Assembly and Inspection of Liquid Crystal on Silicon (LCoS) Devices

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Outline

• LCoS Structure
• General Assembly Techniques
• Pre-Inspection
• Inspection of Assembled LCoS Test Cells
• Cell Gap Measurement
• Conclusion
Architecture of Liquid Crystal on Silicon

Bond Wires  Spacers  Liquid Crystal  ITO Contact  Glue Seal

Cover Glass

Silicon

Substrate
Layer Structure of Liquid Crystal on Silicon Devices
Standardization Assembly Procedures

Glass Cutting → Glass Cleaning → Pattern ITO → Edge Contact → Alignment Layer → Glue Seal → Custom Glue Printing Process

Glass

Custom Jigs Assemble 4 Devices → Cell Assembly → Bonding Substrate → Fill Cell

Vacuum Filling Rig

Probe Station → Photoresist Passivation → Wafer Saw → Wafer Coating → Alignment Layer

Silicon
Ultra Compact 40mm Fizeau Interferometer for Flat or Spherical Surfaces
The Purpose of pre-inspection of the substrates is matching the curvatures of the silicon (the left figure) and the glass (the right figure).
Assembled LCoS Test Cell 1

Measurements in the central area is approximate 1nm/mm variation in x-direction and 2.4 nm/mm variation in y-direction.

10mm*15mm Assembled LCoS Test Cell 1
Uniformity of LC layer Mapping
Assembled LCoS Test Cell 2

More measurements have been implemented indicating the location of 48 points of cell gap thickness.

7mm*12mm Assembled LCoS Test Cell 2
The Histogram of the 48 thickness measurements, where 26 of them are between 2.44µm to 2.48 µm; The Table summarize the cell thickness results.
Assembled LCoS Test Cell 3

Only 2 dot measurements are implemented. Because the consistent interference color in the central area illustrates a best result for the uniformity of the active area using the modern robotic machine.

7mm*12mm Assembled LCoS Test Cell 3
The Kadett Semi-Automatic Device Bonder from SET for High Accuracy Assembly
Conclusion

• Optical pre-inspection is employed for quality LCoS assembly techniques
• Semi-Automatic bonding device from S.E.T is used for excellent accuracy assembly techniques
• Reproducibility of cell assembly results i.e. cell gap uniformity is ascertained.
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