



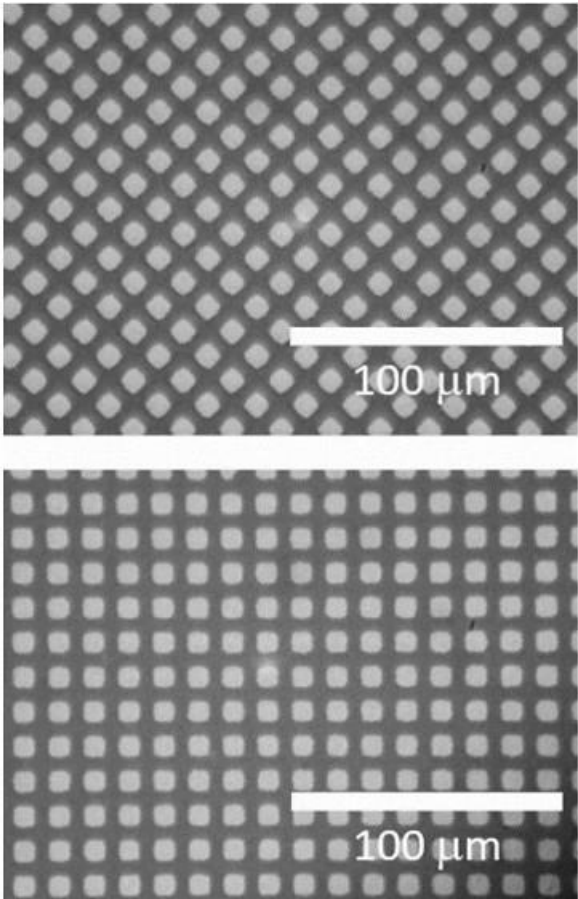
Self-Assembly Patterning of Metals Using ConducTorr™ CPM

Michael G. Helander, PhD

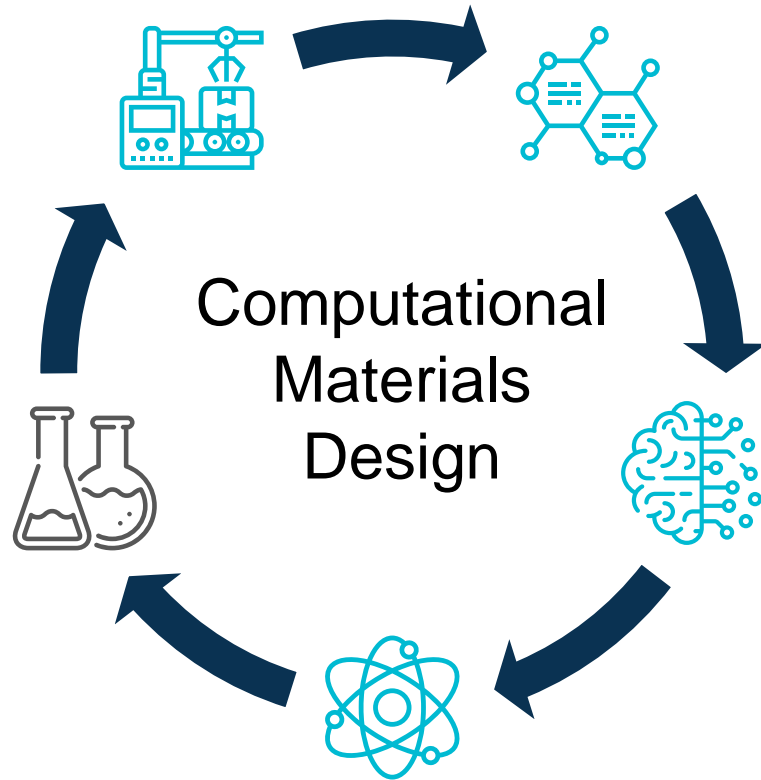
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OTI – Materials Enabled Metal Patterning for Display



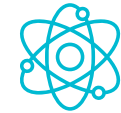
OTI – Computational Materials Design



New Material Concept



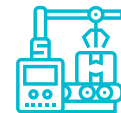
Machine Learning (AI)



Quantum Simulations (HPC)



Synthesis + Scale-up (by Tier 1 partner)



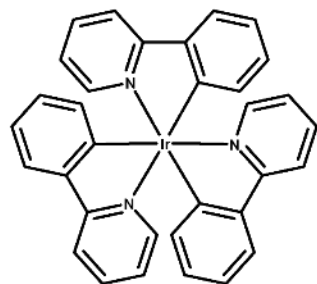
Inhouse Pilot Testing

Enables faster customization of materials at lower costs!

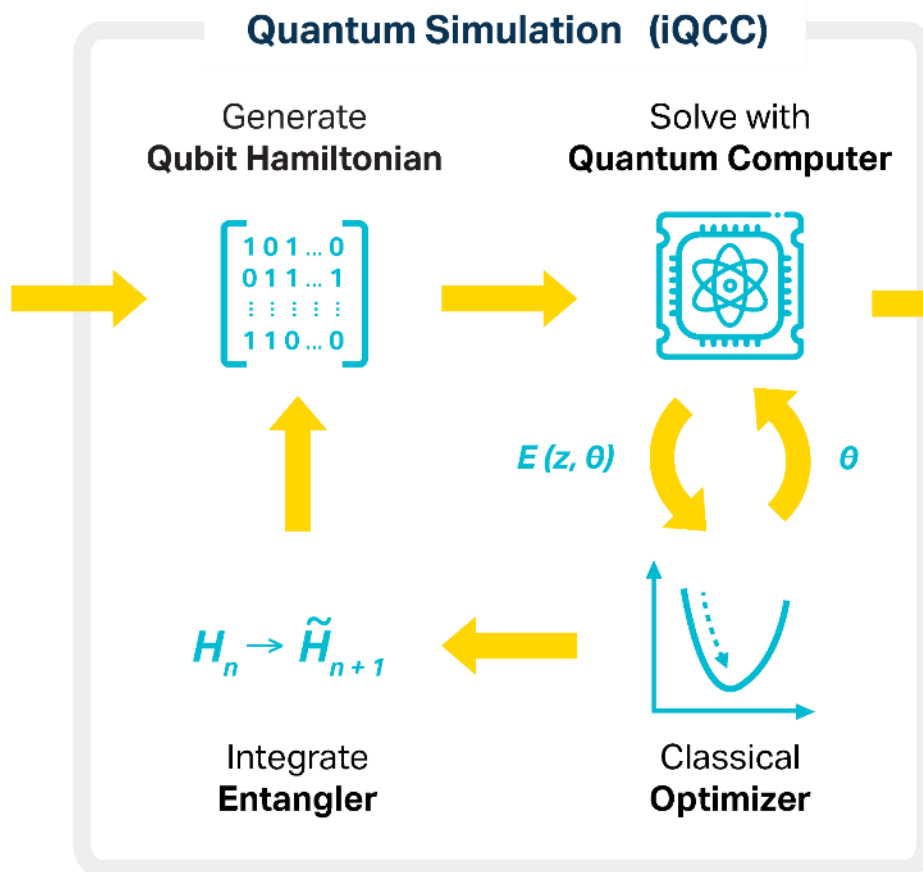
OTI – Quantum Computing for Materials Design



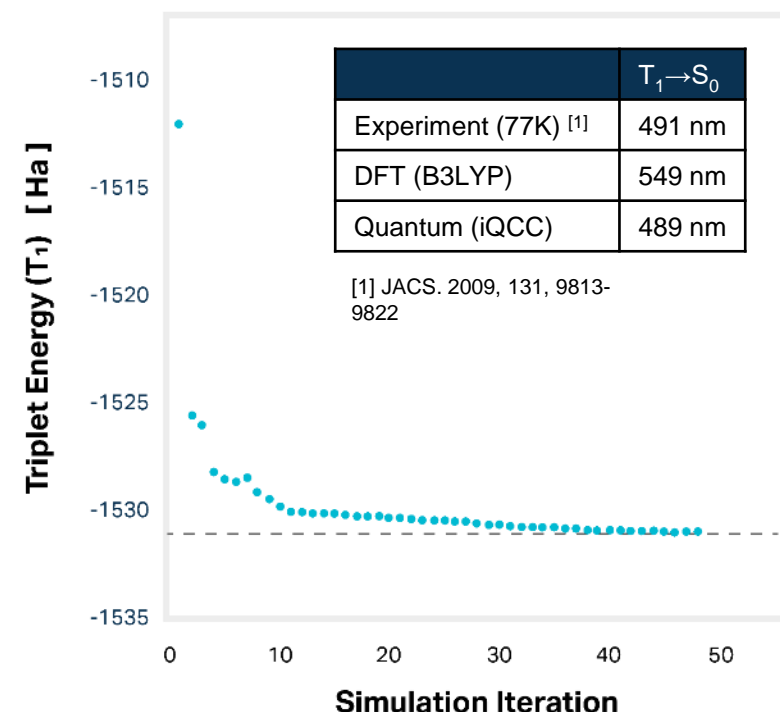
Molecular Structure



Ir(ppy)_3



Predicted Properties



Quantum methods enable faster and more accurate design

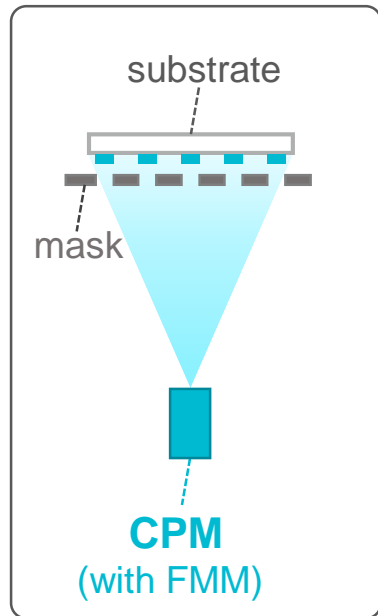
OTI quantum algorithms run on:



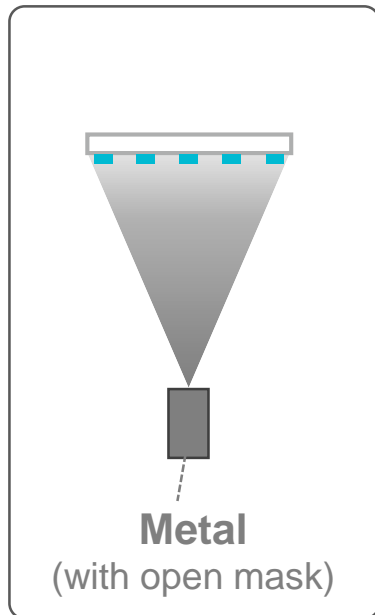
CPM Metal Patterning Process



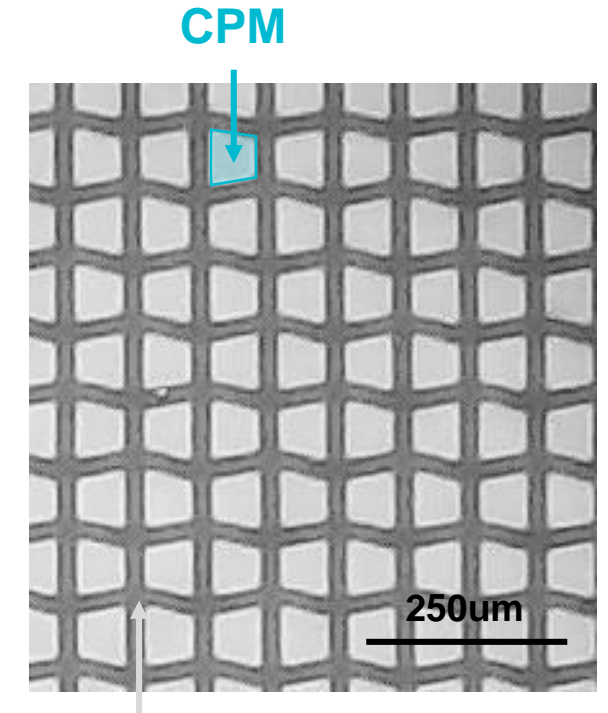
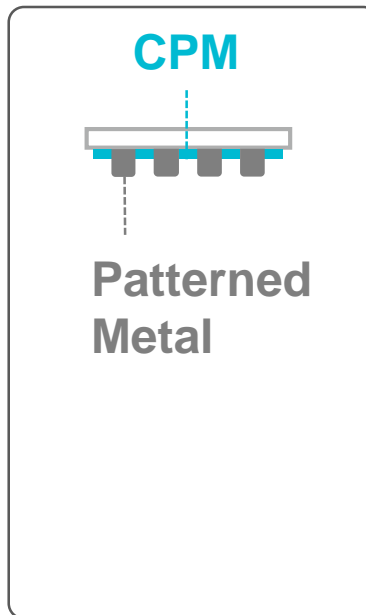
1. Deposit CPM



2. Deposit Metal



3. Self-Assembly



Patterned Metal

* CPM layer can be templated using FMM, printing or laser

CPM Can Pattern Both Large and Small Features

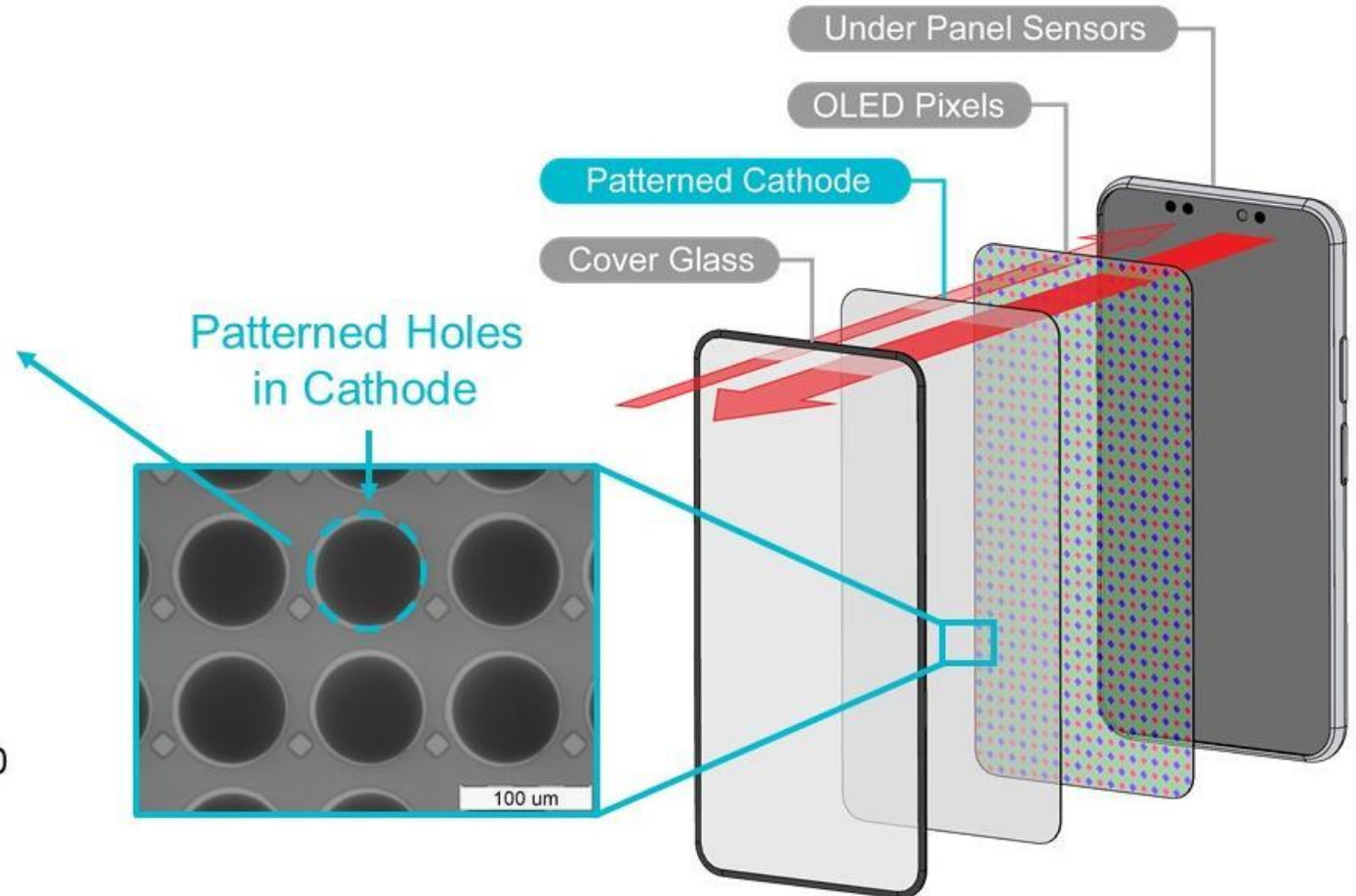
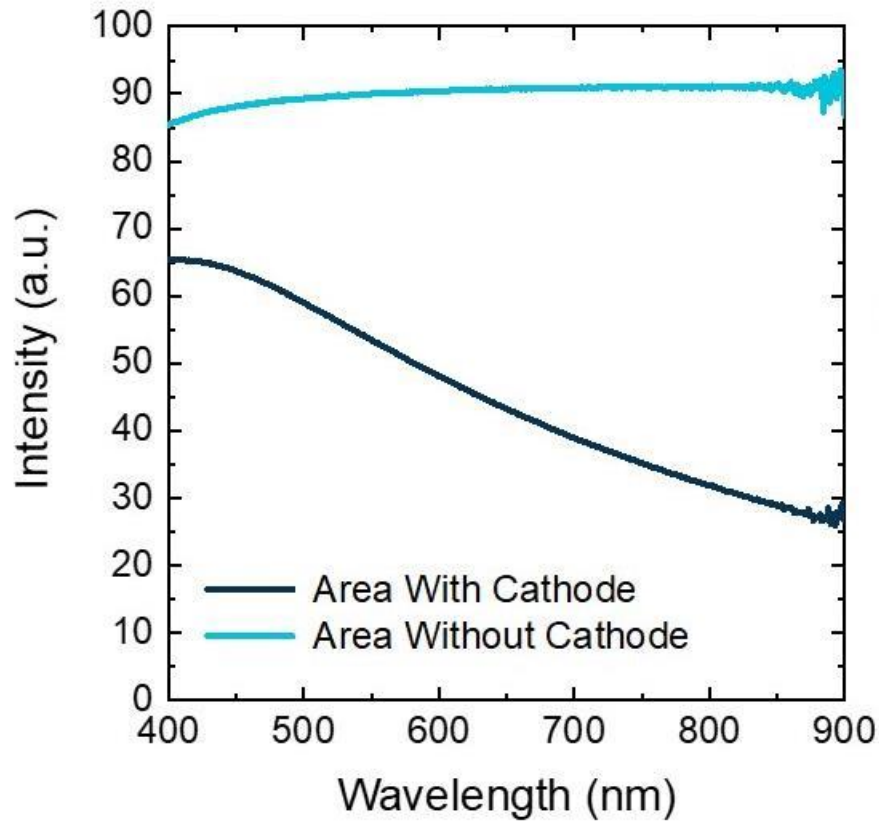


Demo of new CPM patterning MgAg with cm – μm features

CPM Enables Highest Transparency Display Panel



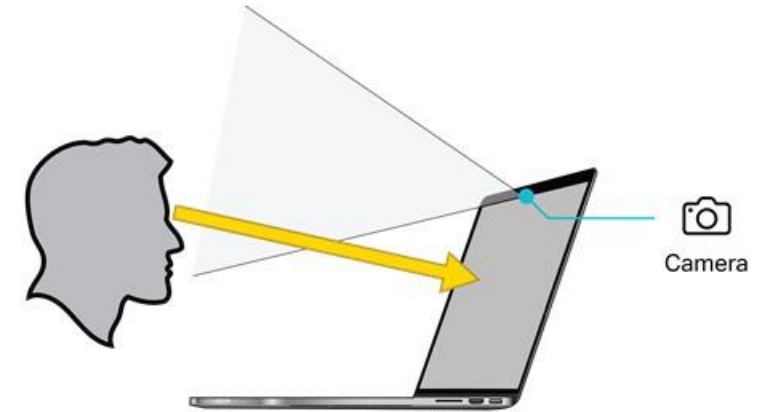
High transparency is essential for under display camera + face unlock



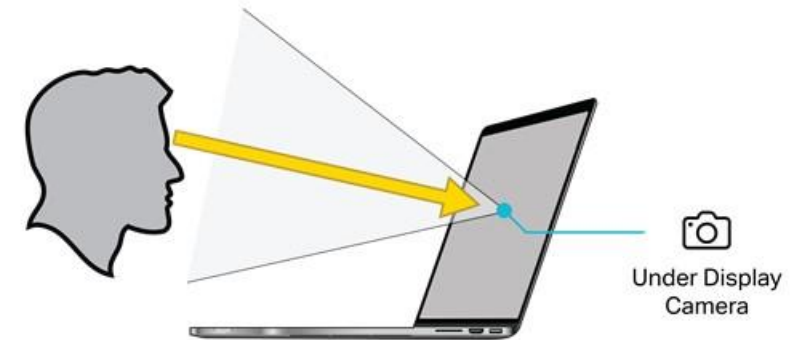
CPM Application for Under Display Camera



Typical Video Call Experience
(participant not looking at camera)



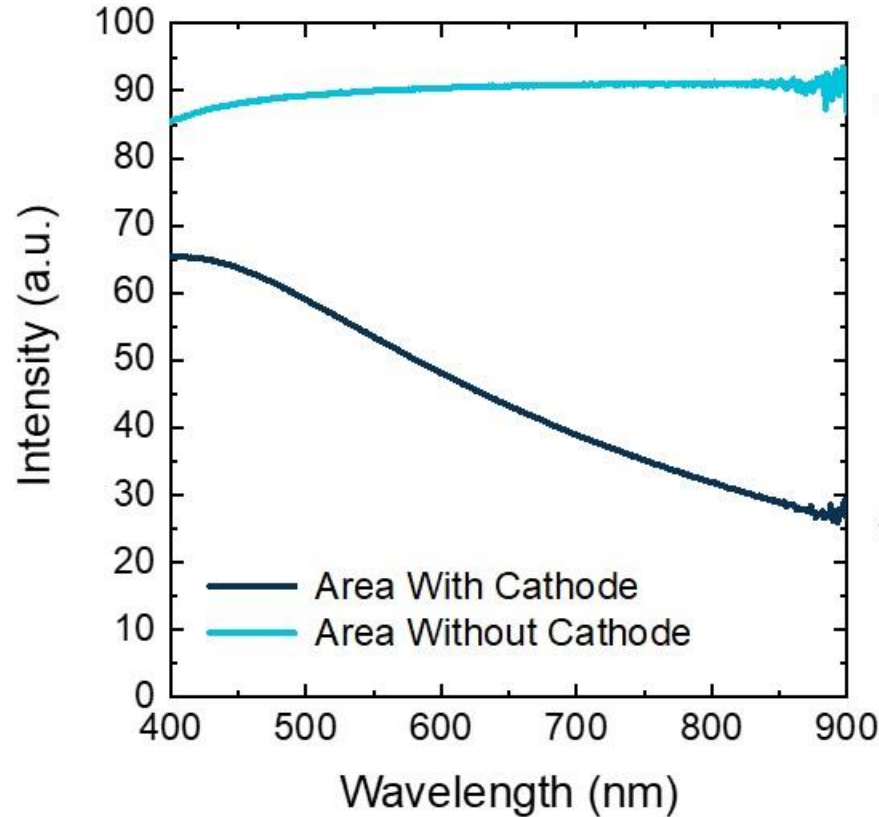
Under Display Camera Experience
(improved engagement + communications)



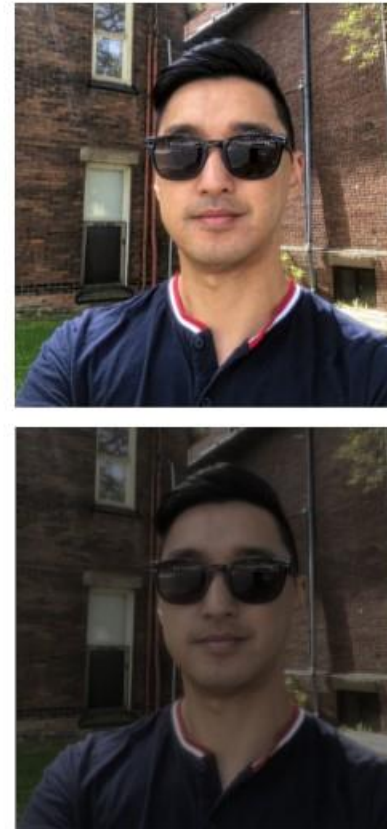
CPM Enables Under Display Camera + Face Unlock



High transparency is essential for under display camera + face unlock



Front Camera



Face Unlock

Face Unlock Works
(tested on iPhone X, XS, 11)



Face Unlock Fails
(tested on iPhone X, XS, 11)

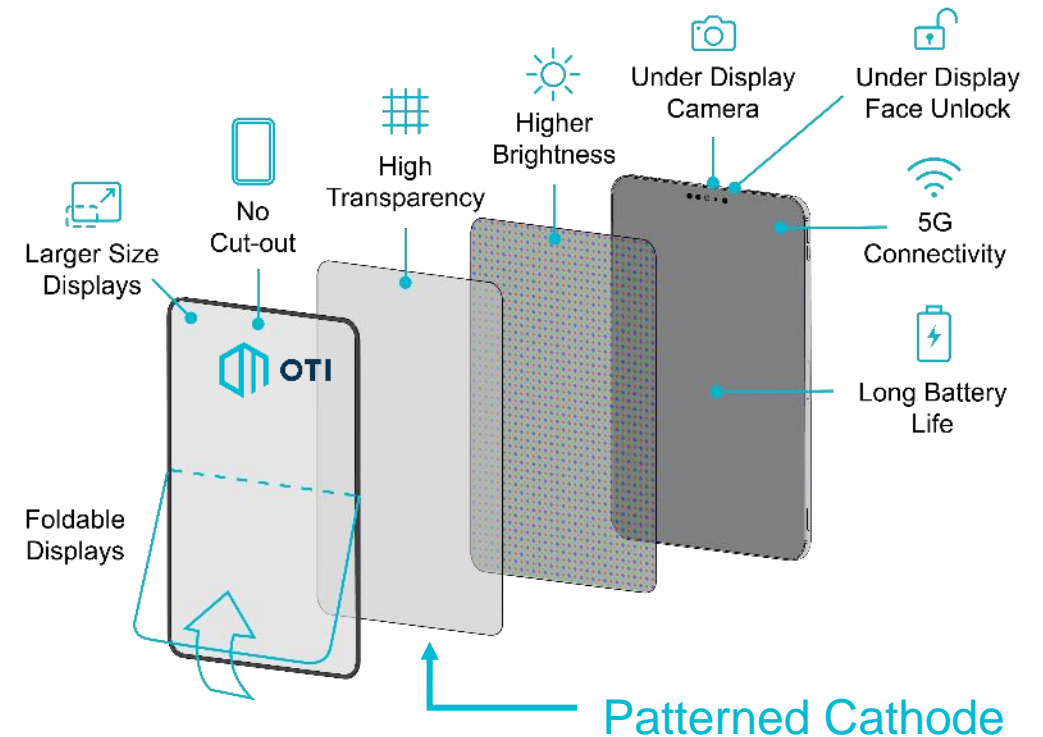


CPM is Enabling New Customer Applications



Display Applications for CPM:

1. Under Display Camera + Face Unlock
2. Transparent Displays for AR
3. Longer Battery Life + Higher Brightness
4. Large Size Panel for Foldable + QD-OLED



CPM is Moving Towards Design Wins in Display



- Materials for mass production are being manufactured by PPG
- Materials have been qualified by multiple display panel makers up to Gen 6 lines
- AMOLED modules are currently being qualified with Tier 1 device makers
- Expected first devices to ship in 2021



CPM has Multiple Applications Beyond Display

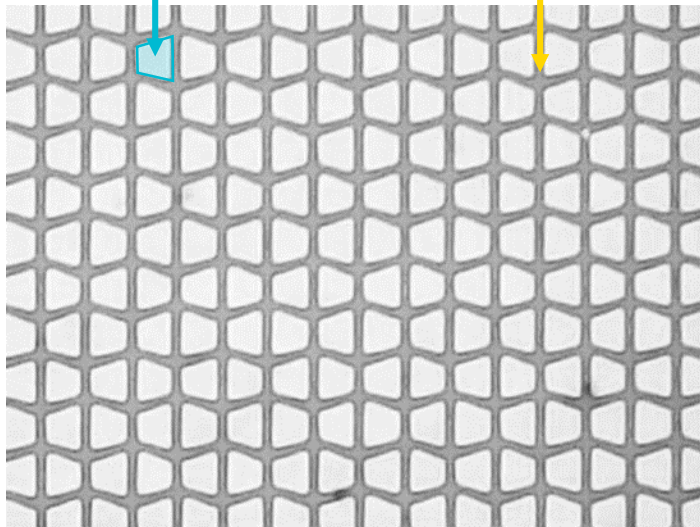


Next generation CPM will pattern most metals!

Next Gen CPM

(under development)

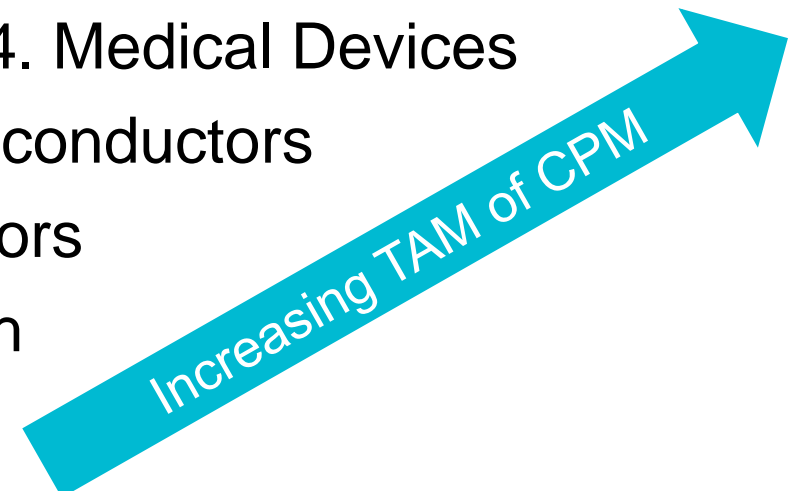
Patterned Cu



Cu patterned using development CPM

Multiple Future Markets for CPM:

1. Antenna + Touch
2. IOT Sensors
3. Semiconductors
4. Medical Devices



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Thank You