What kind of probe card analyzer do we need really in WT floor?

Introduction
- Expected problems ...
- Disadvantages ...
- Wishes ...

WT production needs
- Incoming inspection ...
- Scrub-analysis ...
- Identifying prober / probe card problems ...

Conclusion
A new kind of inspection microscope is the answer
What kind of probe card analyzer do we need really in WT floor?

New technology challenges
- Quality
- New equipment
- New products
- New technology challenges

Throughput
Yield
Operators

Stress 7

Process engineer

What does „wafer test production“ mean for the process engineer?
What kind of probe card analyzer do we need really in WT floor?

Working on the leading edge of probing technology

Introduction of advanced PC-technologies in a short time frame

Changes
* smaller tip dimensions
* new tip forms
* new contact materials
* lower contact force
* a lot more contact tips
* different PC-technologies
* different cleaning materials

Problems
* position stability, penetration depth
* lifetime
* robustness
* burned tips
* needle search
* more observation efforts
* cleaning optimization

Expected problems using advanced probe card technologies
What kind of probe card analyzer do we need really in WT floor?

**Light Microscope**
- working distance
- limited resolution
- only 2D

**SEM**
- located in PFA
- long operation time
- limited chamber size

**Probe Mark Analyzer**
- no production PMI-System
- additional system
- utilization low

Disadvantages of currently available probe card metrology tools

expensiv, takes long, a lot more floor space, damage risc, ...

How can you control the wafer probing process?

**Laser Scan Microscope**
- not specialized for wafer probing,
- no PC fixture
- no PC protection system

**Probe Card Analyzer**
- damage risc
- measurement problems
- correlations
- upgrades
What kind of probe card analyzer do we need really in WT floor?

<table>
<thead>
<tr>
<th>Wishes for a universal probe card inspection tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quick probe card and fixture change</td>
</tr>
<tr>
<td>Easy reference system</td>
</tr>
<tr>
<td>Probe card protection system</td>
</tr>
<tr>
<td>Freestyle microscope mode with magnification up to x5000</td>
</tr>
<tr>
<td>Manual distance measurement mode</td>
</tr>
<tr>
<td>Manual 3D-analysis for tip and scrub with 10nm-accuracy</td>
</tr>
<tr>
<td>Automatic highspeed X/Y/Z-inspection mode</td>
</tr>
<tr>
<td>Automatic scrub analysis on 200 and 300mm wafer</td>
</tr>
<tr>
<td>Suitable for different probecard technologies</td>
</tr>
<tr>
<td>Suitable for measurement on contaminated/burned tips</td>
</tr>
<tr>
<td>Quickly find a needle or pad</td>
</tr>
<tr>
<td>Easy chart- and picture generation</td>
</tr>
<tr>
<td>Clear display subdivided in clearly functions</td>
</tr>
</tbody>
</table>
What kind of probe card analyzer do we need really in WT floor?

**Useful operation modes**

- **Microscope Mode**
  - manual
  - Image capture
  - Distance measurement
  - 3D-Analysis

- **Reference**

- **Inspection Mode**
  - semi automatic
  - Free style
  - Search a Pin
  - Scan mode
  - automatic
  - Autoinspection XYZ
  - Autoinspection 3D
What kind of probe card analyzer do we need really in WT floor?

Higher probe card precision reduces the flow

<table>
<thead>
<tr>
<th>Checks</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Manufacturer Data</td>
<td>- Outcoming inspection (PCA-Data: X,Y,Z, tip-dia., Caps, Leakage)</td>
</tr>
<tr>
<td></td>
<td>- Inspection sheet (Spec)</td>
</tr>
<tr>
<td>10 min</td>
<td>- Drawings*) components, wiring</td>
</tr>
<tr>
<td></td>
<td>- Vendor Audit**) (outcoming process control)</td>
</tr>
<tr>
<td></td>
<td>**) only for the 1st card</td>
</tr>
<tr>
<td></td>
<td>**) once per year</td>
</tr>
<tr>
<td>(2) Optical Inspection</td>
<td>- visual (components, soldering, cleanliness)</td>
</tr>
<tr>
<td>10 min</td>
<td>- Inspection microscope (tip quality of 1% of the needles)</td>
</tr>
<tr>
<td>(3) Tester Correlation</td>
<td>- Prober Setup (1st/last contact, PCB-Bending, Scrubs)</td>
</tr>
<tr>
<td>~ 2h***)</td>
<td>- Wafer correlation (yield difference &lt; limit)</td>
</tr>
</tbody>
</table>

Incoming inspection for advanced probe card technologies

*) depends on the test time
What kind of probe card analyzer do we need really in WT floor?

Taking a microscope picture with magnification up to the needle tip

Automatic file name generation: design x DUT_PCno_pin_date_time

picture size 400x400 pixel 128MSGRAMx16_15_01052_09/04/2001_09:24
What kind of probe card analyzer do we need really in WT floor?

Exchanging SEM-pictures by microscope pictures
What kind of probe card analyzer do we need really in WT floor?

3D-analysis from a needle tip
What kind of probe card analyzer do we need really in WT floor?

3D-analysis from a scrub with 10nm-accuracy
What kind of probe card analyzer do we need really in WT floor?

How many cleaning TD's?
What is the best cleaning material?
How good is the tip refreshment process?

Cleaning optimization
What kind of probe card analyzer do we need really in WT floor?

What happens here?

Avoid alu-flags
What kind of probe card analyzer do we need really in WT floor?

How to find a needle tip in an array of 20,000?

The inspection microscope should do this automatically by one click on the pad name, pad map or pad function.

Quick find a needle or a pad.
What kind of probe card analyzer do we need really in WT floor?

Highspeed measurement: 50 pins/min

Is this card in spec?

X/Y/Z-measurement on contaminated/burned tips
What kind of probe card analyzer do we need really in WT floor?

**Bonding requirements**
- no exposed oxide
- scrub size
- max. number of touchdowns

**Designer requirements**
- min. padsize
- min. pitch
- thinner aluminum
- active structures under the pad

<table>
<thead>
<tr>
<th>TV-opening [µm]</th>
<th>pad area [µm²]</th>
<th>max. probemark area [µm²]</th>
</tr>
</thead>
<tbody>
<tr>
<td>100x100</td>
<td>10,000</td>
<td>2500</td>
</tr>
<tr>
<td>72x72</td>
<td>5184</td>
<td>1296</td>
</tr>
<tr>
<td>65x65</td>
<td>4225</td>
<td>1056</td>
</tr>
</tbody>
</table>

25%

How do we get statistical data about the WT production limits?

Look at bonding and designer requirements
**What kind of probe card analyzer do we need really in WT floor?**

**Problem**
unequal scrub length on wafer edge

**Facts**
- Probe card: Cantilever 2DUT
- Temperature: RT
- Chuck type: standard Z stage
- Force: about 3kg

**Reason**
- chuck tilting
- chuck movement

**Solution**
change to a high rigid Z stage

**Identifying prober problems**
What kind of probe card analyzer do we need really in WT floor?

**Problem**
unequal scrub marks in one needle row after 3/4 of the wafer

\[-10^\circ C\]

red chips = VF-OPN

**Reason**
temperature depends on needle movement

**Solution**
decrease in tip diameter => increase in penetration depth

Identifying probe card problems
What kind of probe card analyzer do we need really in WT floor?

You will learn a lot more about your probecards and your probing process.
What kind of probe card analyzer do we need really in WT floor?

<table>
<thead>
<tr>
<th>different requirements on a probe card analyzer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using Epoxy-PC-Technology</td>
</tr>
<tr>
<td>Using as PC-Manufacturer</td>
</tr>
</tbody>
</table>

customized probe card analyzer for the WT floor

- universal
- compact
- high speed measurement
- data reduction
- fast problem finding
- 3D-option is a must
- protection for PC damages

You will save time, money and floor space