

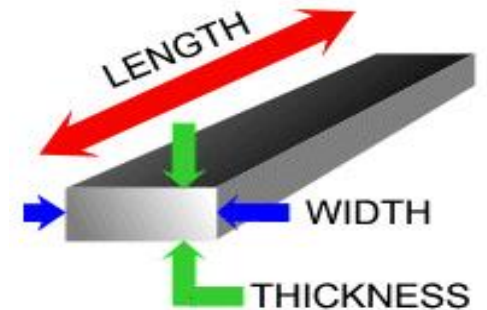
› **USED SAMPLES AND ANALYSIS AREA**
D003: 2023 FPL/INK 29 | R.P. EBELING

30 March 2023

› INTRO

- › This appendix is part of tender document 2023 FPL/INK 029
- › This appendix will cover
 - › **Required** sample size of the samples which shall be able to be loaded in the SEM
 - › **Required** measurement area on those samples
- › It is required that on all samples the following research can be performed:
 - › By means of SEM imaging, obtain information on:
 - › Material topography
 - › Material morphology
 - › Material contrasts
 - › Using EDX, perform analysis of materials

Definition of size



› SAMPLES TO BE LOADED

1. 1", 1.5 mm thick samples
2. 1", 6.35 mm thick samples
3. Wafers
4. Full size reticles
5. Fiducials
6. Diced reticle pieces

› 1" 1.5 MM THICK SAMPLES

- › Size:
 - › 1" diameter, round
 - › 1.5 to 2 mm thick
- › Measurement area:
 - › Full top surface
- › Material:
 - › Substrate: Quartz
 - › Conductive top layer (~20 nm metal)
- › Weight:
 - › ~2.6 grams
- › Mounting/ clamping areas
 - › Backside of sample
 - › Side of sample
 - › Sometimes (part of the) top of sample (rare)



› 1" 6.35 MM THICK SAMPLE

- › Size:
 - › 1" diameter, round
 - › 6.35 mm thick (1/4 inch)
- › Measurement area:
 - › Full top surface
- › Material:
 - › Substrate: Silicon
 - › Conductive top layer (< 5 nm metal)
- › Weight:
 - › ~7.5 grams
- › Mounting/ clamping areas
 - › Backside of sample
 - › Side of sample
 - › Sometimes (part of the) top of sample (rare)



› **ADDITIONAL INFORMATION 1” SAMPLE 6.35MM THICK**

› SEM analysis goal

- › Investigate the sample surface before and after an experiment, to observe any changes to the surface.

› SEM analysis details

- › The investigation is done by SEM imaging on a number of pre-defined locations on the sample.
- › The SEM imaging before and after the experiment is done on the exact same locations.
- › Imaging should be done both with SE and BSE detectors at the same time to obtain topographical-, morphological- and material contrast.
- › On some occasions, a large area (~2 mm x 2 mm) needs to be imaged in high detail, with resolution of 0.1 um or better.
- › A number of pre defined magnifications will be used per location.
- › Occasional EDX analysis of surface features may be required. Quick switching ability between imaging settings and analysis settings is highly preferred.

› WAFERS

- › Size:
 - › Up to 4 inch diameter
 - › 0.3 to 1.5 mm thick
- › Measurement area:
 - › Full top surface
- › Material:
 - › Silicon
 - › Sometimes coated with conducting or semi-conducting layer.
- › Weight:
 - › ~13 grams
- › Mounting/ clamping areas
 - › Backside of sample
 - › Side of sample
 - › Sometimes top of sample (rare)

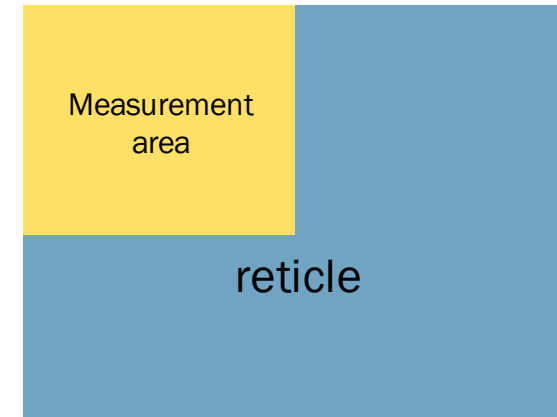
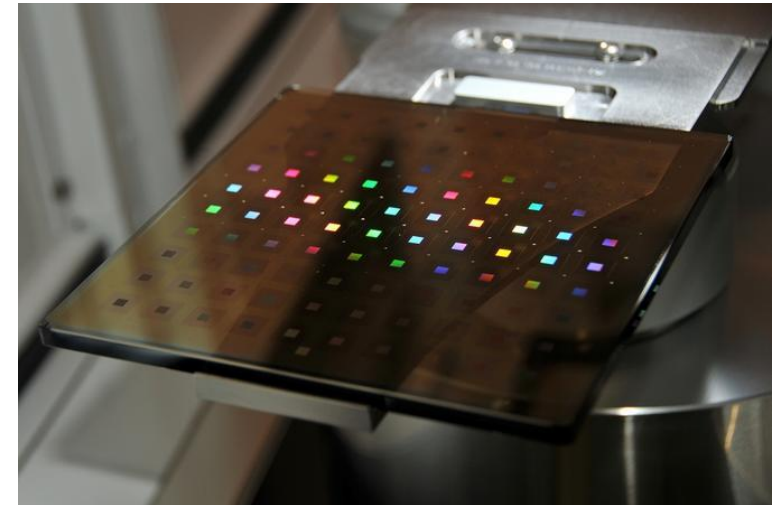


› **ADDITIONAL INFORMATION WAFER**

- › For some projects, a large number of particles is deposited on a wafer.
- › Particle dimensions are usually in the order of 10 nm – 10 μ m.
- › The particles are individually characterized by imaging them before and after an experiment.
- › Dimensions of individual particles are sometimes determined.
- › Imaging is done with both SE and BSE detectors.
- › Occasionally, particle area coverage (PAC) is determined before and after an experiment.
- › EDX analysis on particles may be required. Quick switching ability between imaging settings and analysis settings is highly preferred.

› FULL SIZE RETICLE

- › Size:
 - › 6" by 6", square
 - › 6.35 mm thick (1/4 inch)
- › Measurement area:
 - › At least $\frac{1}{4}$ of reticle top surface area, including one corner
- › Material:
 - › Substrate: Quartz, ULE or LTEM
 - › Top layer may vary between conducting and non-conducting
- › Weight:
 - › ~300 grams
- › Mounting/ clamping areas
 - › Backside of sample
 - › Side of sample



› **ADDITIONAL INFORMATION FULL SIZE RETICLE**

› SEM analysis goal

- › Investigate the sample surface before and after an experiment, to observe any changes to the surface.

› SEM analysis details

- › The investigation is done by SEM imaging on a number of pre-defined locations on the sample.
- › The SEM imaging before and after the experiment is done on the exact same locations.
- › The sample has a non conducting substrate, charging of the sample surface can easily occur.
- › The sample surface may not be grounded by means of copper tape or any other method touching the surface.
- › Imaging should be done both with SE and BSE detectors at the same time to obtain topographical-, morphological- and material contrast.
- › On some occasions, a large area (~2 mm x 2 mm) needs to be imaged in high detail, with resolution of 0.1 um or better.
- › A number of pre defined magnifications will be used per location.
- › Occasional EDX analysis of surface features may be required. Quick switching ability between imaging settings and analysis settings is highly preferred.

› FIDUCIALS

- › Size:
 - › 6" length, 19 to 26 mm width
 - › Thickness may vary between 5 mm and ~20 mm
- › Measurement area:
 - › At least 1/2 of fiducial top surface area, including one corner
- › Material:
 - › Substrate: Quartz, ULE or LTEM
 - › Top layer may vary between conducting and non-conducting
- › Weight:
 - › ~50 grams
- › Mounting/ clamping areas
 - › Backside of sample
 - › Side of sample



› ADDITIONAL INFORMATION FIDUCIALS

› SEM analysis goal

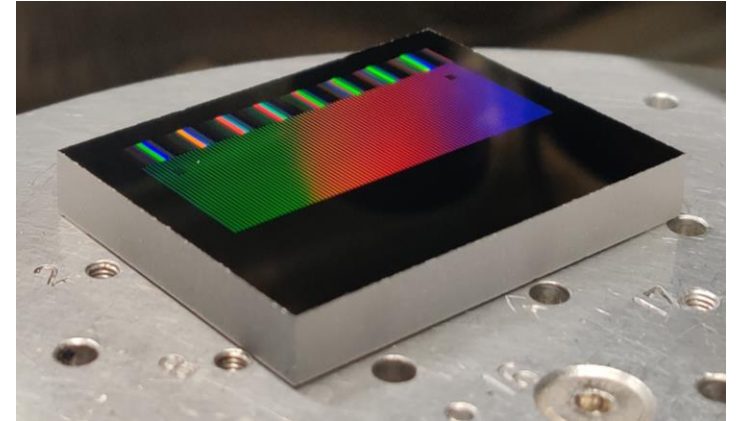
- › Investigate the sample surface before and after an experiment, to observe any changes to the surface.

› SEM analysis details

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- › The SEM imaging before and after the experiment is done on the exact same locations.
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› DICED RETICLES PIECES

- › Size (length x width) varies:
 - › 45 mm x 45 mm
 - › 53 mm x 53 mm
 - › 45 mm x 35 mm
 - › 25 mm x 25 mm
- › 6.35 mm thick
- › Measurement area:
 - › Full top surface
- › Material:
 - › Substrate: Quartz, ULE or LTEM
 - › Top layer may vary between conducting and non-conducting
- › Weight:
 - › ~50 grams
- › Mounting/ clamping areas
 - › Backside of sample
 - › Side of sample



› **ADDITIONAL INFORMATION DICED RETICLES PIECES**

› SEM analysis goal

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› SEM analysis details

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› AFM TIPS

› Size:

- › 1 – 20 μm length per AFM tip
- › Loading box of ~10 cm length

› Measurement area:

- › Tip and sides of tip, using rotation and tilt
- › Rotation range: 360 degrees.
- › Tilt range: -5 to 60 degrees.

› Material:

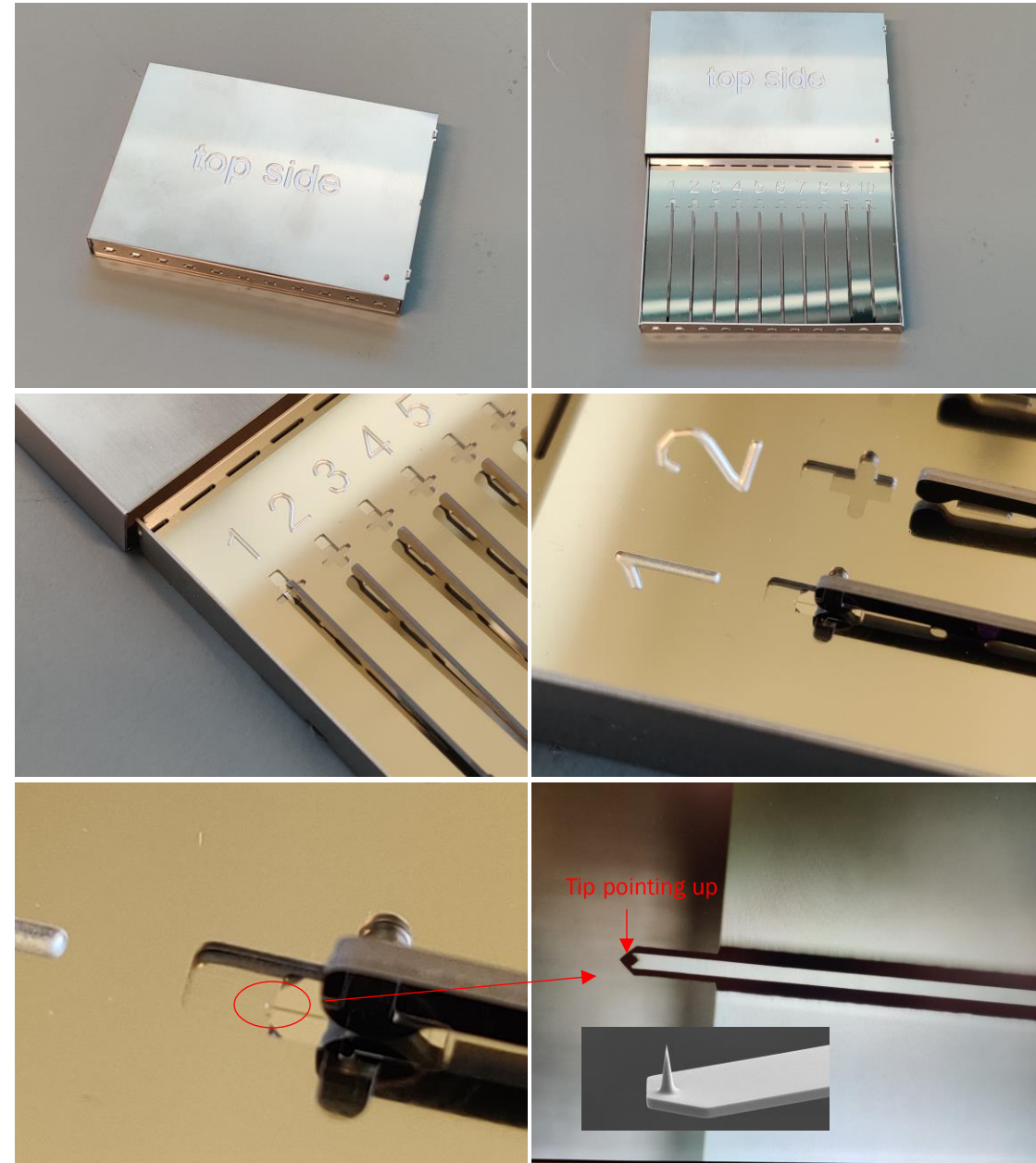
- › Substrate: Si
- › Non conductive top layer

› Weight:

- › Unknown. Estimate: ~100-200 grams

› Mounting/ clamping areas

- › Backside of tip
- › Full box



› **ADDITIONAL INFORMATION AFM TIPS**

- › SEM analysis goals
 - › Check the sharpness of the tip point.
 - › Check for any damage of the tip.
- › SEM analysis details
 - › Since the tip is round and pointing upward, the SEM stage needs to rotate and tilt the sample such that all sides of the tip can be imaged in detail.
 - › If contamination is found on the tip, EDX will be used to investigate the composition of the contamination.

› MINIMUM SAMPLE HEIGHT

- › In addition to the previous slides, a minimum requirement on sample height is defined.
- › **The minimum sample height shall be: 30 mm.**
 - › Assuming a round flat sample with 4" diameter.
- › Such a sample shall be able to be loaded *and* the top surface area shall be able to be fully measured.

» **THANK YOU FOR
YOUR TIME**

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