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

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

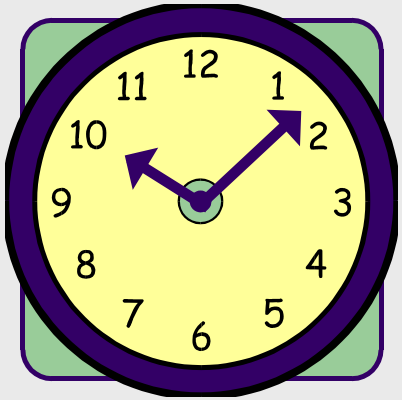
WT production needs
- **Incoming inspection ...**
- **Scrub-analysis ...**
- **Identifying prober / probe card problems ...**

  :

  :

Conclusion
A new kind of inspection microscope is the answer

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



24h

Throughput

Yield

Operators

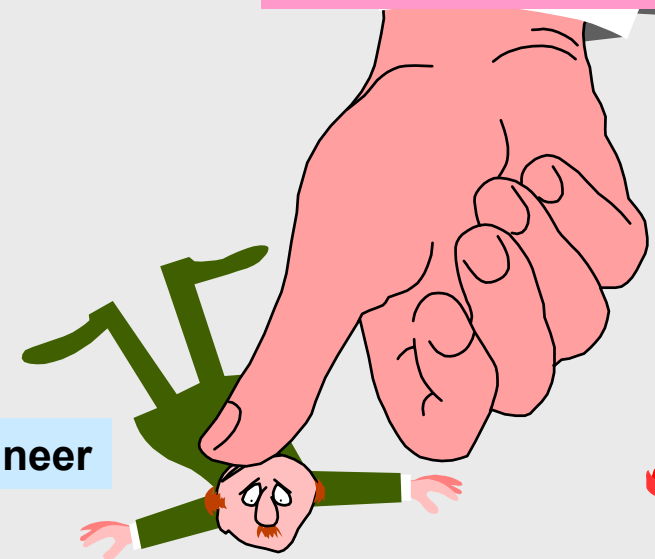
Quality

New equipment

New products

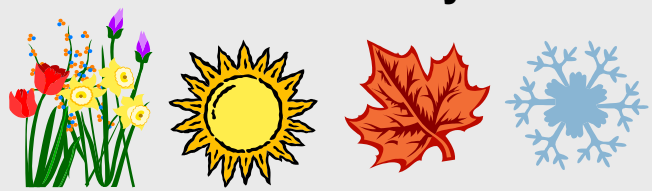
New technology challenges

= Stress 7



Process engineer

each day



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 egde of probing technology

▼

Introduction of advanced PC-technologies in a short time frame

▼ ▼

Changes

* smaler 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

Never stop thinking

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

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

Disadvantages of currently available probe card metrology tools

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

- Quick probe card and fixture change
- Easy reference system
- Probe card protection system
- Freestyle microscope mode with magnification up to x5000
- Manual distance measurement mode
- Manual 3D-analysis for tip and scrub with 10nm-accuracy
- Automatic highspeed X/Y/Z-inspection mode
- Automatic scrub analysis on 200 and 300mm wafer
- Suitable for different probecard technologies
- Suitable for measurement on contaminated/burned tips
- Quickly find a needle or pad
- Easy chart- and picture generation
- Clear display subdivided in clearly functions

Quick registration of production problems

Wishes for a universal probe card inspection tool

stop thinking Never

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

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

Useful operation modes

Never stop thinking

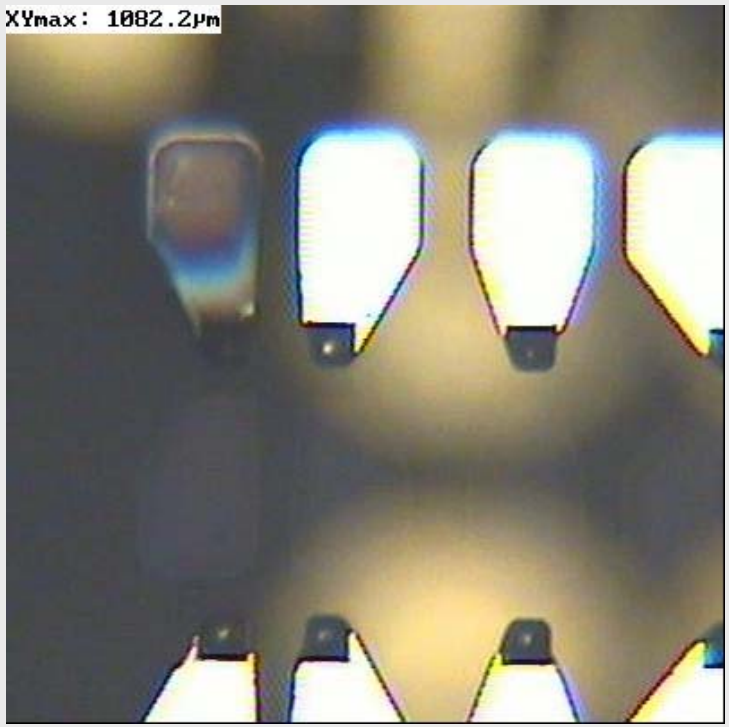
What kind of probe card analyzer do we need really in WT floor ?

Higher probe card precision reduces the flow

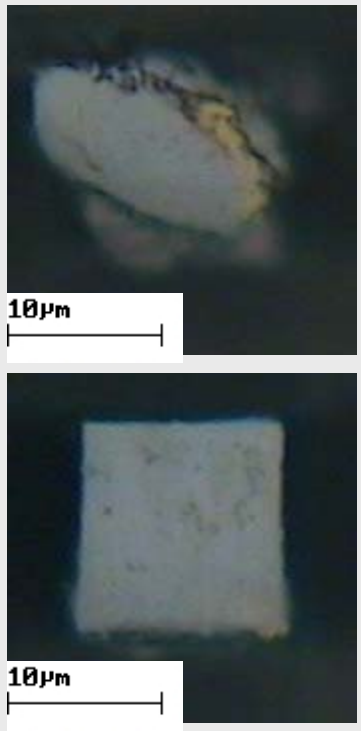
Checks	Contents
(1) Manufacturer Data	- Outcoming inspection (PCA-Data: X,Y,Z, tip-dia., Caps, Leakage)
	- Inspection sheet (Spec)
10 min	- Drawings*) components, wiring *) only for the 1st card
	- Vendor Audit**) (outcoming process control) **) once per year
(2) Optical Inspection	- visual (components,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

Incoming inspection for advanced probe card technologies

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



smallest magnification



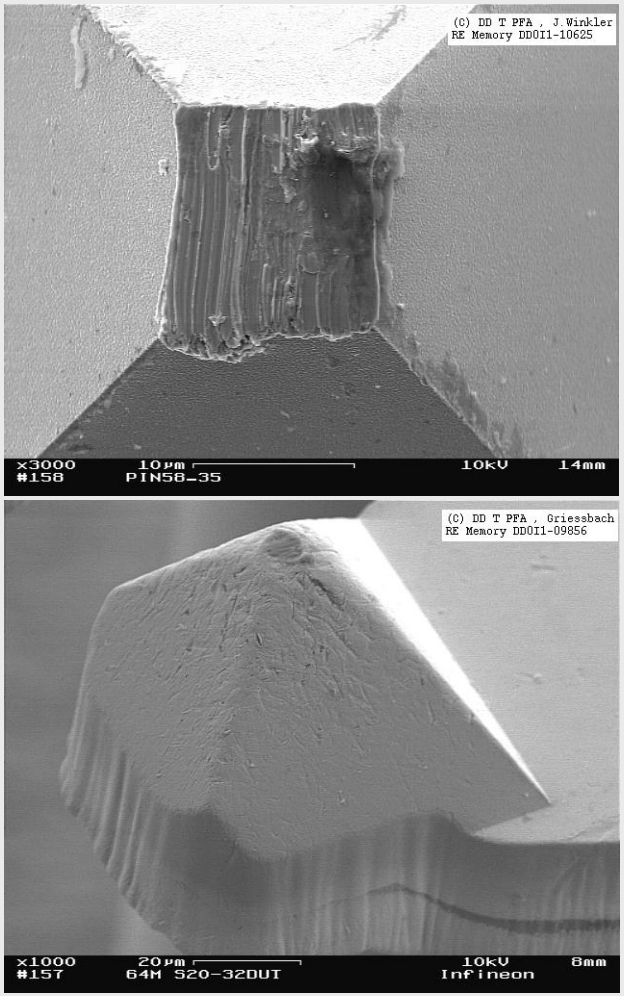
highest magnification

Automatic file name generation: **design x DUT_PCno_pin_date_time**

picture size 400x400 pixel 128MSGRAMx16_15_01052_09/04/2001_09:24

Taking a microscope picture with magnification up to the needle tip

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

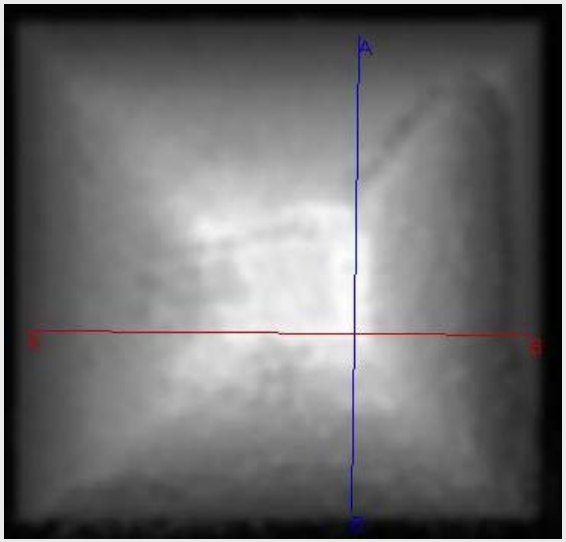


SEM - picture

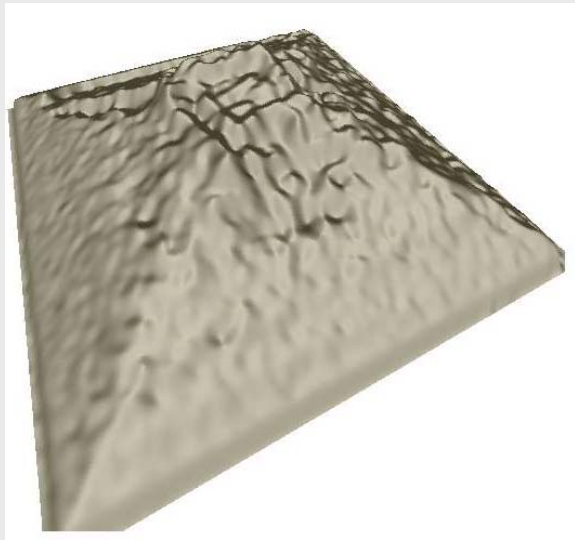
microscope - picture

Exchanging SEM-pictures by microscope pictures

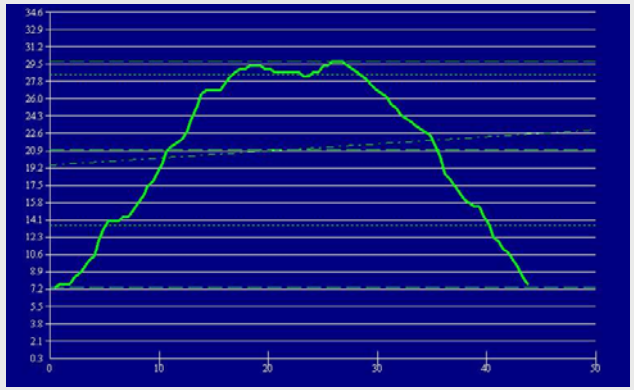
What kind of probe card analyzer do we need really in WT floor ?



2D picture



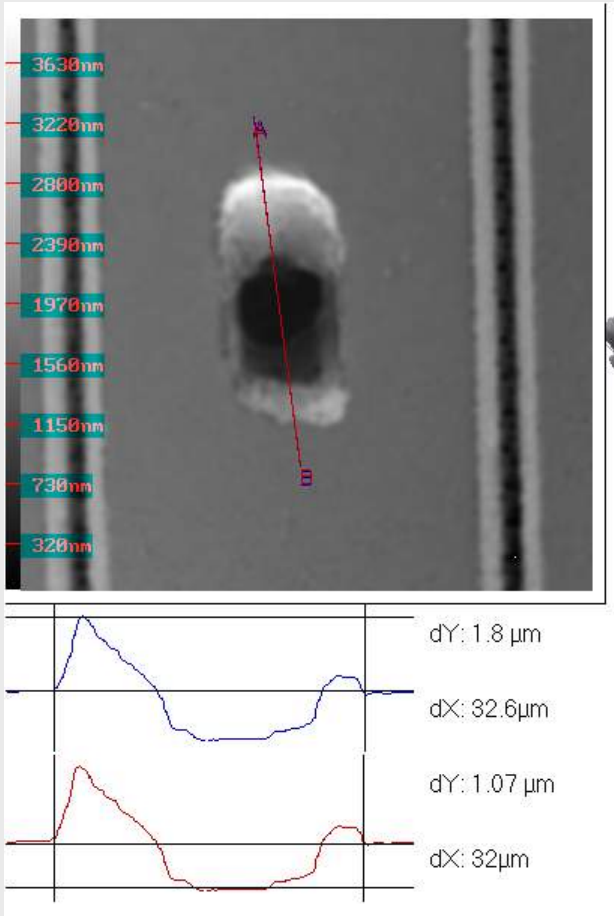
3D image

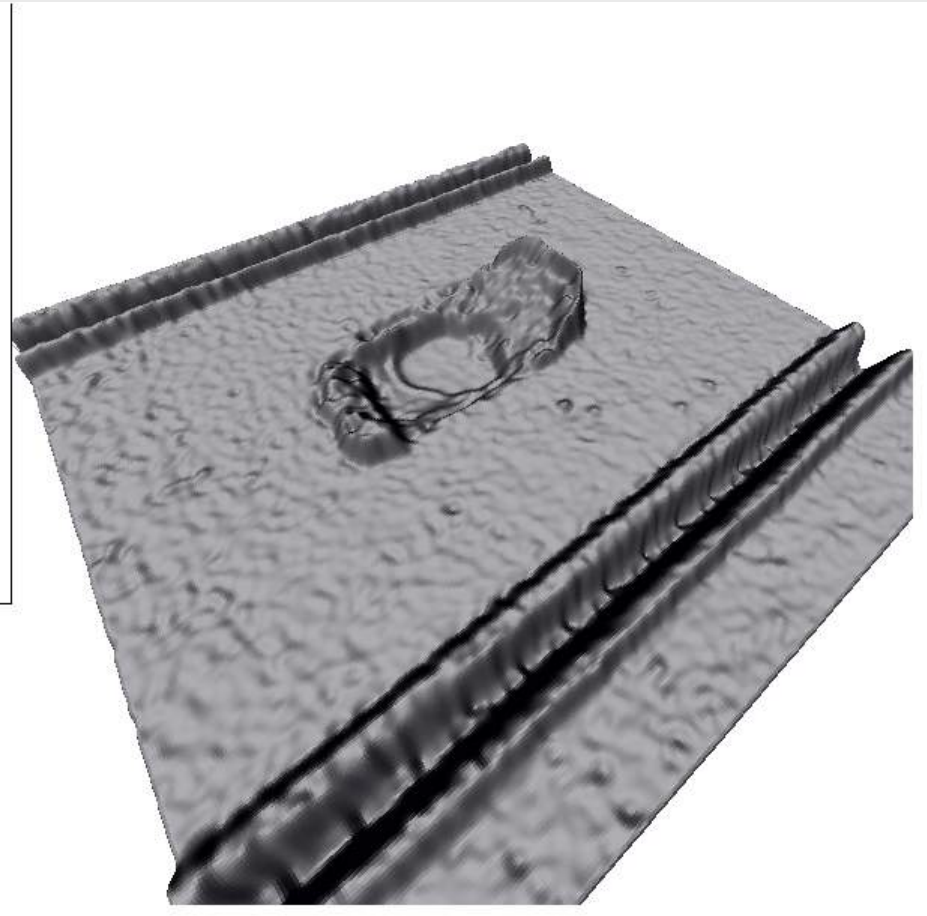


tip profile

3D-analysis from a needle tip

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

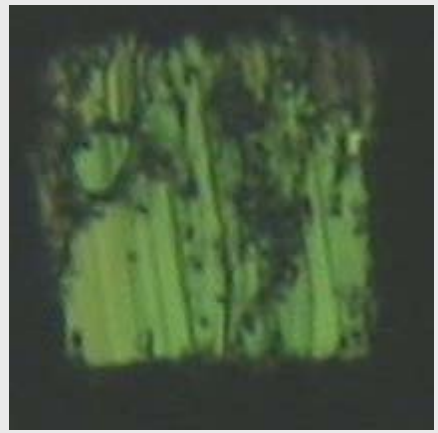




3D-analysis from a scrub with 10nm-accuracy

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

after 300 cleaning TD‘s

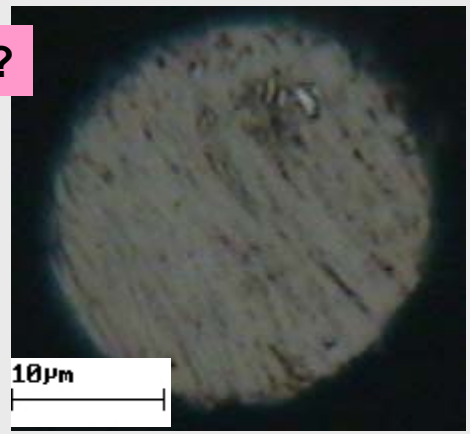


after 750 cleaning TD‘s

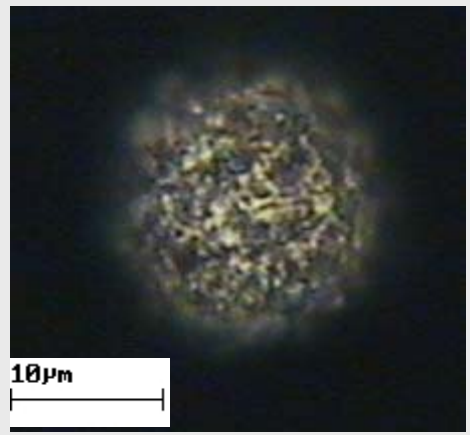
How many cleaning TD‘s ?

What is the best cleaning material?

How good is the tip refreshment process ?



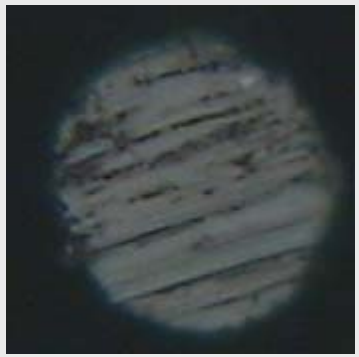
new needle tip



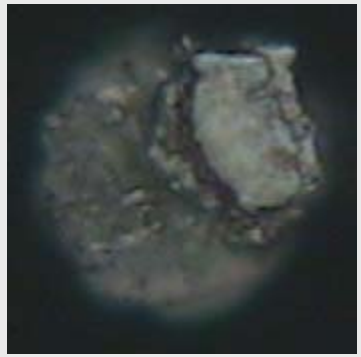
after tip refreshment process

Cleaning optimization

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

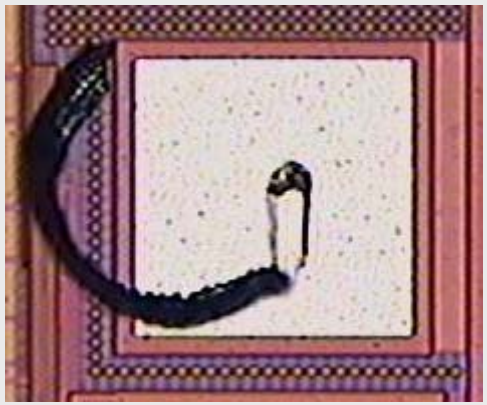


flat tip



after some TD‘s

after one wafer



pad

round tip

cleaning wafer

What happens here ?

Avoid alu-flags

stop thinking
Never

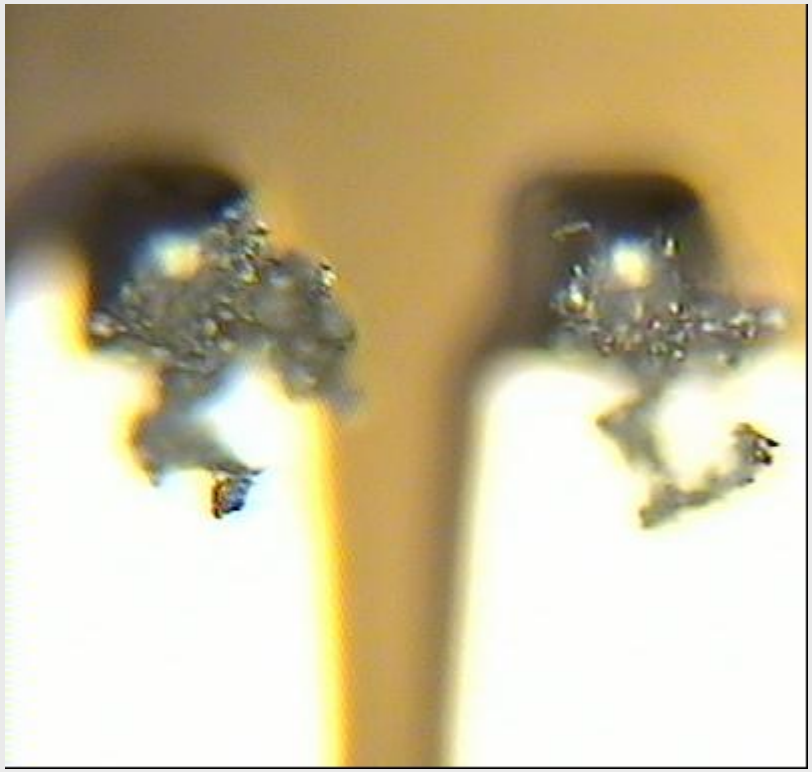
What kind of probe card analyzer do we need really in WT floor ?

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

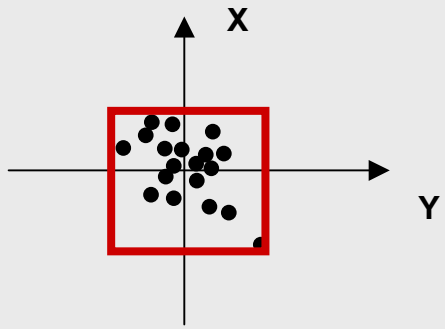
What kind of probe card analyzer do we need really in WT floor ?



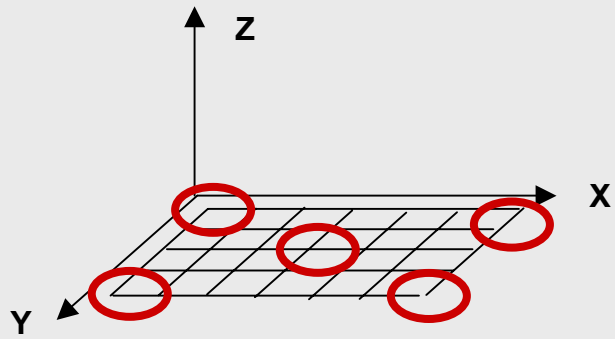
Highspeed measurement: 50 pins/min

Is this card in spec ?

Points of interest



X/Y-Pos-Err min. and max.

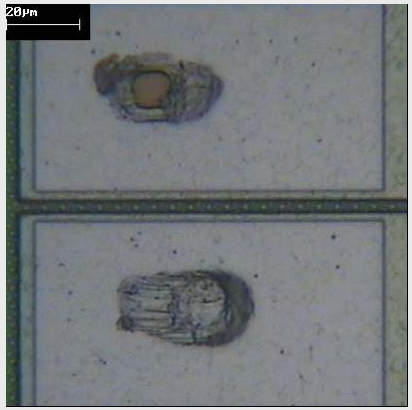


1st/last contact, edge and center of the array

X/Y/Z-measurement on contaminated/burned tips

Never stop thinking

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



What is the difference / reason ?

Bonding requirements

- no exposed oxyde
- scrub size
- max. number of touchdowns

TV-opening [µm]	pad area [µm²]	max. probemark area [µm²]	
100x100	10.000	2500	
72x72	5184	1296	25%
65x65	4225	1056	

Designer requirements

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

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

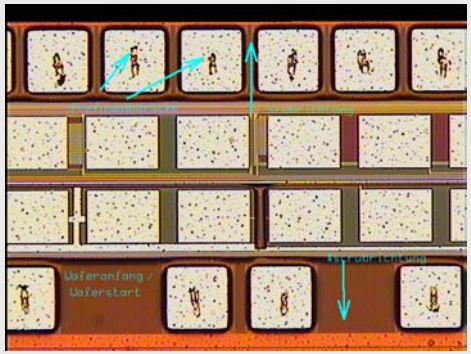
Look at bonding and designer requirements

Never stop thinking

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

Problem

unequal srub length on wafer edge



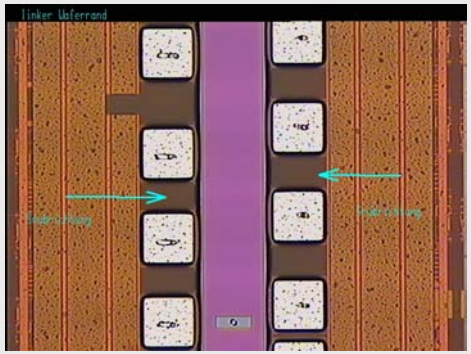
Facts

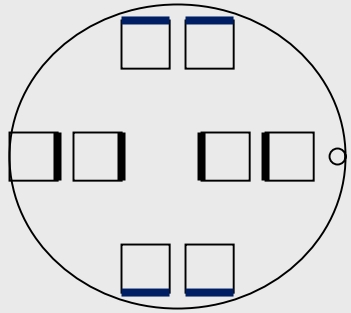
Probe card: Cantilever 2DUT

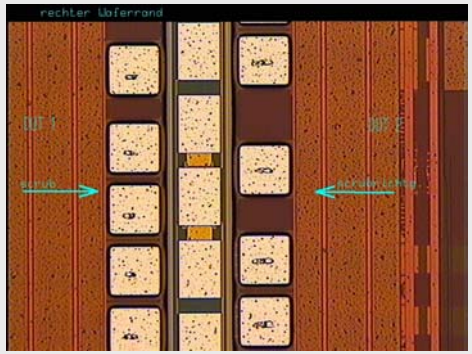
Temperature: RT

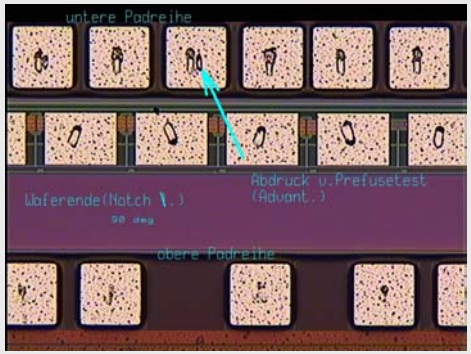
Chuck type: standard Z stage

Force: about 3kg









Reason

- chuck tilting

- chuck movement

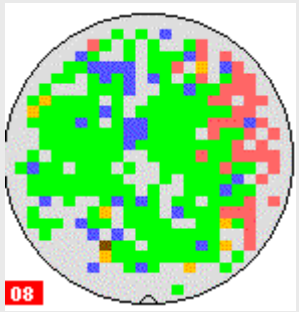
Solution

change to a high rigid Z stage

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

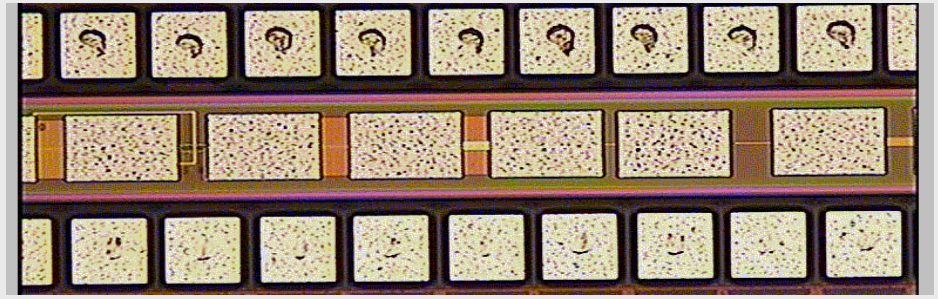
Problem

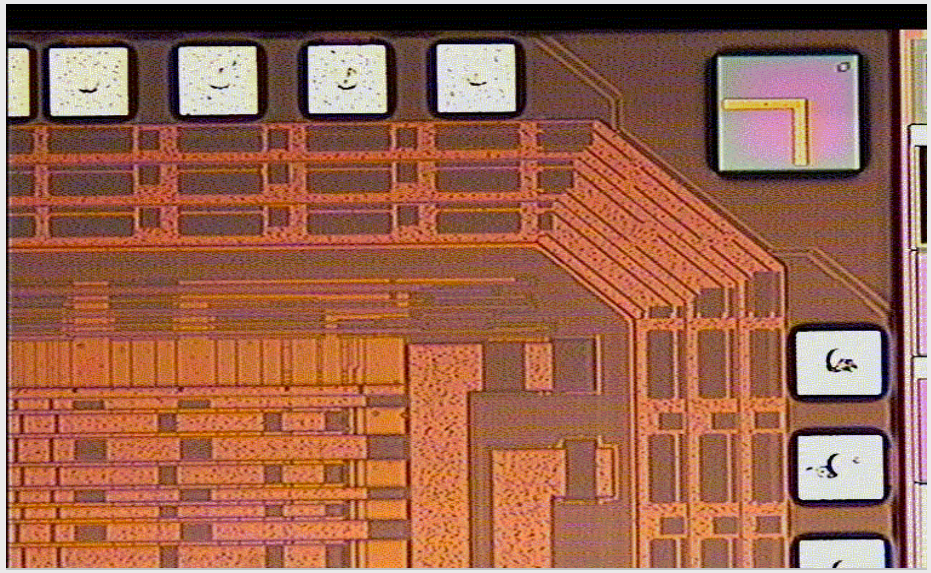
unequal scrub marks in one needle row after 3/4 of the wafer



-10°C

red chips = VF-OPN





Reason

temperature depends on needle movement

Solution

decrease in tip diameter => increase in penetration depth

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

zygo

SYNCOTEC

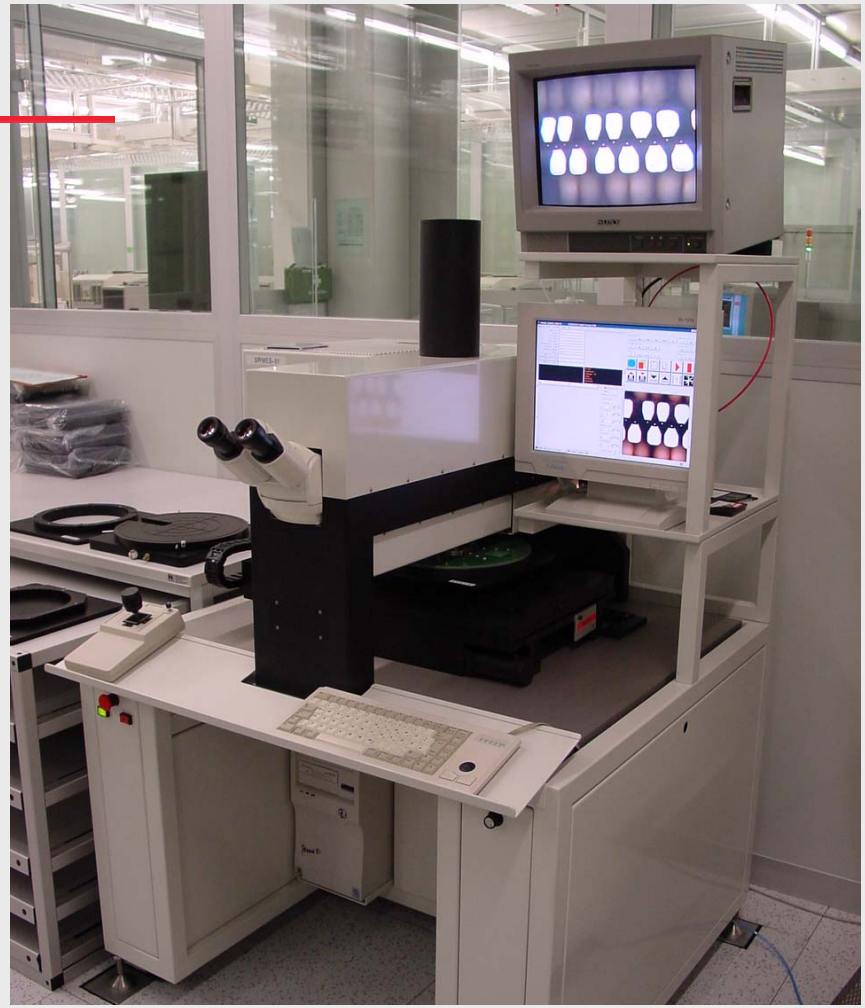
CCD camera

probe card fixture

wafer fixture

joystick

computer



TV-monitor

computer monitor

microscope bridge

X/Y-stage

keyboard

You will learn a lot more about your probecards and your probing process

Never stop thinking

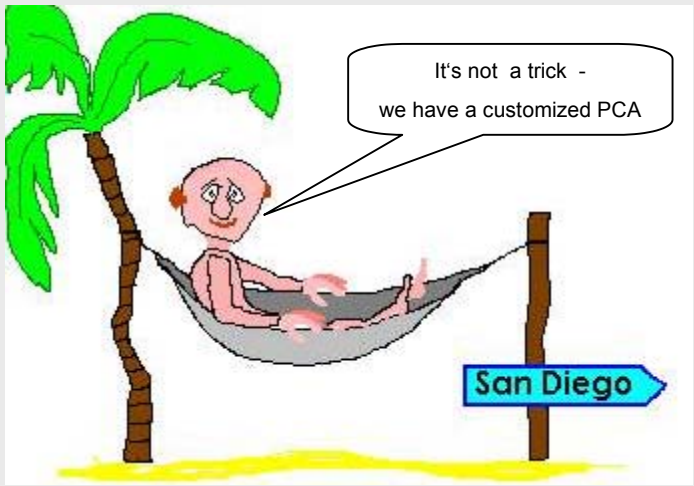
What kind of probe card analyzer do we need really in WT floor ?

different requirements on a probe card analyzer

Using **Epoxy-PC-Technology** ⟷ **Lithographic-PC-Technology**

Using as **PC-Manufacturer** ⟷ **PC-User**

customized probe card analyzer for the WT floor



Process engineer

* **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

Never stop thinking