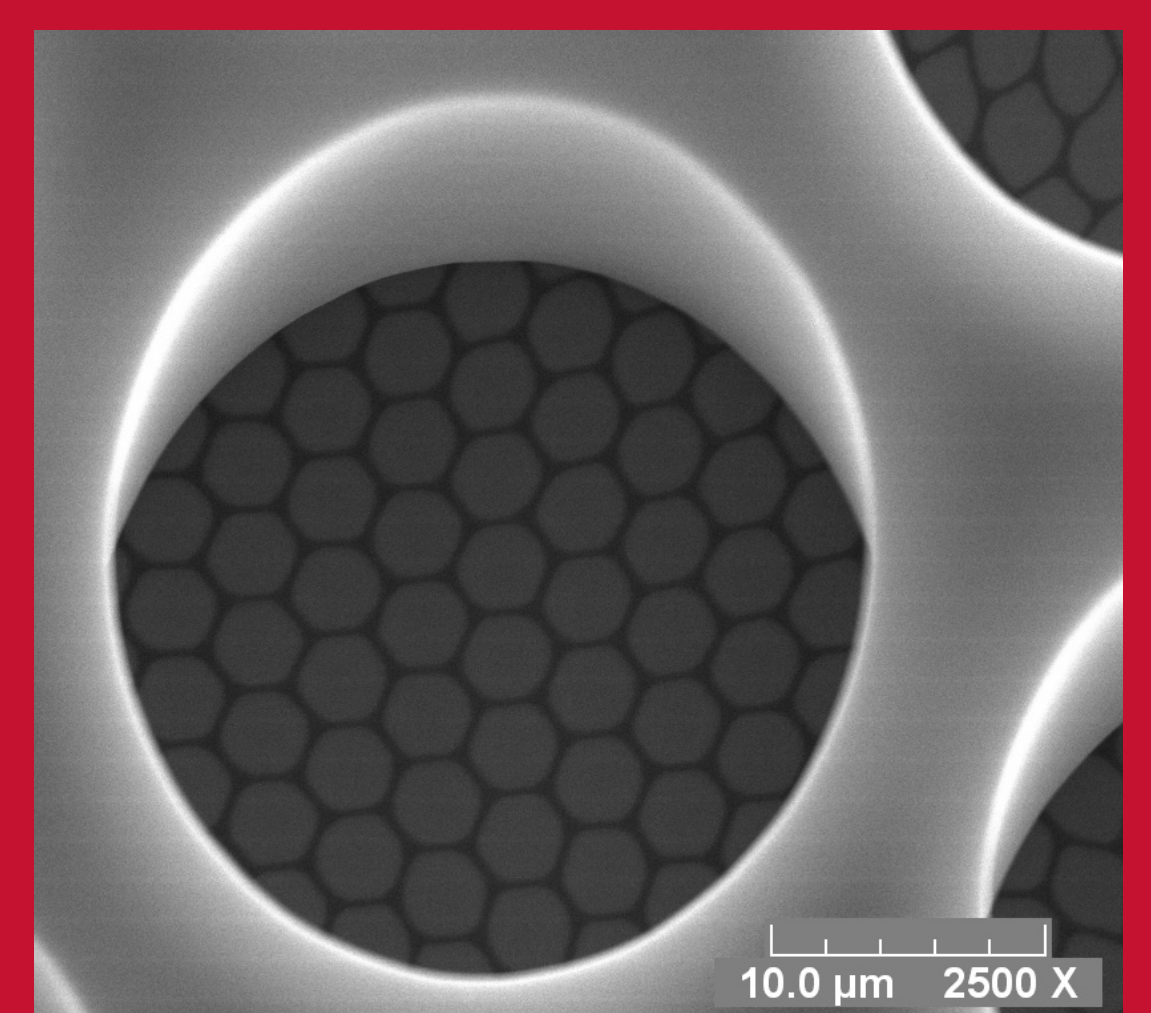
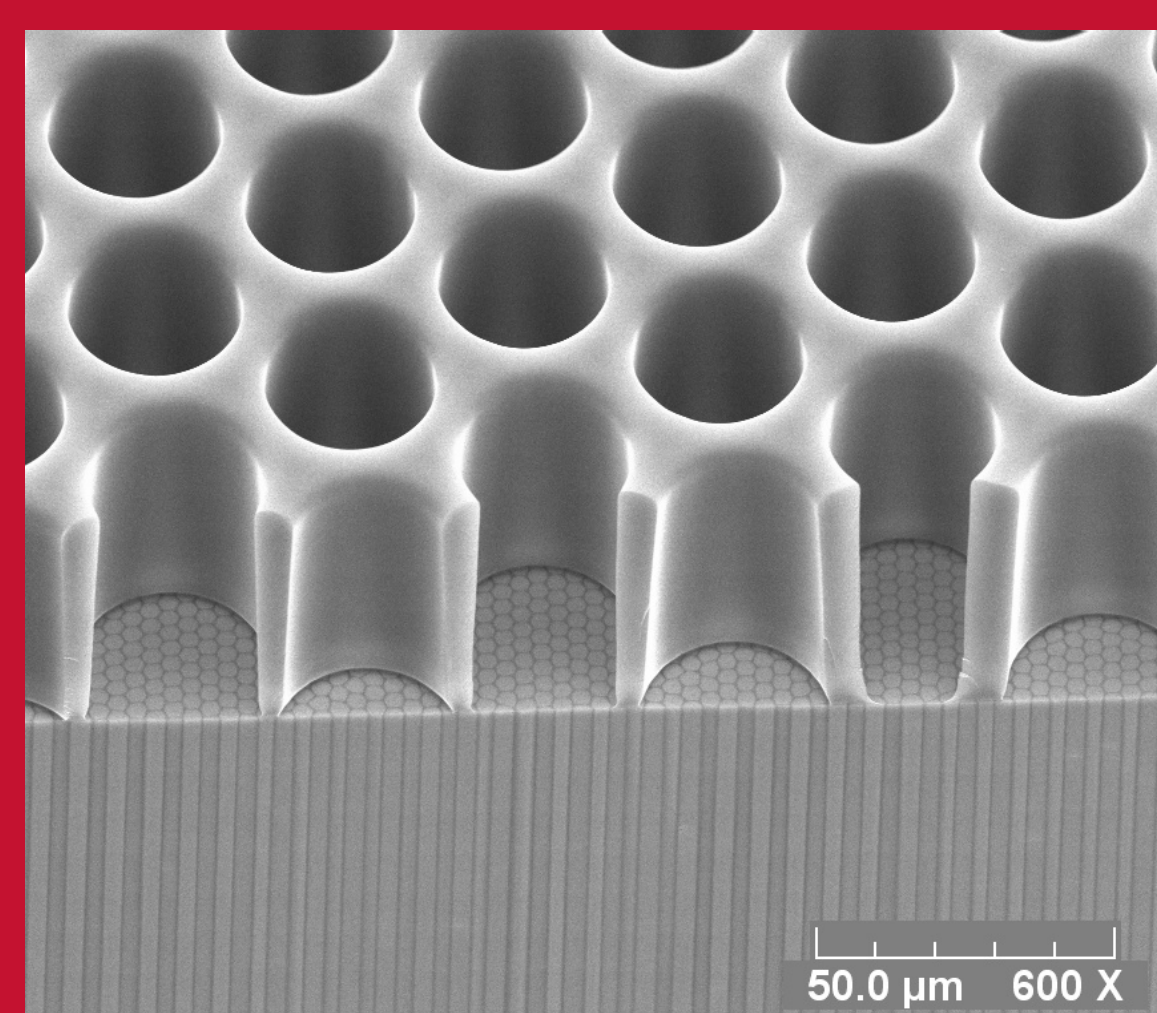
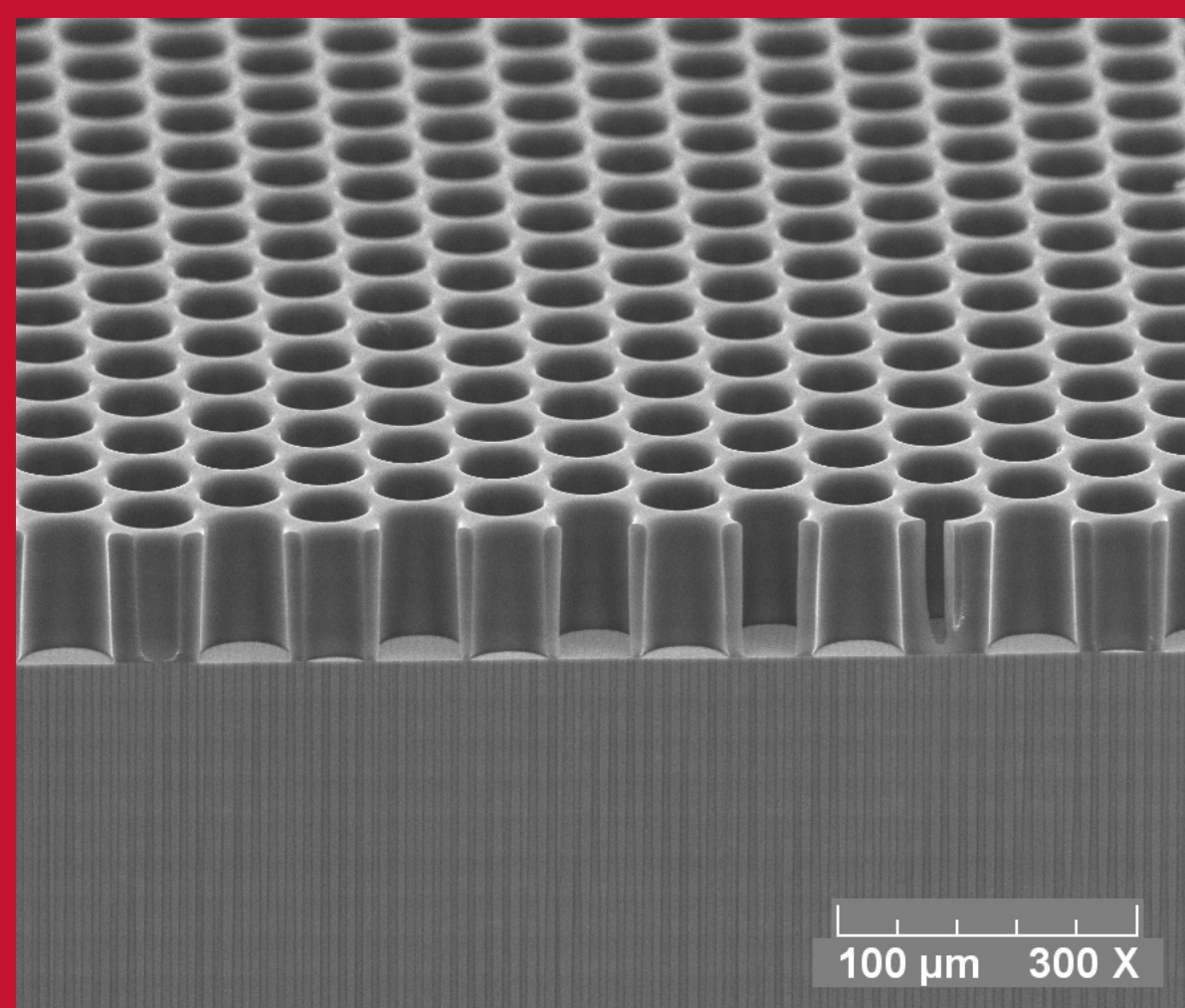
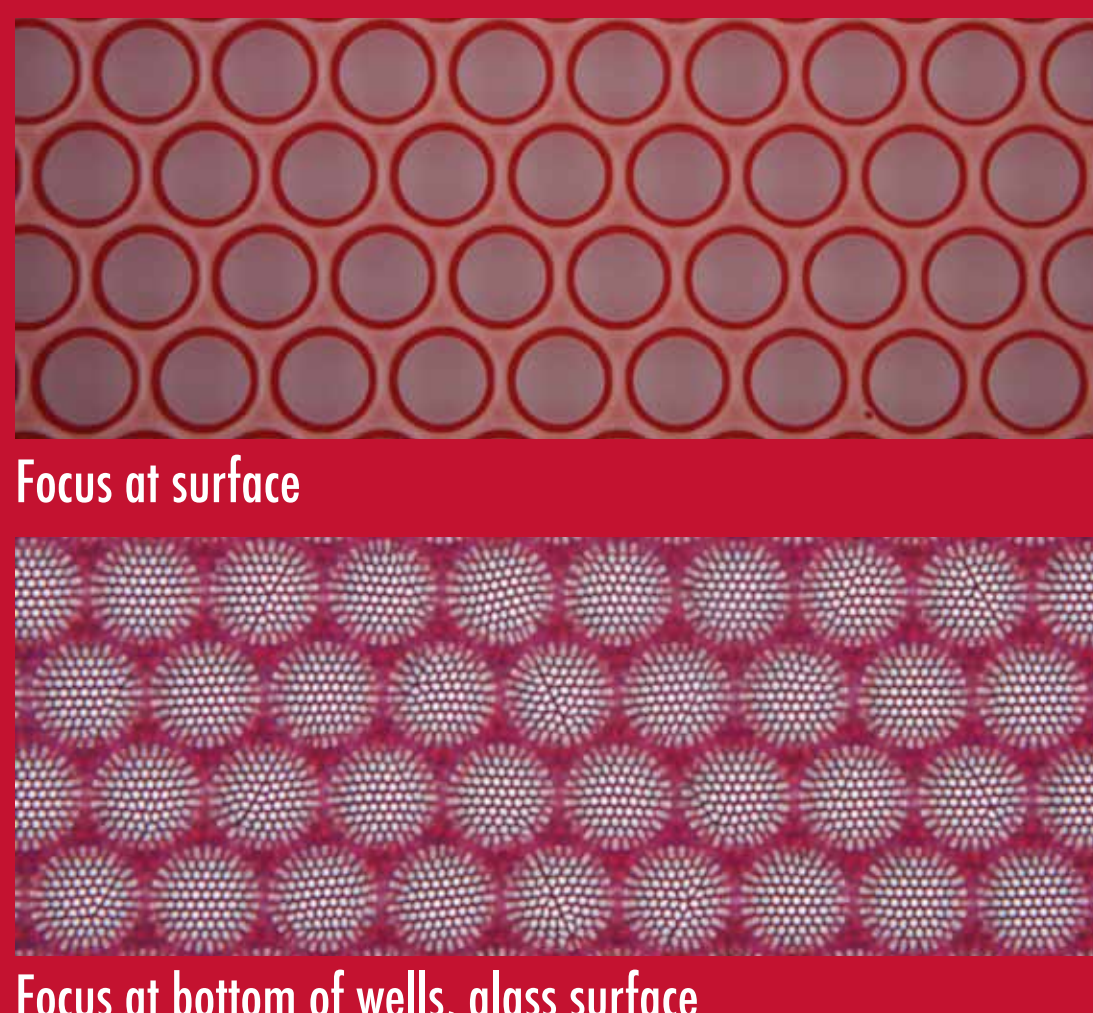
### Process



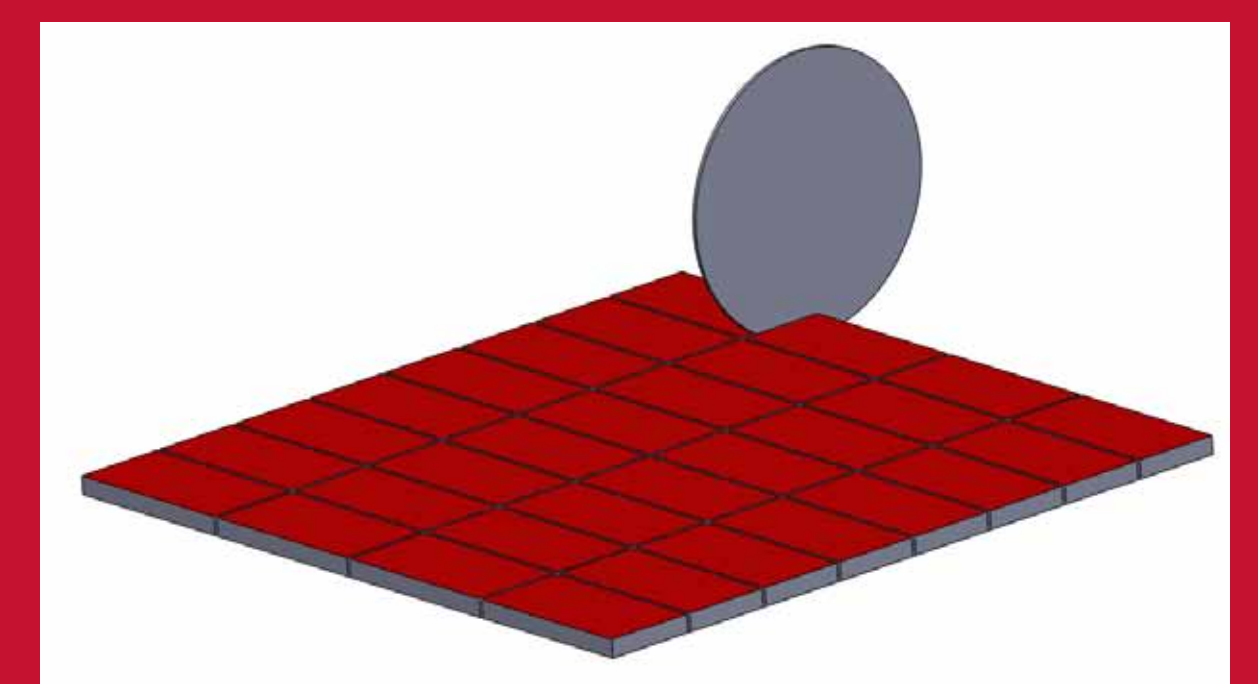
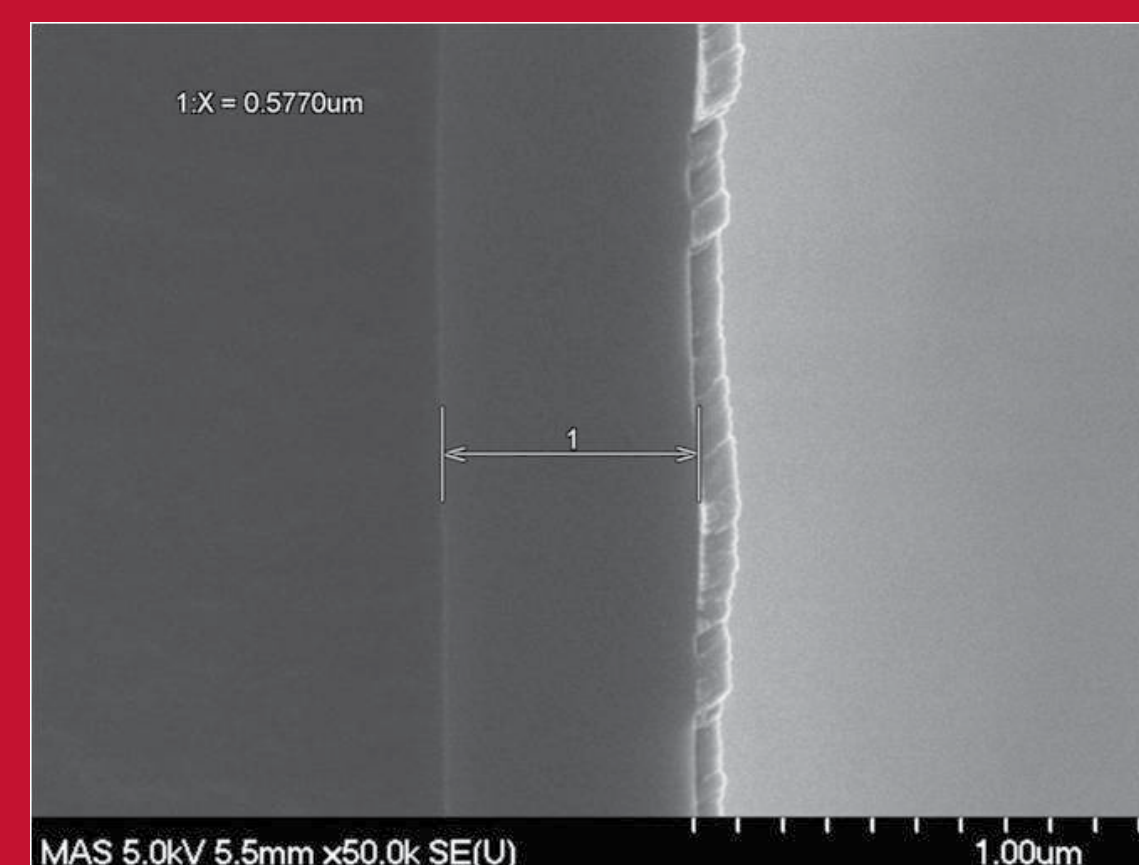
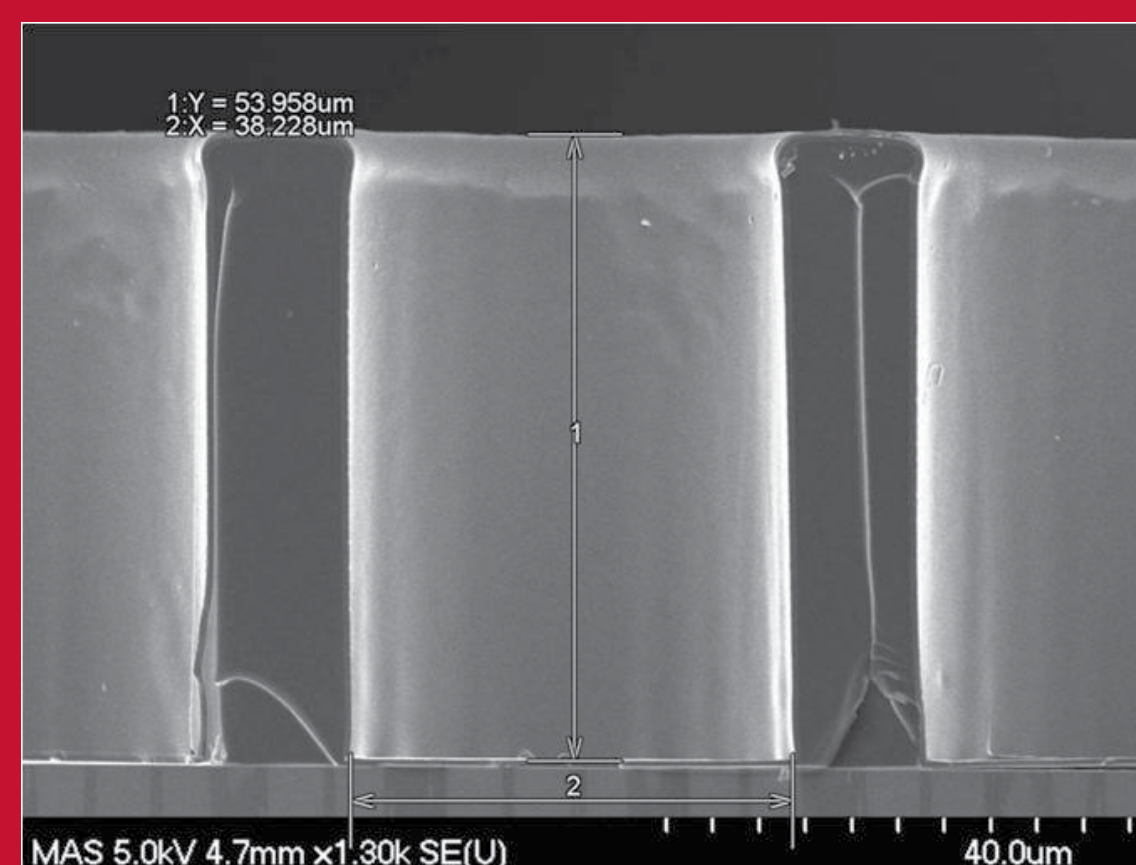
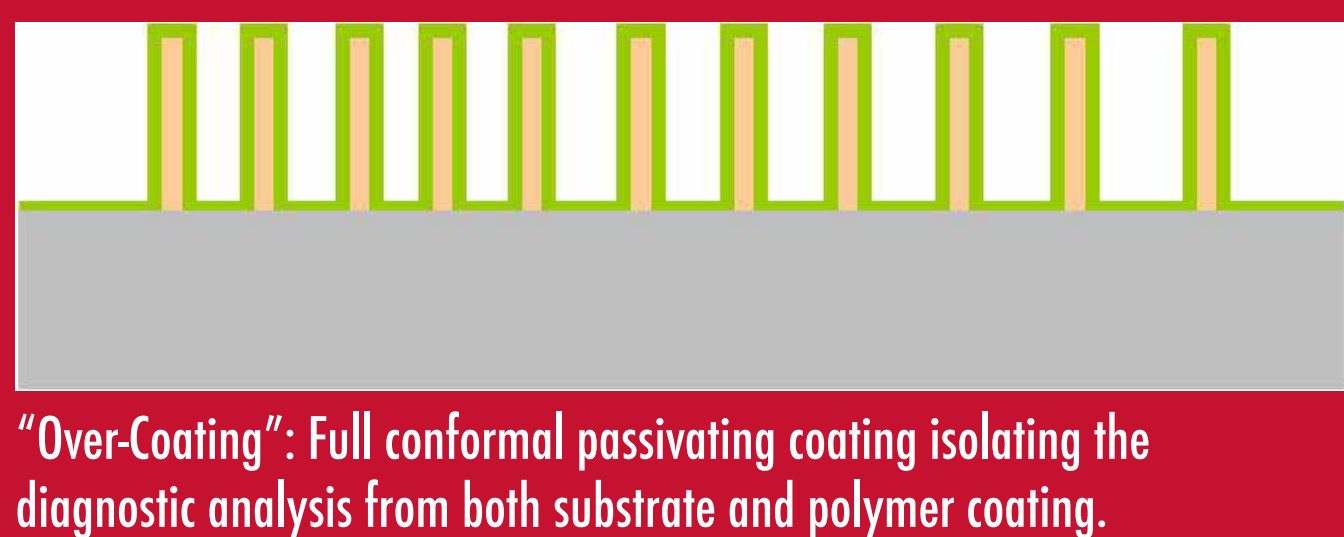
Continuous slot-coating of XP SU-8 Magenta.



### Hybrid Structure

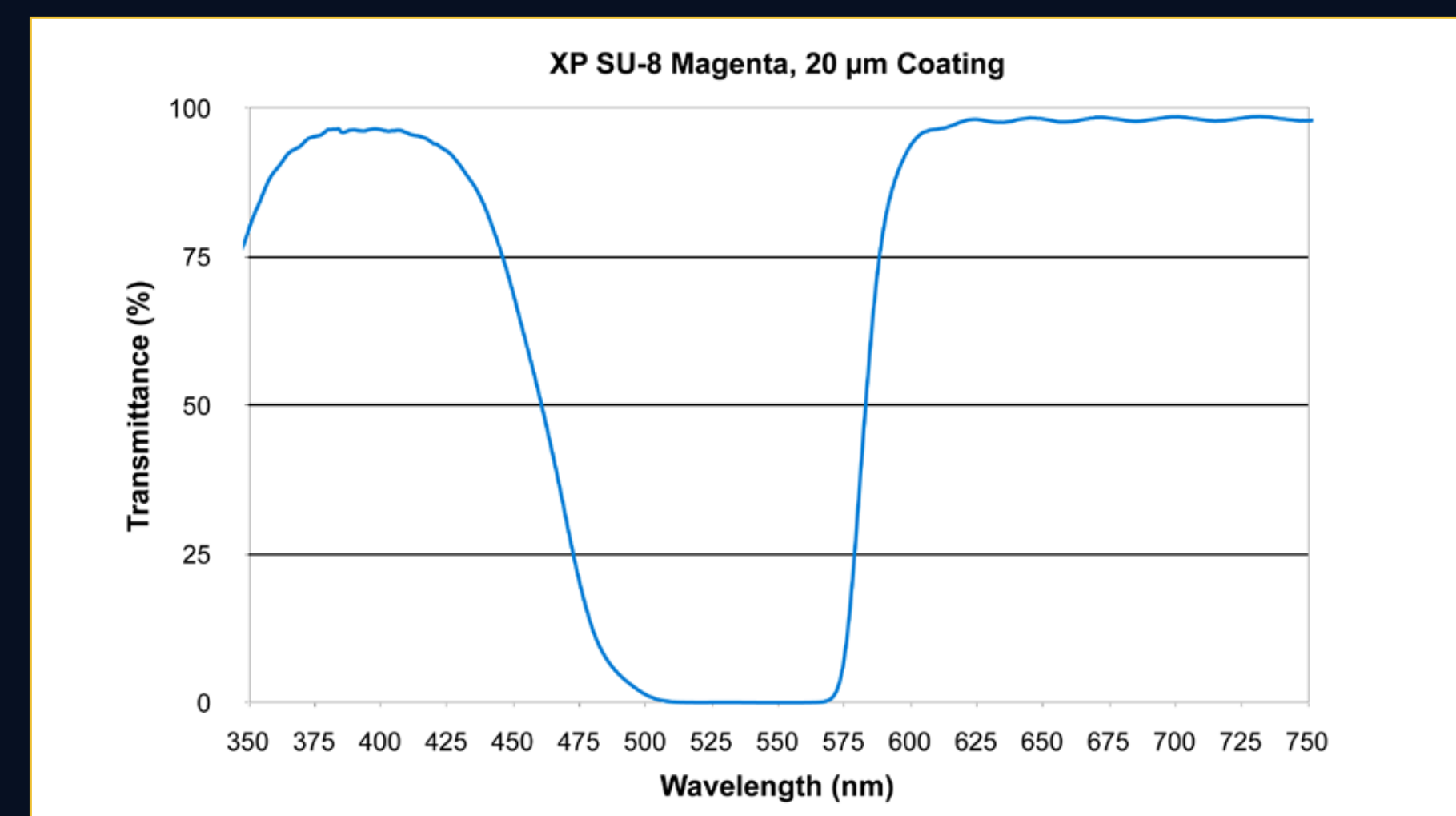


### Fabrication

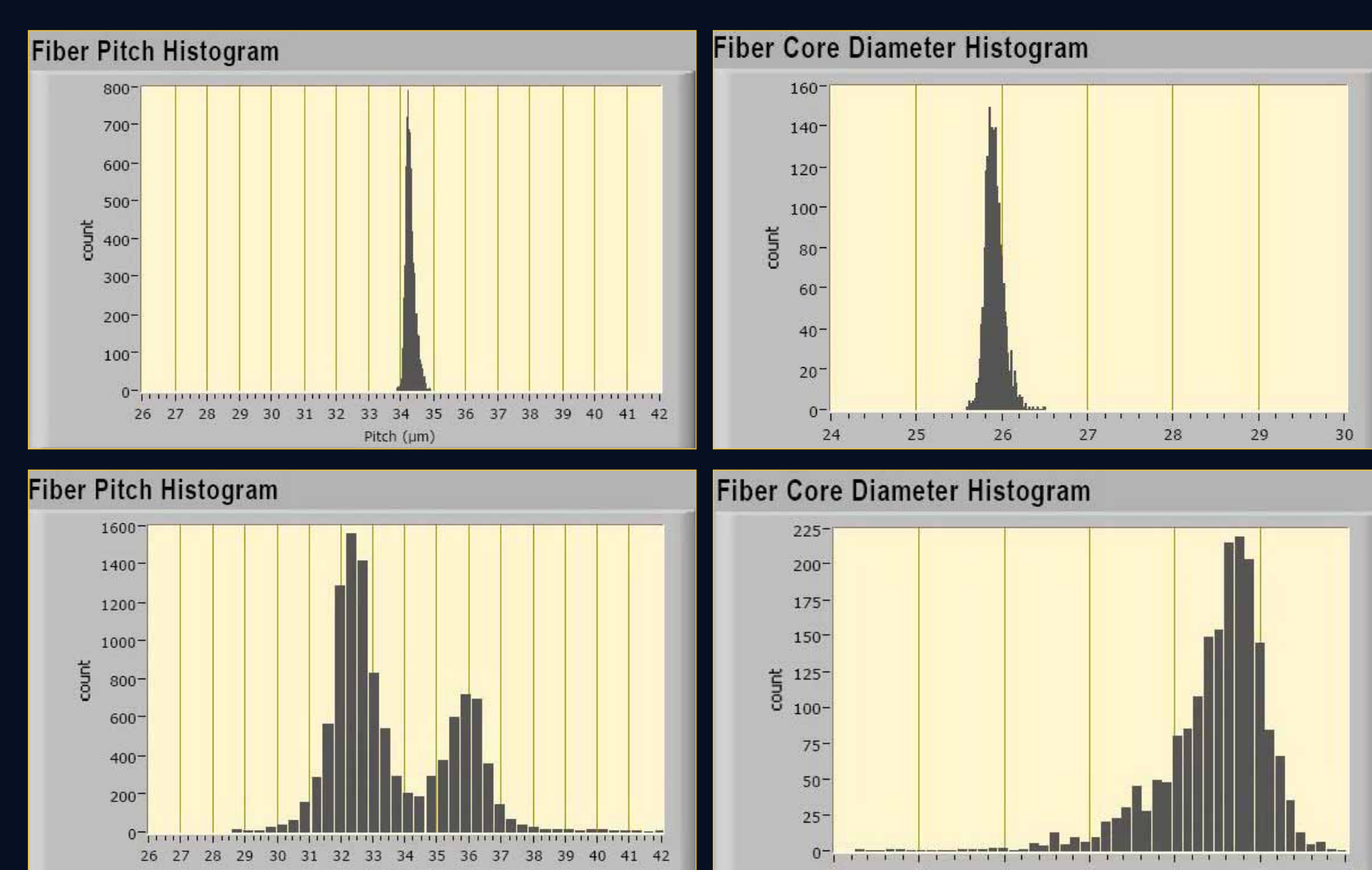


Dice each plate into multiple biochips.

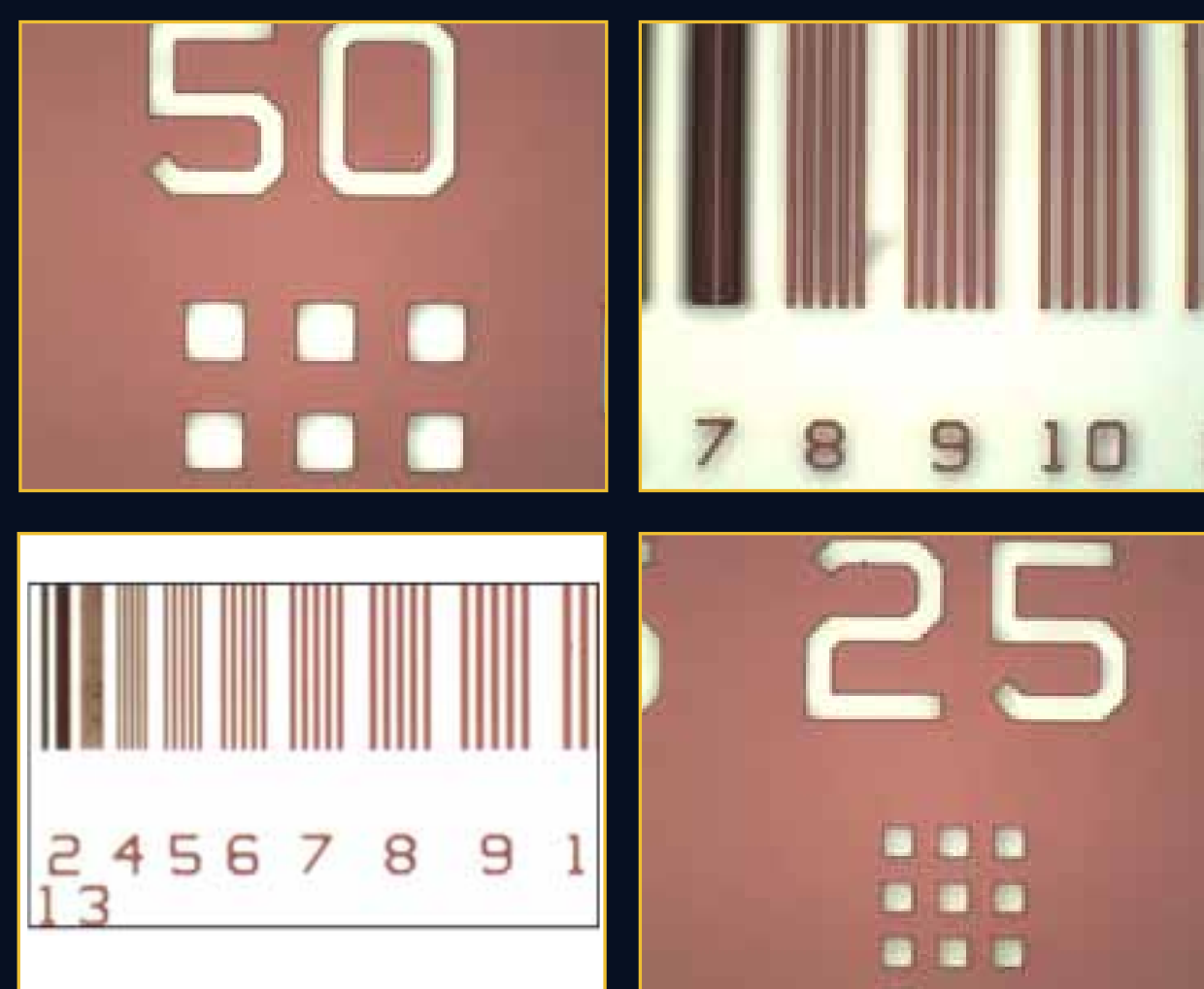
## Performance



Magenta dye blocks cross talk from luciferin reaction. Other dyes can be used.



Microwell pitch and diameter. Hybrid structure (top). Etched glass structure (bottom).



Industry-leading resolution

Property	Test Method	SU-8
Dielectric Constant (at 1 GHz, 50% RH)	ASTM-D-150-98	3.0
Dielectric loss (at 1 GHz)	ASTM-D-150-98	0.018
Dielectric Strength (V/µm)	ASTM-D-149-97a	32
Volume Resistivity (Ω cm)	ASTM-D-257-99	2.3 x 10 <sup>16</sup>
Surface Resistivity, Ω cm	ASTM-D-257-99	NA

Selected electrical properties

Substrate	SU-8 (MPa)
Silicon	82
Copper	75
Gold	62
Silicon dioxide	81
Aluminum	88
GaAs	59
Silicon Nitride	82
Glass, borosilicate	65
Quartz	64

SU-8 adhesion

## Conclusions

Unique attributes of Incom's fiber optic substrate for bottom viewing microarray application:

- Enhanced resolution
- High density
- 100,000 X light collection efficiency
- Reduced chromatic dispersion
- Image transfer eliminates focusing optics
- No optical cross talk between microwells

Hybrid 'polymer on glass' biochip advantages:

- Microwells interrogated by multiple small diameter (3-micron) optical fibers
- Precise control of well diameter, pitch, depth and position
- Wells addressed based on their rectilinear coordinates
- Flexibility to fabricate channels and other shapes
- Spectrally appropriate absorbing chemistries eliminate optical cross talk between microwells
- XP-SU-8 Magenta blocks 480-575 nm transmission eliminating optical crosstalk for luminescent reactions
- Strong shear-strength adhesion to glass
- Chemically resistant in diagnostic environments
- Continuous coating enables fabrication of large wafers that can be diced into hundreds of smaller biochips
- Enables many novel applications

## Market & Applications

Proteomic  
Genomic  
Luminescent-based  
xHigh Density