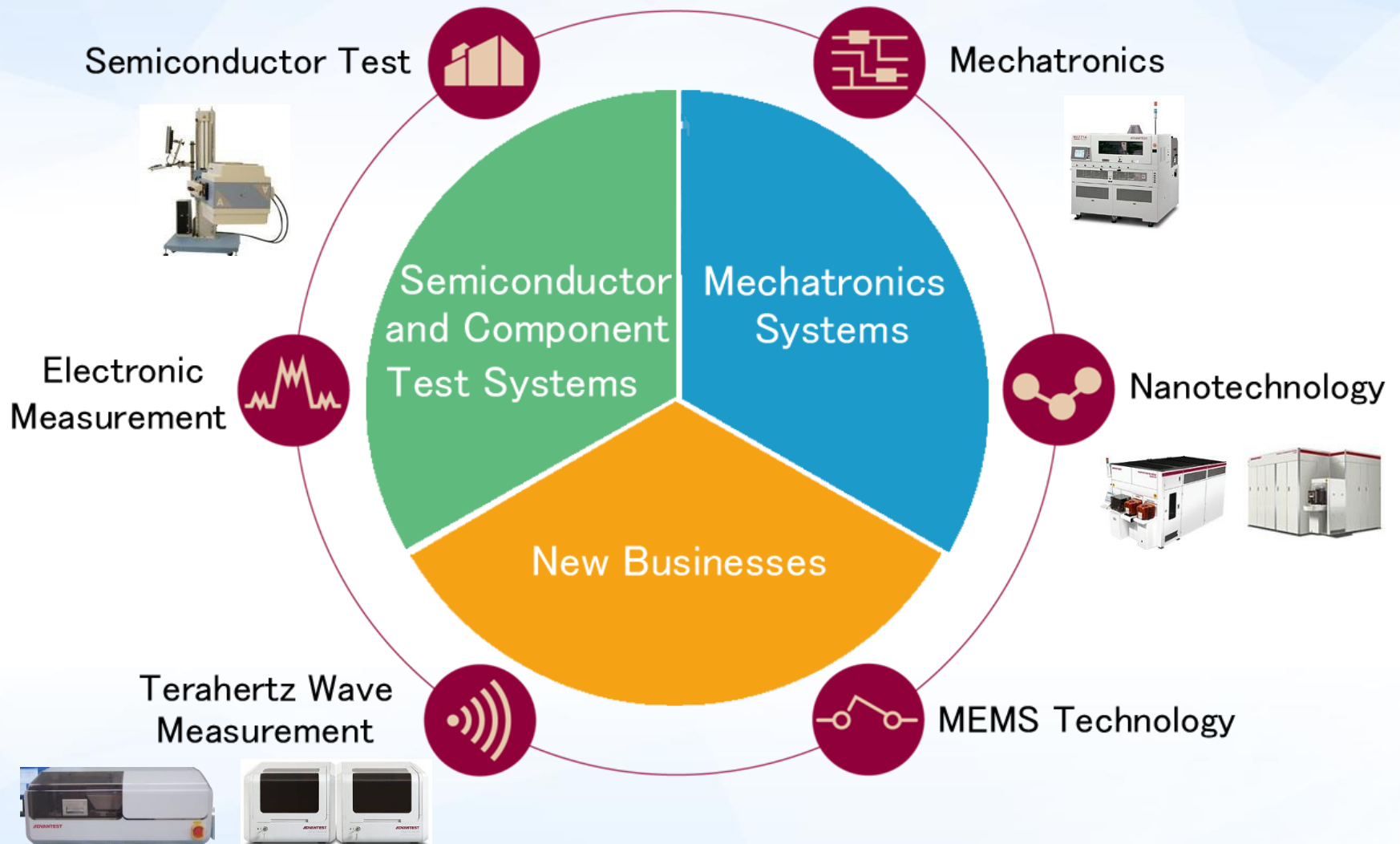


Finger Print Sensor Molding Thickness None Destructive Measurement by Terahertz Technology



**Presented by: Longhai Liu
ADVANTEST CORPORATION**

Business Segments

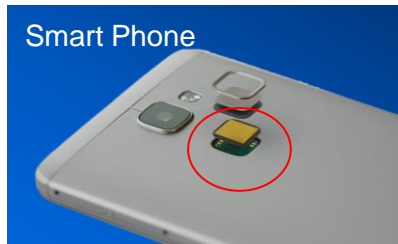


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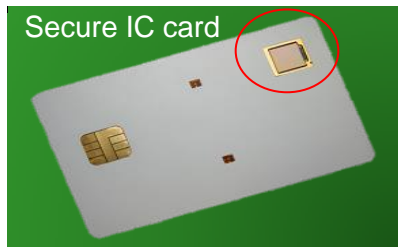
Necessity of FPS mold thickness analysis

- Mold thickness distribution must be flat/evenly on array, for error free finger print sense.
- Must be measured within few micrometer order accurate for thickness quality control.

Small & thin FPS chips producing is increasing with smartphone, secure card. equipment, More thin packaging is necessary for mounting very small space .. Thinner molding is required for small space housing.



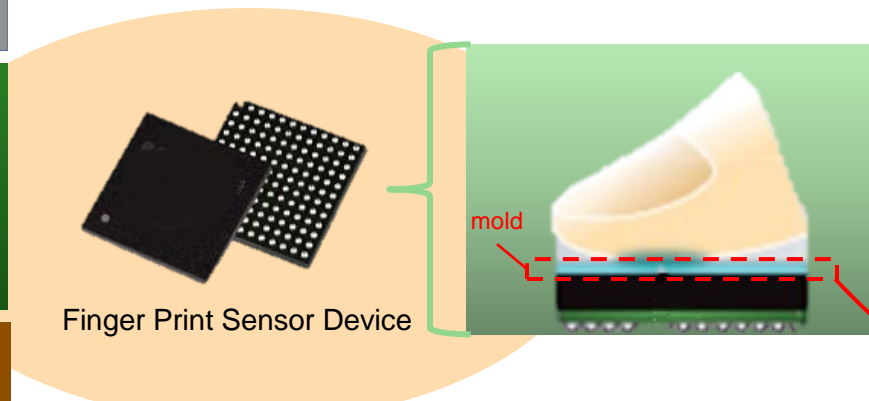
Smart Phone



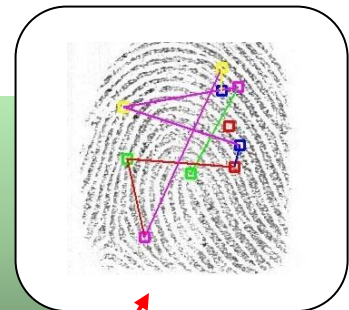
Secure IC card



Secure PC



Finger Print Sensor Device



Photos by M-Commerce Co.Ltd

Unevenness of mold on array
Causes pattern reading error

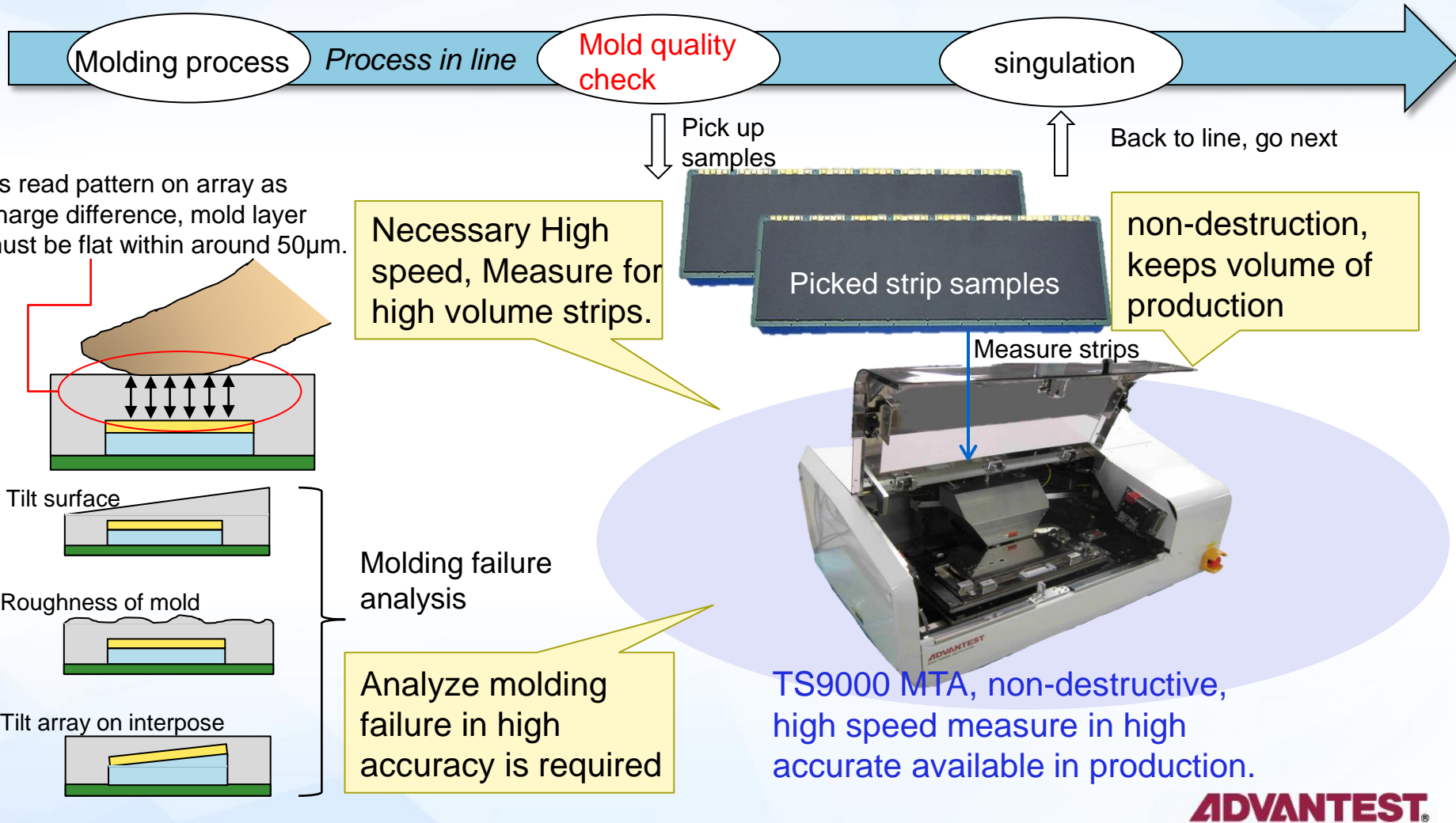
Mold layer thickness must be distributed in flat, evenly, no tilt, for the error free fingerprint pattern capturing

Need high accurate measurement system in production for better quality control.

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Mold thickness analysis in product line

- High volume FPS products need to be measured for better quality control.
- Need to analyze molding failure on produced devices in high accurate.
- Must be in non-destructive measurement method.



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FPS Molding Thickness Measurement Methods

Optical height measure.

Measures height of sample by laser reflection shift.



Can not observe only a mold thickness, warped sample mold thickness is not available to be measured.

- Non destructive measurement.
- Warped strip can be measured.
- fast measurement for high volume

Static capacitance method.

Measures capacitance change in electrodes to see thickness.



Difficult to measure multi layers of integration of pattern layer, array, mold in strip

Ultrasonic thickness meter.

Measures sound wave reflection delay to see thickness.

Dispersion of wave near array in chip is too large to measure mold thickness. Also sample needs to be in liquid/gel to propagate sound.



Terahertz Technology

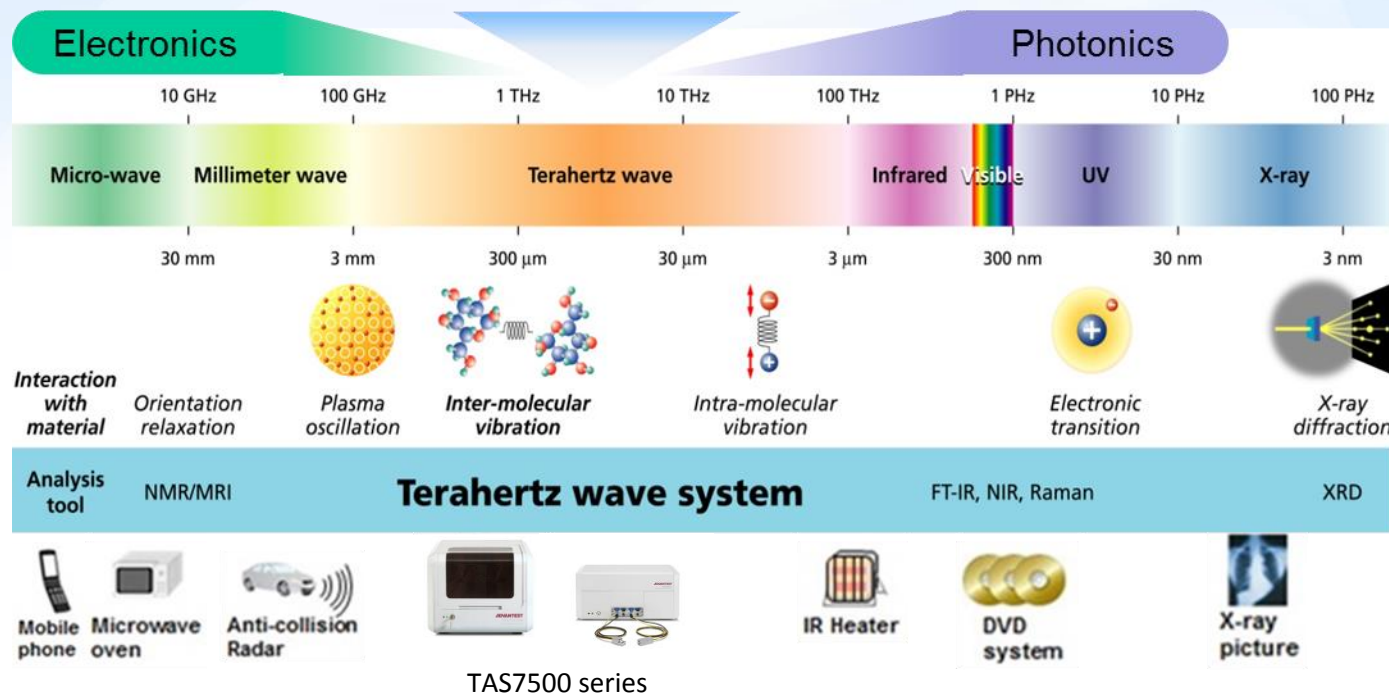


ADVANTEST T9000 MTA

- High speed measurement for high volume samples.
- Measure mold thickness even in warped strip in high accuracy.
- Multi layer measurement.
- Various type of mold material is available to be measured.

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Advantages of the Terahertz Region



Low photon energy

- Crystal lattice vibration, hydrogen-bond, intermolecular interaction
- Non-ionizing radiation
- No sample heating

Technological advantage

- High transparency for non-conducting materials
- Time-domain spectroscopy

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Terahertz Transmission Characteristics



THz transmission image of plastics

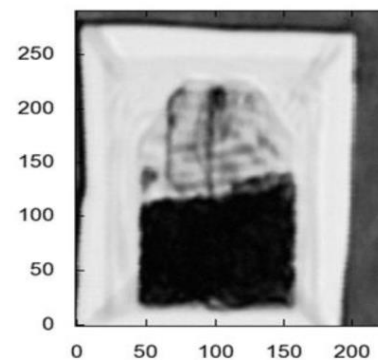


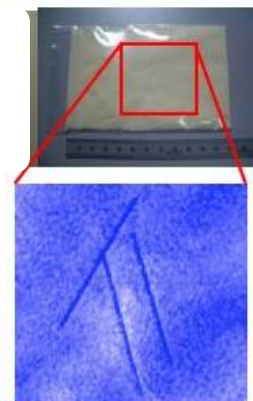
Image of the tea leaves that are invisible and hidden in an aluminum-coated plastic package



Ceramics



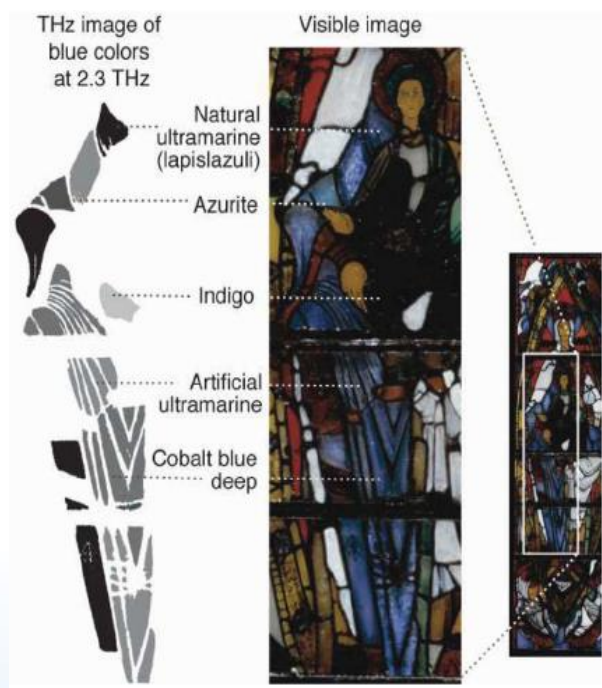
Examination for dangerous stuffs



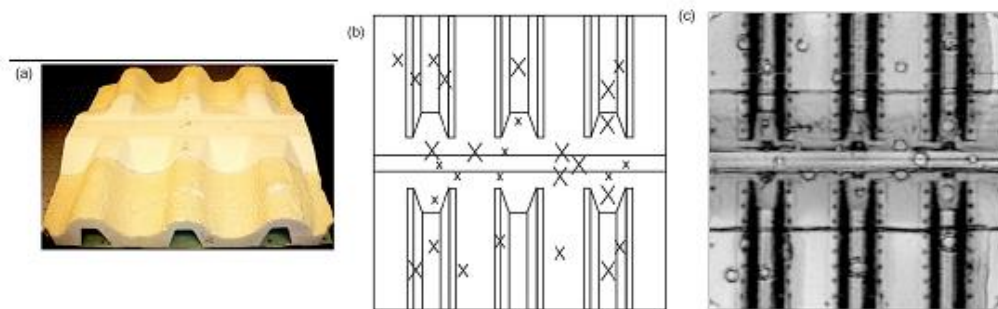
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Terahertz Application Examples

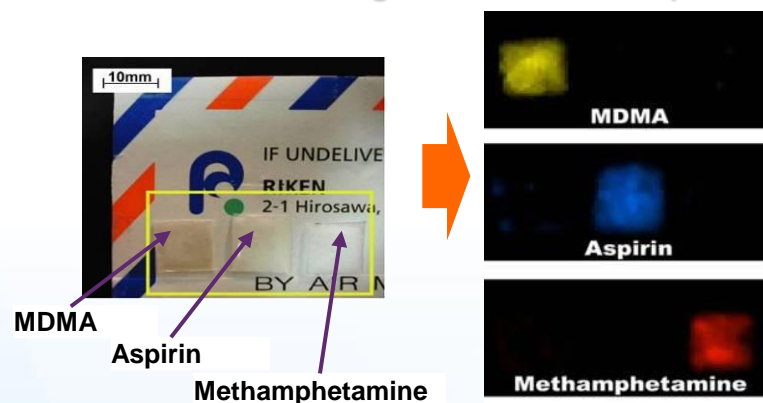
Non-destructive inspection of inner layer of the picture,
Analysis of restoration.



Quality inspection of heat insulator of the fuel tank of the Space Shuttle.



Non-destructive inspection and identification of the banned drugs in the envelope.



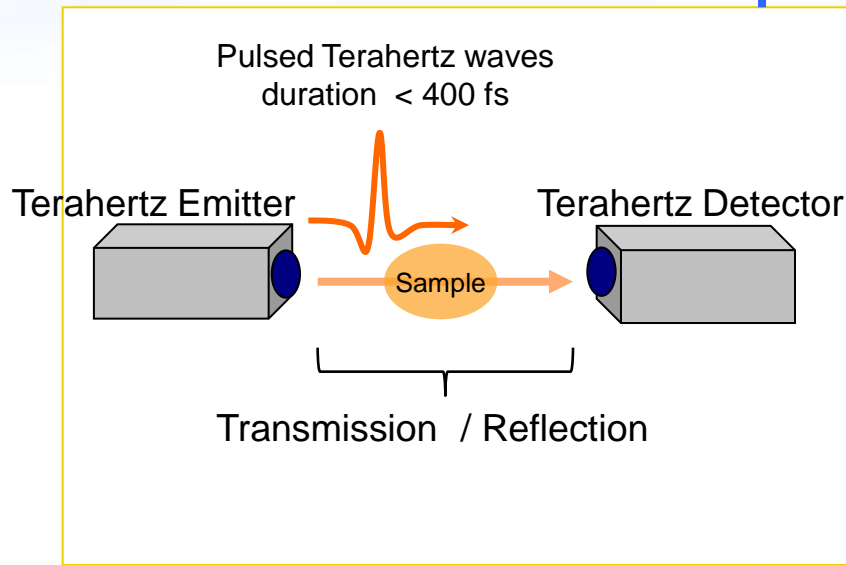
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Application of Terahertz Wave

1. Time-domain analysis

Time-of-flight technique using reflection waveform

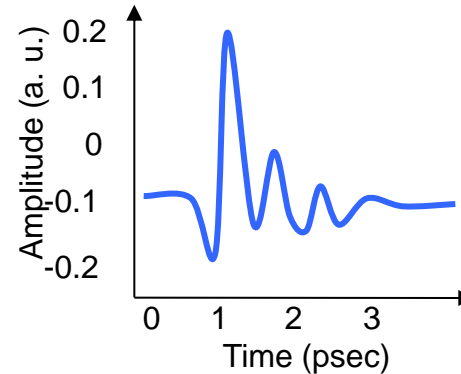
Measurements



2. Frequency-domain analysis

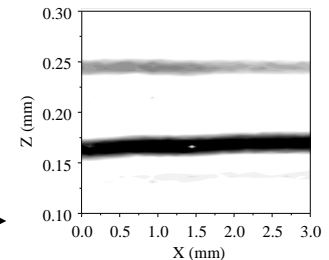
Fourier analysis

Imaging

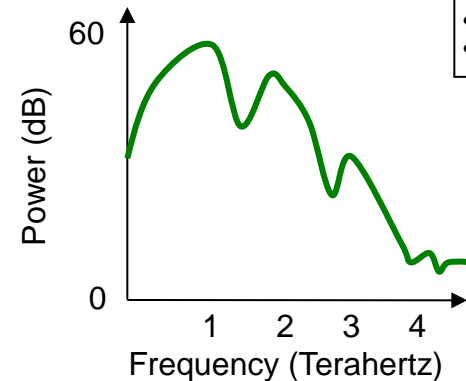


Example pharmaceutical tablets

- coating thickness
- density
- interfacial state

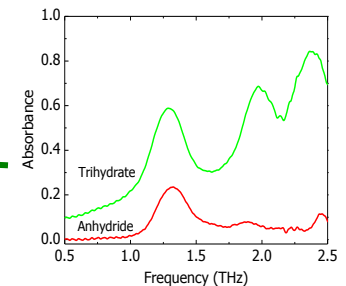


Spectroscopy



Example crystal polymorph

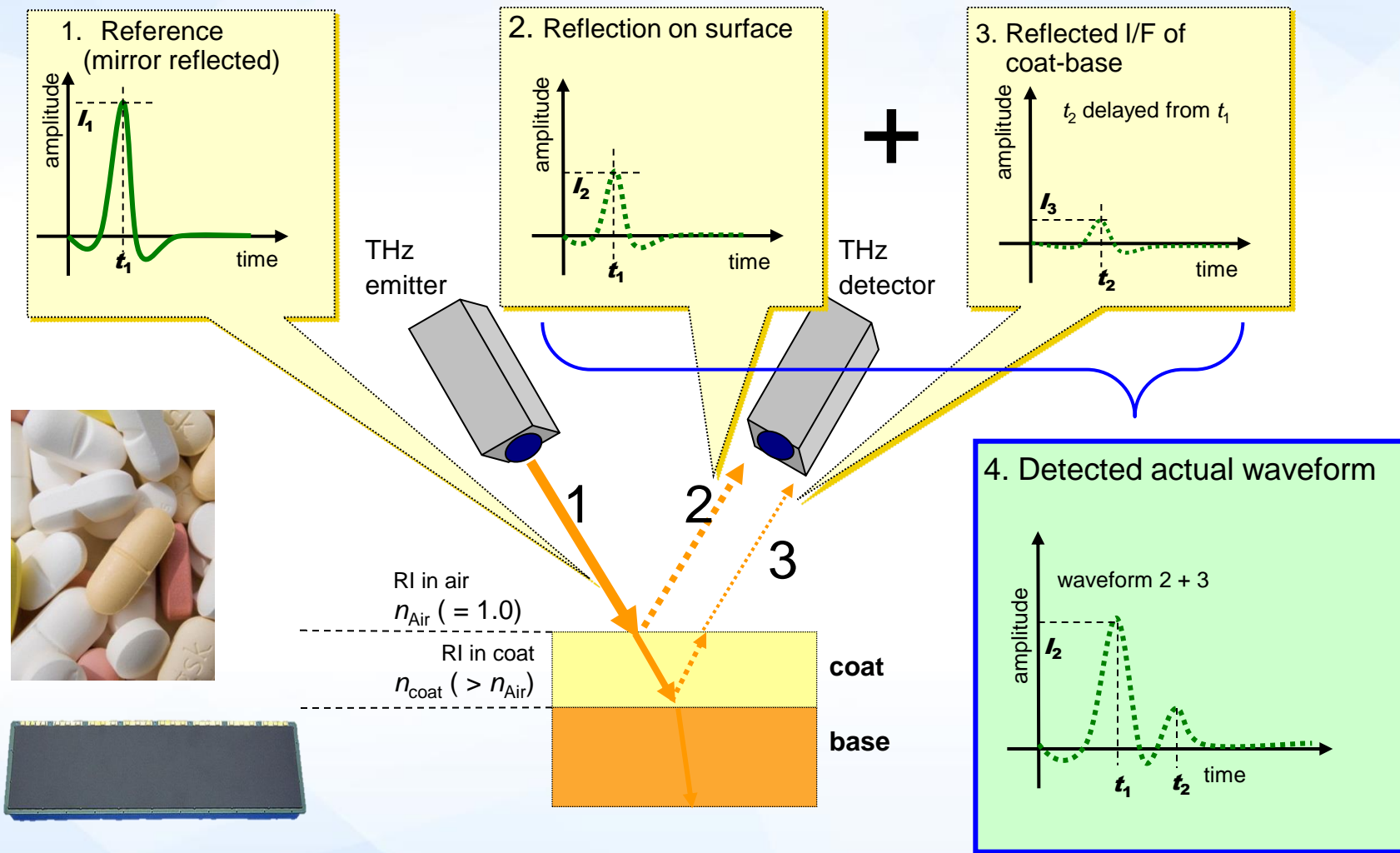
- finger print
- identification of hydrate
- interfacial state



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Application of Terahertz Wave

Time of Flight (TOF) analysis

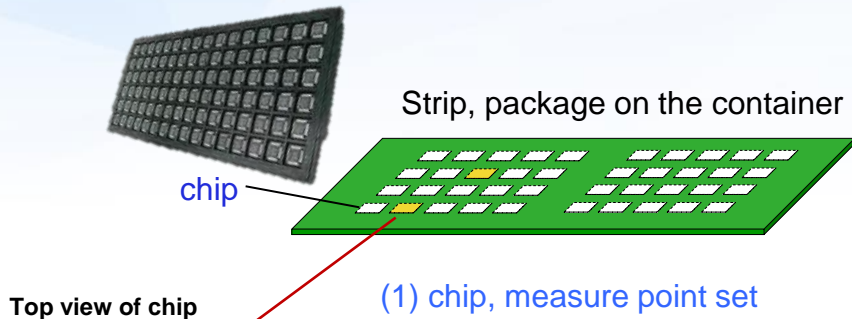


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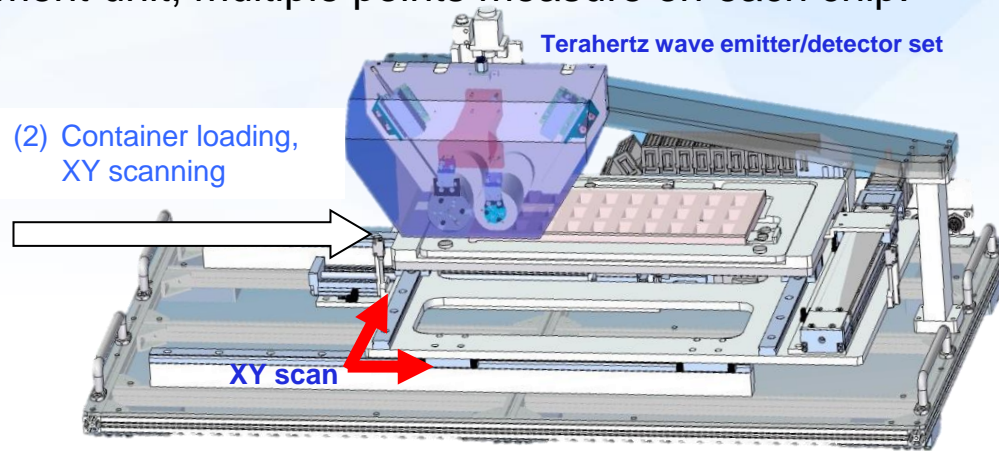
TS9000 MTA Measurement Process

Load molded sample into TS9000 measurement unit, multiple points measure on each chip.

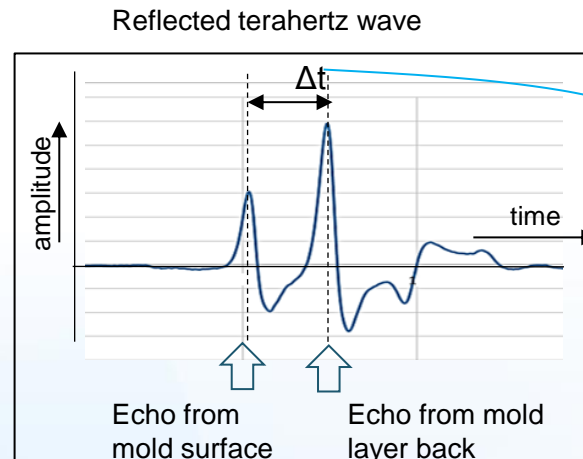
Strip, packaged sample with mold (BGA type)



(2) Container loading, XY scanning



(3) Show measurement result and go/no go for each chip, measurement point



Measure thickness from Δt as delay time of two echoes by following

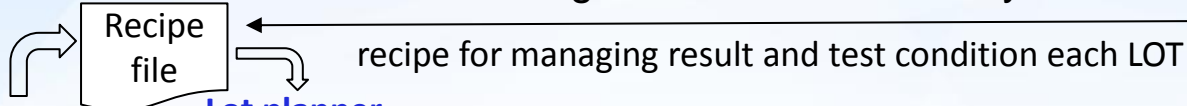
$$\text{thickness} = \frac{\Delta t \cdot c \cdot \cos \theta}{2n}$$

Δt : time delay
 θ : angle of terahertz wave shot
 C : ray speed
 n : refractive index of mold

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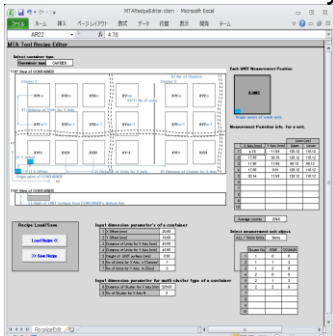
TS9000 functional software units and relations

- Easy operation to setup and measurement on GUI tools, real time measure process monitoring is available
- Result and condition data are managed over the network system.



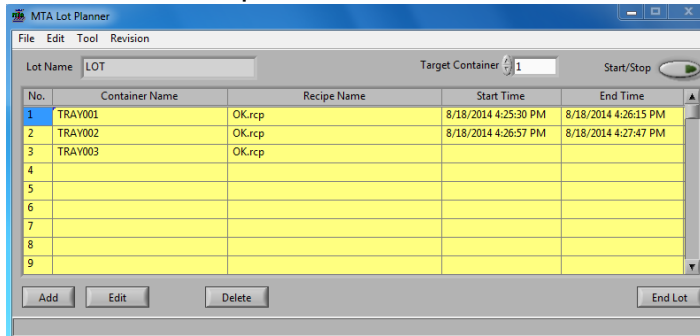
Recipe Editor

Set measurement location and die on tray

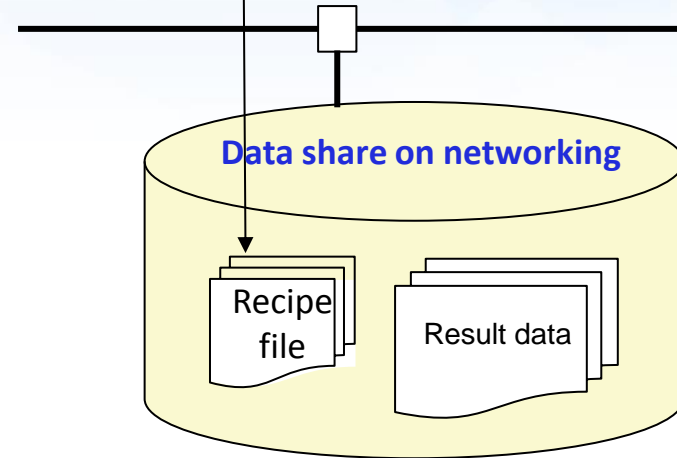


Lot planner

Load measurement recipe, make order of measurement plan of each lot

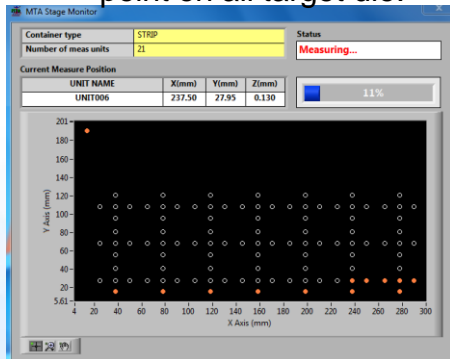


Data share on networking



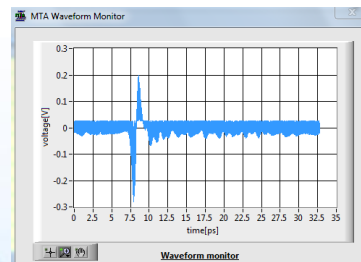
Stage Viewer

Monitor each measure point on all target die.



Wave Viewer

Realtime time-domain wave monitor on measurement point

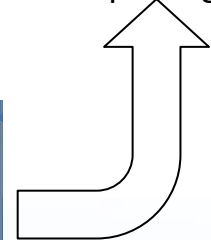


Result viewer

Show mold thickness result of each point and selected die.

Unit name	Meas position ID	Thickness (um)	RI
UNIT001	4	1003.77	1.200
UNIT002	4	1204.34	1.200
UNIT003	4	1010.12	1.200
UNIT004	4	539.15	1.200
UNIT005	4	328.20	1.200
UNIT006	4	656.32	1.200
UNIT007	4	448.25	1.200
UNIT007	5	307.42	1.200
UNIT007	3	615.63	1.200
UNIT007	1	311.75	1.200
UNIT006	5	277.41	1.200
UNIT006	3	490.38	1.200
UNIT006	1	979.82	1.200

exporting



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Main System Specification Data

Items		Specification data
Measurement object		IC mold thickness
Measurement sample shape		IC strip, Packaged IC
Mold thickness measurement spec.	points to measure	1 ~ 20 point/chip
	thickness range	30 μ m ~ 600 μ m
	spot size on the sample	300 μ m
	number of samples/h	> 250 units/hour, (4points/chip measure x 250 chips)
	Accuracy	$\pm 3\mu$ m
Certificated standards		MET, SEM S2, SEMI S8, ESD, NFPA79, ISO7(class 10k), Laser: class 3B
general	power	AC100V(100-120) / 200V(220-240) $\pm 10\%$,
	Size/weight	- analysis unit: 430 (W) \times 540 (D) \times 330 (H) mm / 30 kg or less - optical unit: 430 (W) \times 240 (D) \times 220 (H) mm / 14 kg or less - measurement unit: 1050 (W) \times 650 (D) \times 450 (H) mm / 67kg or less

TS9000 MTA, Mold Thickness Analysis System

High Volume Automatic Measure

In 250 units/hour, multipoint on the chip, auto measurement capability.

Measure Mold Thickness in Warped Strip

As it measures relative terahertz pulse timing, no influence to height of sample as warped/bend strips.

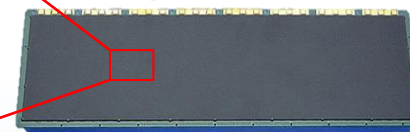
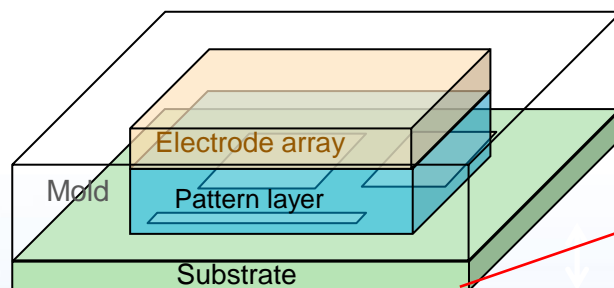
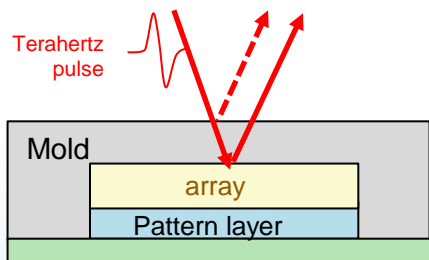
High Reliable/Accurate Measure

Within $\pm 3\mu\text{m}$ accurate thickness measurement .

Advantest TS9000 MTA Mold Thickness Analysis system



Terahertz reflect on both on mold and array top.



Strip, packaged chips

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Thank You!

更多垂询

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