DIE (HBM) LEVEL TEST HANDLER

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TestConX한국 Korea

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- DIE (HBM) Characteristics & Test Environment
- DIE (HBM) Reliability Test Issues
- Resolving issues in DIE (HBM) reliability testing
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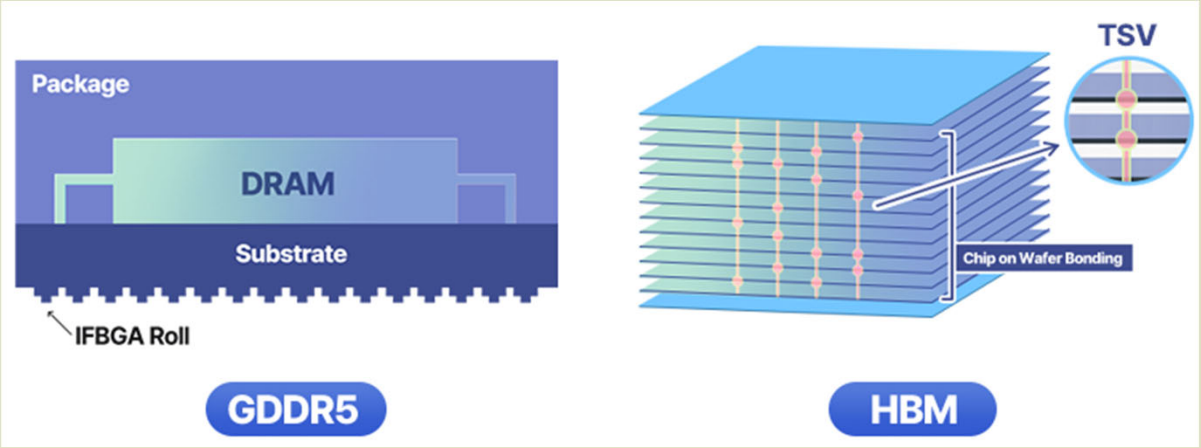
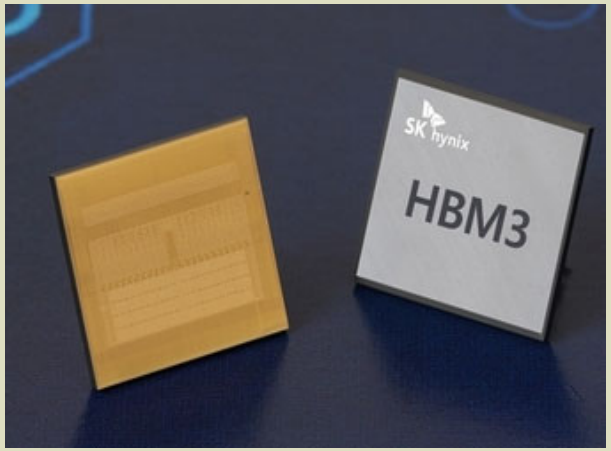
1. Introduction to DIE(HBM)



Source: Samsung Electronics



Source: SK Hynix

- High Bandwidth Memory (HBM) is a 3D-stacked synchronous dynamic random-access memory
- To increase bandwidth, the width of the bus is expanded
- Achieve high bandwidth and power efficiency while maintaining a small form-factor

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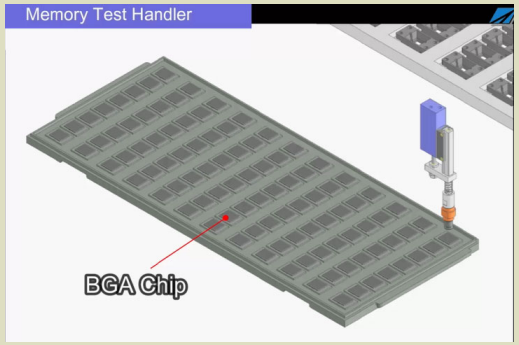
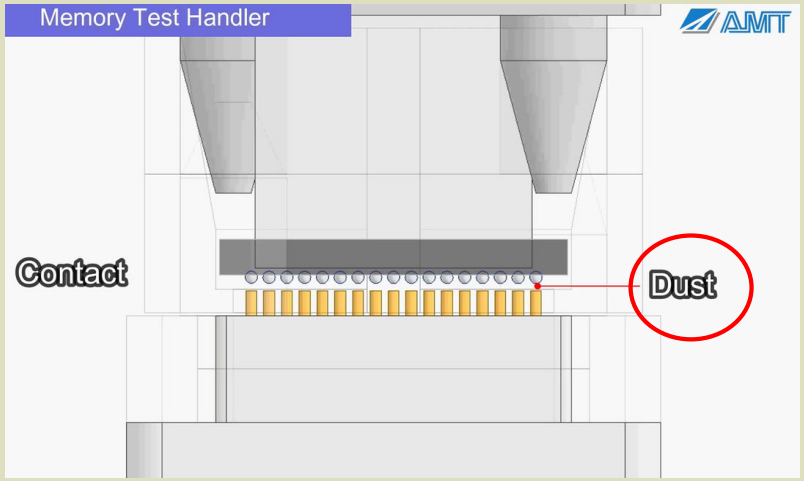
2. DIE (HBM) Characteristics & Test Environment



Dust Particle



➢ Dust particle contamination issue in DRAM Test Handler

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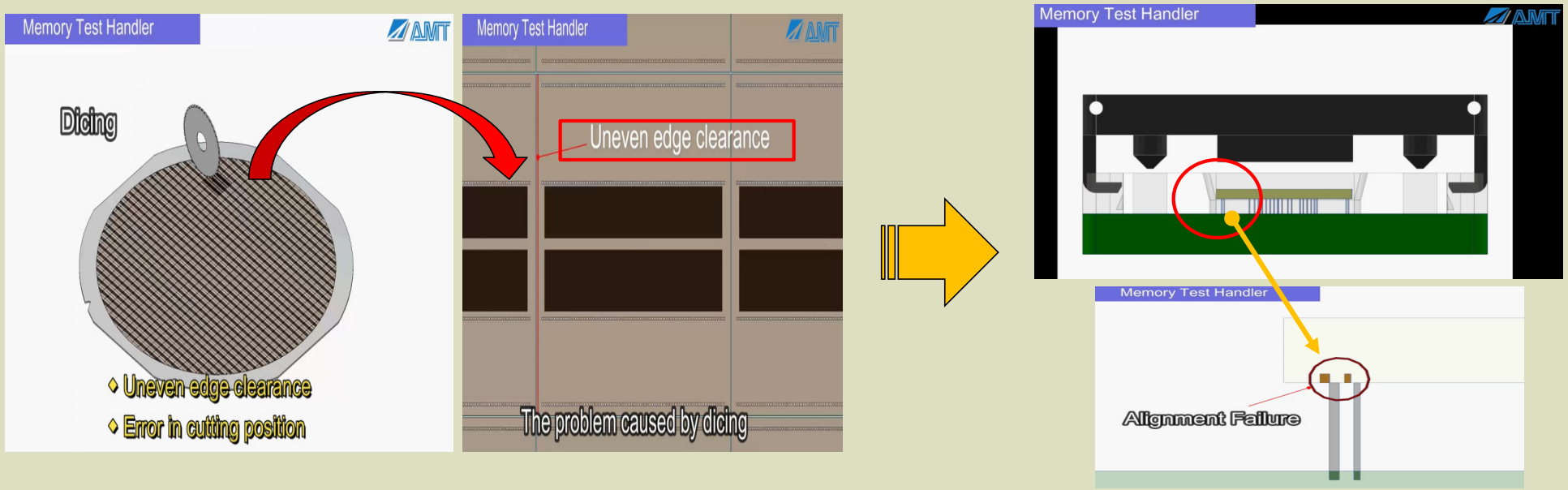
2. DIE (HBM) Characteristics & Test Environment



Die Alignment Failure

➢ Deformation of the DIE(HBM) shape occurs after dicing the wafer

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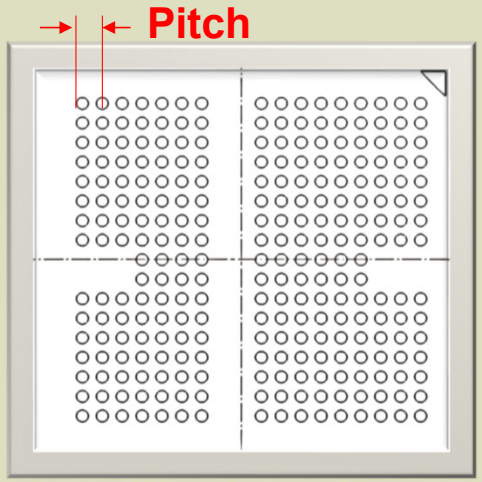
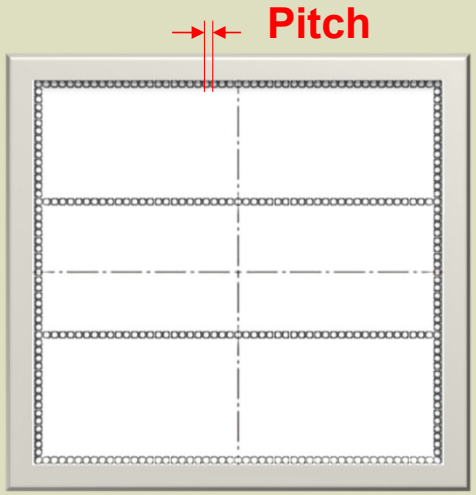
2. DIE (HBM) Characteristics & Test Environment

○ BGA Type : 0.3mm ↑



VS

○ HBM Pad Pitch : 0.1mm ↑



➢ Pad pitch width structure of DIE (HBM) finer than DRAM

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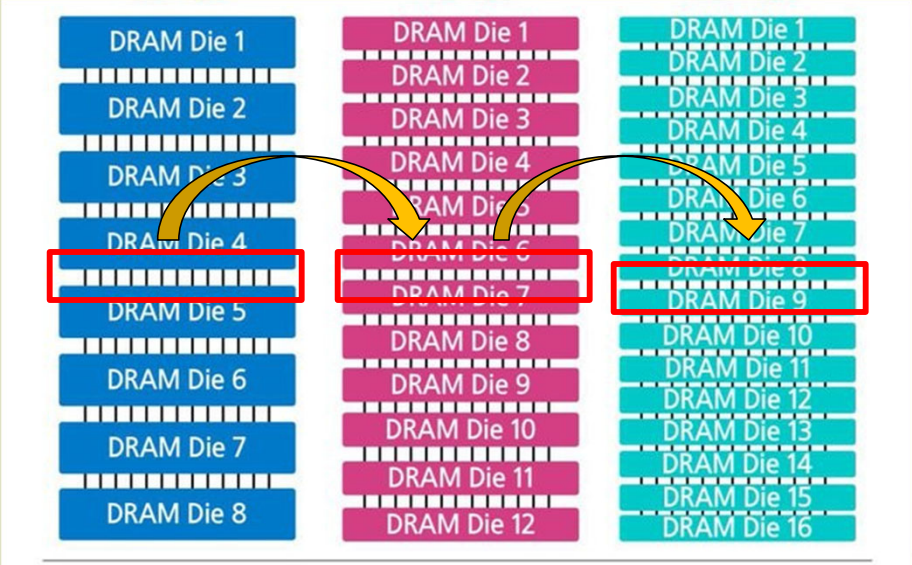
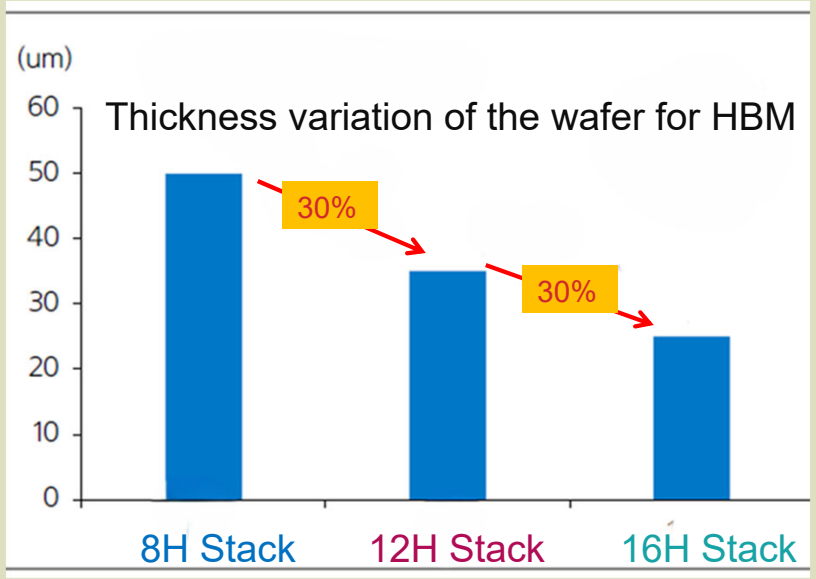
2. DIE (HBM) Characteristics & Test Environment





Source : Samsung Securities

- The more DIEs are stacked, the narrower the gap between them, leading to heat generation and dissipation issues

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2. DIE (HBM) Characteristics & Test Environment

Spec	Data Speed (Gb/s)	BandWidth (GB/s)	Maximum Stack Height	Voltage(V)	Maximum DRAM Capacity(Gb)	Maximum device Capacity(GB)	Application Year
HBM 1	1.0	128	8	1.3	16	16	2015년
HBM 2	2.0	256	8	1.2	16	16	2016년
HBM 2E	3.6	461	12	1.2	24	36	2020년
HBM 3	6.4	819	16	1.1	32	64	2023년
HBM 3E	9.6	1229	16	1.1	32	64	2024년
HBM 4	?	?	?	?	?	?	2026년

Source : Rambus

- Fast data transfer speed , High Bandwidth, High capacity , Low latency, High-density Manufacturing
- Thermal Management issues , Complex Structure

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3. DIE (HBM) Reliability Test Issues

A. Dust particle contamination issues in DIE (HBM)

B. Shape deformation issues after dicing DIE (HBM)

C. Pin contact issues due to fine pad pitch in DIE (HBM)

D. Heat generation issues during DIE (HBM) reliability testing

E. Test stability issues during DIE (HBM) reliability testing [High – Frequency]

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4. Resolving issues in DIE (HBM) reliability testing

- DIE(HBM) TEST HANDLER SPEC

Item	Description
Test Parallel	64Para, 128Para, 256Para
Test Device	HBM, BGA, CSP, MCP, POP, etc.
Loader & Unloader	Wafer Ring Frame (Cassette or FOUP), JEDEC Tray(Option)
Test Site	Probe Station : Probe Card or Fine Pitch Hi-Fix Board Tester : Ultra flex HPM, T5503HS, T5833, T5391, i7000, MT6133, etc
	Stage (X,Y,Z,θ) : Dual
	Die Align Accuracy(±5㎛)
	Hot & Cold : -45°C ~ +125°C (±1℃), 145°C (±1.3℃)

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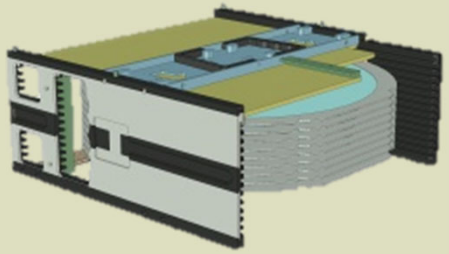
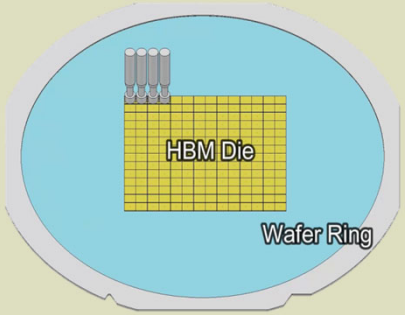
4. Resolving issues in DIE (HBM) reliability testing

A. Dust particle contamination issues in DIE (HBM)

- Contamination prevention through improvements in DIE (HBM) load/unload methods



Cassette / FOUP Stacker



Wafer Ring

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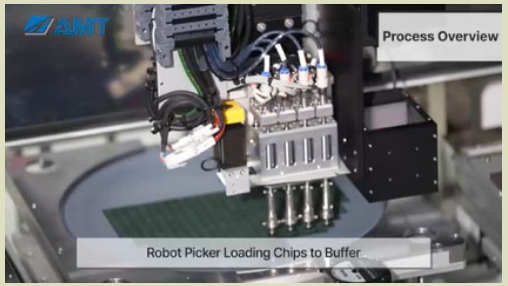

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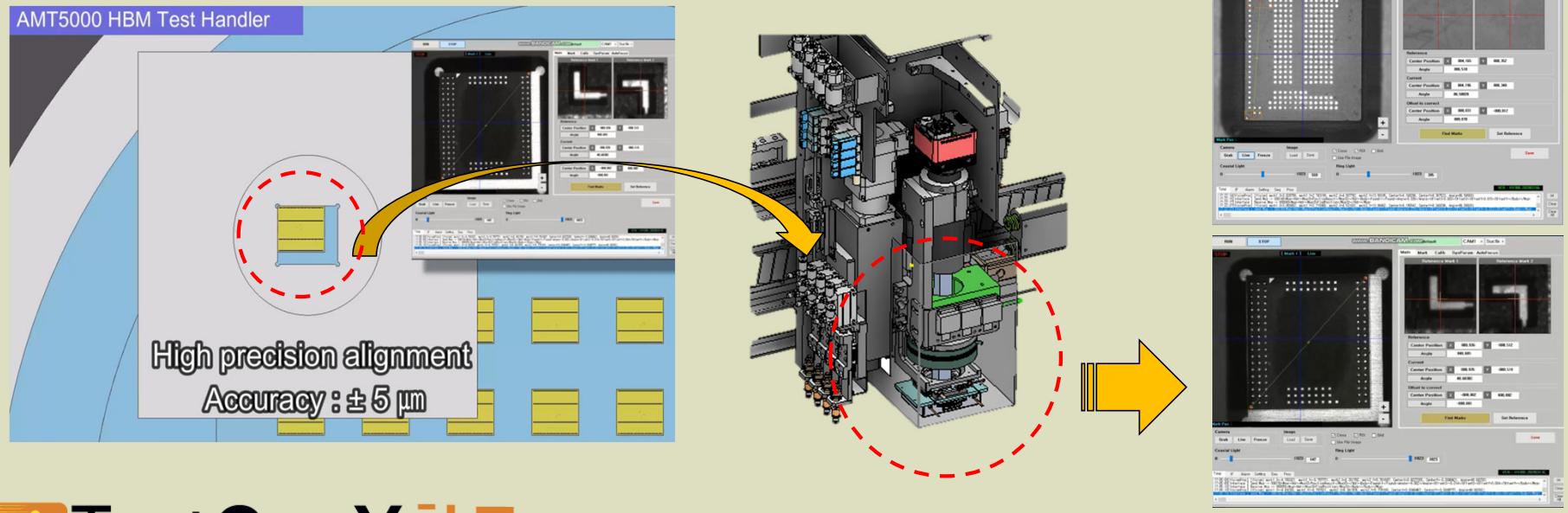
4. Resolving issues in DIE (HBM) reliability testing

B. Shape deformation issues after dicing DIE (HBM)

➢ DIE Aligner & Vision ▶ DIE Align Accuracy = ±5㎛ (pad standard)

Alignment of DIE (HBM) within the range



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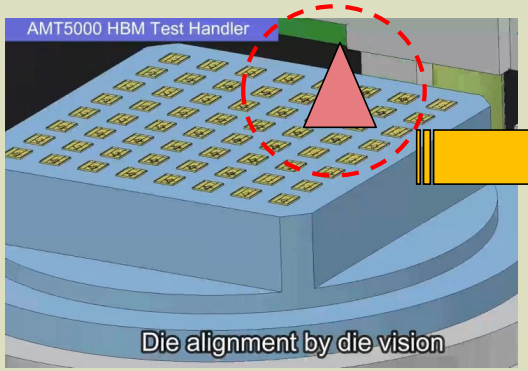
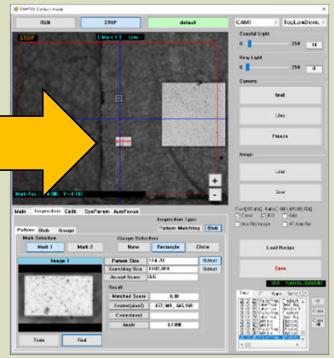
4. Resolving issues in DIE (HBM) reliability testing

C - 1. Pin contact issues due to fine pad pitch in DIE (HBM)

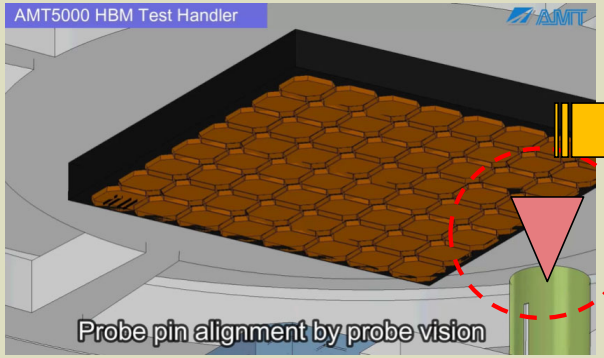
- Check the variation in the position of socket pins and DIE pads using vision systems at the head stage and probe station

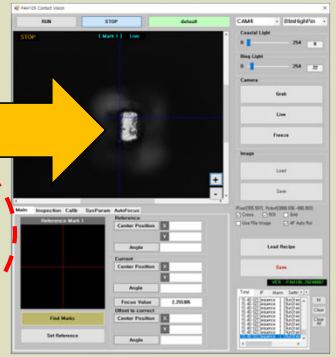




Die Alignment by Vision

Die Pad





Probe Pin Alignment by Vision

Socket Pin

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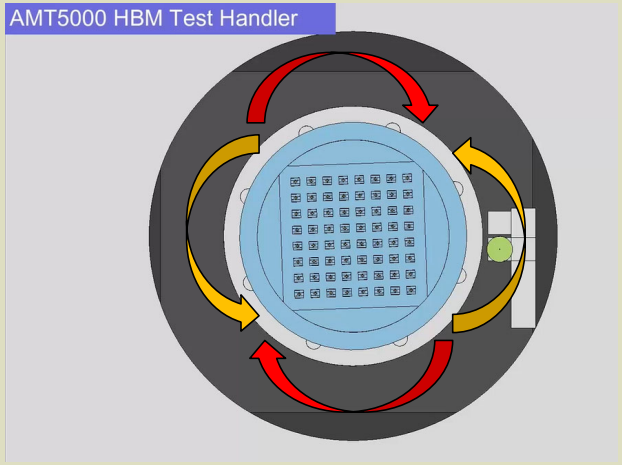
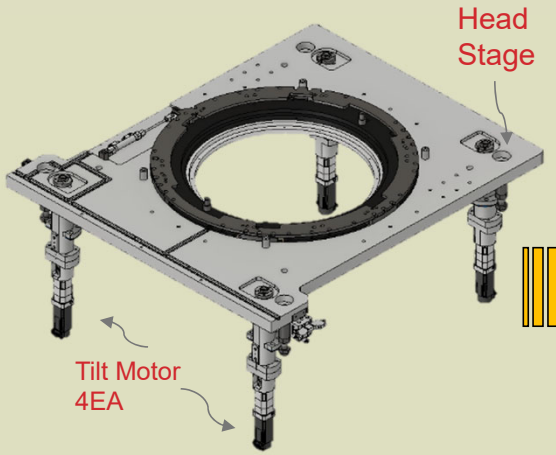
4. Resolving issues in DIE (HBM) reliability testing

C - 2. Pin contact issues due to fine pad pitch in DIE (HBM)

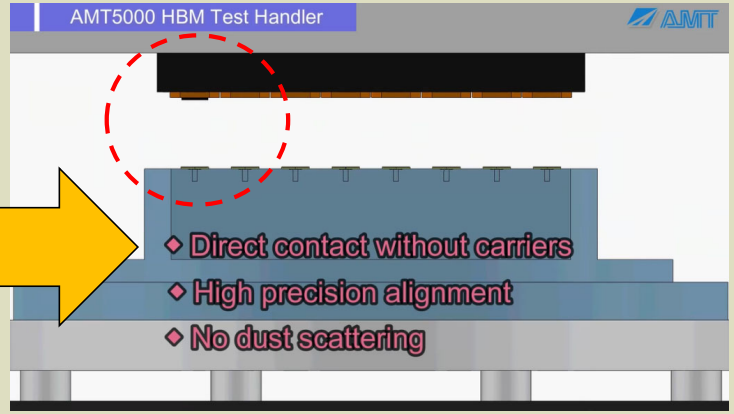
➢ Control and correct the variation in pad pitch and socket pin position



Chuck Stage Control
▶ Die Pad Pitch Calibration



Probe Head Stage Tilting Control
▶ Socket Pin Calibration



Head Stage Die & Probe
Socket Pin Contact

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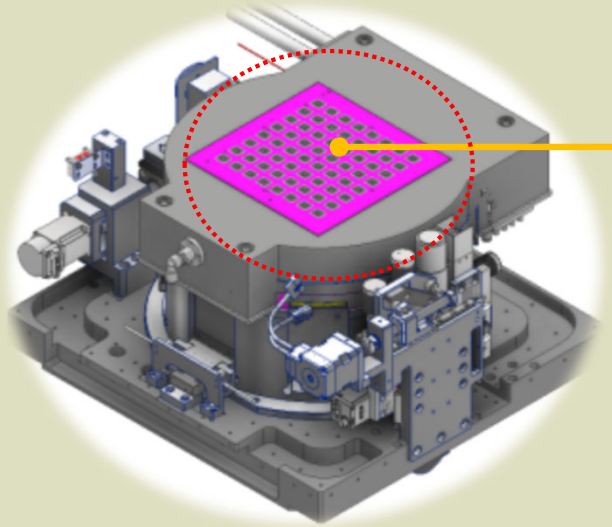
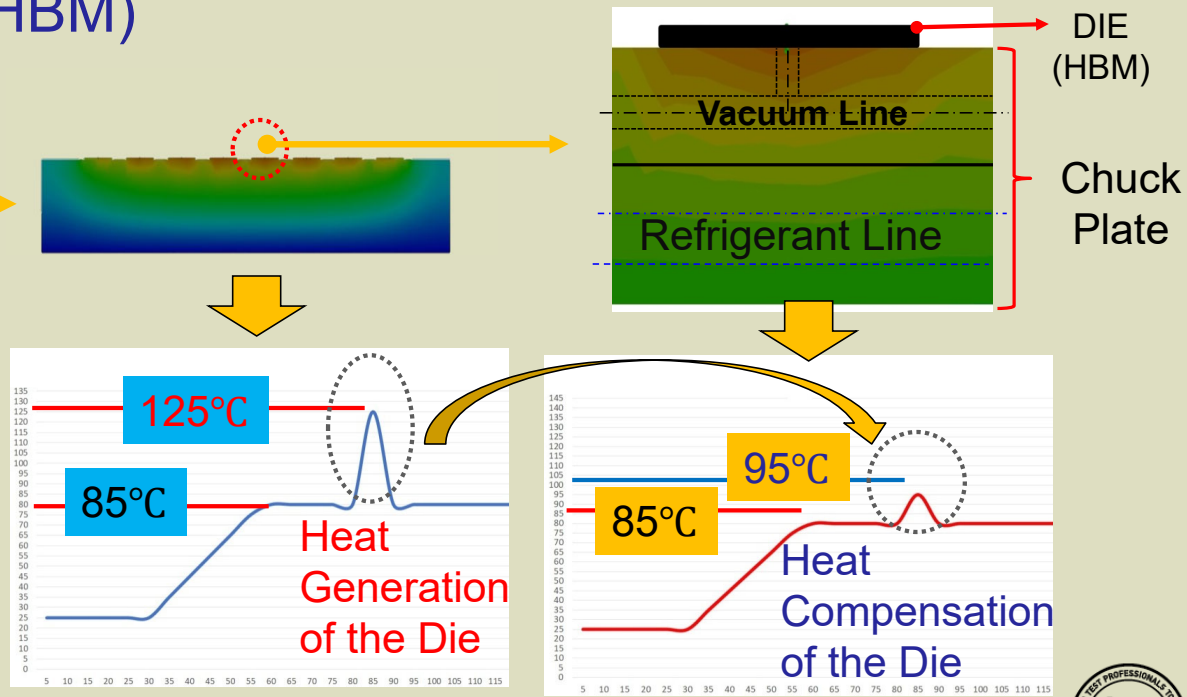
4. Resolving issues in DIE (HBM) reliability testing

D. Heat generation issues during DIE (HBM) reliability testing

- The chuck plate acts as a heat sink to compensate for the heat generated by the DIE (HBM)



Chuck Plate



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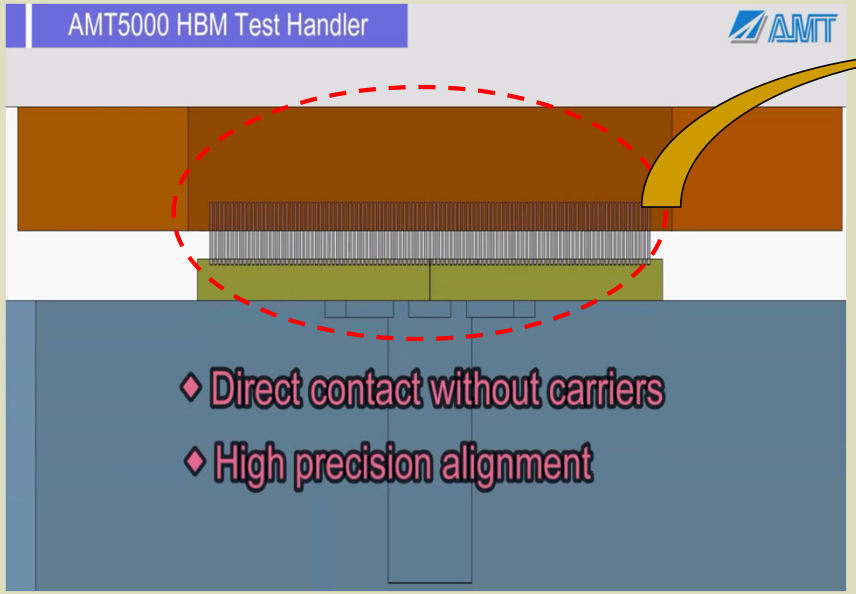
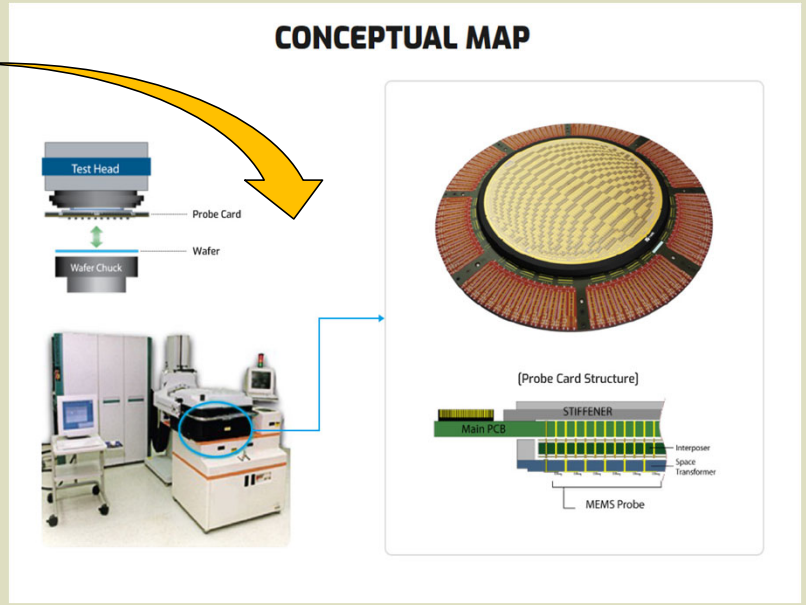
4. Resolving issues in DIE (HBM) reliability testing

E. Test stability issues during DIE (HBM) reliability testing

[High- Frequency]

- Ensure test reliability by applying a probe system (probe card)





Source : Google

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5. Content Summary

- Prevent contamination factors by applying improvements in the DIE (HBM) supply method
- Alignment adjustment using Align Vision based on DIE (HBM) pad standards (Align Accuracy = ±5㎛)
- Prevention of crack formation factors in DIE (HBM) (A structure that does not apply pressure directly to the DIE)
- Correct mutual deviations through precise alignment vision applied to DIE (HBM) pads and probe socket pins
- When the DIE (HBM) generates heat, the DIE chuck acts as a heat sink to compensate for the heat
- Implement the shortest distance test by applying a probe system (probe card) during DIE (HBM) reliability testing

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