USE OF EUV PODS
at imec

RIK JONCKHEERE
@ IEUVI MASK TWG, 30 SEPTEMBER 2012
UNIQUE INFRASTRUCTURE REALIZED INTEGRATING CLEANING, BACK-SIDE INSPECTION AND AUTOMATED HANDLING OF NXE3100 RETICLES

Süss MaskTrack Pro Cleaner

Süss MT Pro InSync

Pre Clean
Wet Transfer
Final Clean
172 nm UV Exposure

Transfer Handling

Buffer
Aligner

Backside Particle Inspection
EIP Library

Dry Flip
Soft RTP

Exchange Port

EIP Transfer Handling

Was for ADT)

Dual Pod Load Port

SMIF Load Port

R. JONCKHEERE @ IEUVI MASK TWG, 30 SEPTEMBER 2012, BRUSSELS

Mask shop

Shippable EUV POD to be established

EUV POD Type A

NXE3100
Darkfield full substrate imaging technology

**Typical Performance**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particle detection size</td>
<td>150nm (via PSL)</td>
</tr>
<tr>
<td>Routine use (back-side)</td>
<td>&gt;95% capture rate &gt;250nm</td>
</tr>
<tr>
<td>Defect size repeatability</td>
<td>&gt;90%</td>
</tr>
<tr>
<td>Measurement time</td>
<td>&lt; 5min</td>
</tr>
<tr>
<td>Defect detection on front-side</td>
<td>Empty areas, needs dedicated calibration</td>
</tr>
</tbody>
</table>

Assignment of a size to a detection is based on the intensity of the scattered light!

**DISCLAIMER:** Calibration done for PSL. Mind that the **sizing accuracy** for an arbitrary “defect” with a given shape and morphology may be limited.
OUR TARGET SCENARIO FOR MASK HANDLING

New NXE3100 reticles
- Receive the reticle in EUV pod.
- Inspect reticle back-side on SPARK.
- Evaluate inspection results against practical target “OK for NXE3100”
  - If OK: Reticle in Type A EUV Pod can be moved to Scanner
  - If not OK: Clean reticle to reach OK status ( + follow-up if not possible)
- Reticle mates with fixed EUV pod.

Routine check of NXE3100 reticles in use (particle monitoring)
- Same way, automated, via its EUV pod Type A in use on the NXE3100

All via fully automated handling within MT Pro + InSync
New NXE3100 reticles

- The reticle is received from the mask shop in ...
  - ... shipping box: manual load into RSP200, auto transfer into EUV pod on InSync
  - ... RSP200: auto transfer into EUV pod on InSync
  - ... EUV pod: so far it was not yet fully considered shippable
- Reticle back-side is inspected on SPARK.
- Evaluate inspection results against practical target “OK for NXE3100”
  → Still operator decision (inspired by # detections)
- Reticle mates with fixed EUV pod.

Routine check of NXE3100 reticles in use (particle monitoring)
- Same way, automated, via its EUV pod Type A in use on the NXE3100

All via fully automated handling within MT Pro + InSync
EUV pod status

- So far only **Entregris pods Type A** in use at imec.
- Imec ordered **modified Type B of Entegris** (InSync requiring “pockets”).
- The latter is now less relevant because of shipping data for Type A?
- **Gudeng pods**: More recently qualified for NXE3100 by ASML. Modification to InSync EIP gripper scheduled. Hence not used at imec so far.

EUV pod cleanliness testing (Entegris Type A)

- 1st test via 20x open/close cycling on Insync:
  - no adder for new pod, nor for one **after ~10 months of use**

Shipping results in EUV pods (Entegris Type A)

- 2 plates, prequalified on SPARK, sent back and forth to US, one site each
  - **Front-side**: both plates have zero adders >250nm
  - **Back-side**: 1st plate has 2 adders >1µm, 2nd plate has 6 such adders

---

Need to establish shipping by/from mask shop in EUV pod!!
(= removable hard pellicle, assuring FS cleanliness)
CONCLUSIONS

▸ **Infrastructure** in place for **integrated cleaning, automated handling** and **back-side inspection** of NXE reticles (interfaced to scanner via EUV pods).

▸ **Particle adders by on-site handling are minimized.**

▸ Very valuable for **learning** about particle contamination of NXE reticles, and **avoiding** it.

▸ **Not shown here, but see my presentation in session 3 at EUVL Symposium**
  - Back-side monitoring helps a lot to trace overlay critical particles, but still **misses capability to differentiate** between those and other (large) detections.
  - Infrastructure and procedures in place ...
    allow to reveal **particle adders by other sources**

▸ Our intention and suggestion is ...
  To start using **EUV pods for shipping** from the mask shop.
Details: see session 3 at EUVL Symposium