Challenges and New Developments in Die Sorting
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Mühlbauer Group Introduction

- 35 production & service locations
- Technology centers in the USA, Slovakia, Serbia, Malaysia & China
- In-house precision-part production
- Provision of
  - High-end semiconductor & RFID systems
  - Reliable vision inspection technologies
  - Innovative ID document end-to-end solutions
  - Secure access & border control systems
A SOLUTION is more than just a machine

- **Process**
  - Flexible
  - High speed
  - Low COO

- **Life cycle Management**

- **FACTORY Smartification**

- **100% Vision QUALITY INSPECTION**
- Reconstructed wafer Indexer for up to 12” wafers

- Optional Waffle Packs / JEDEC Trays or Hoop Ring can be mounted onto adapter plate at input or output:

  - Pick from Waffle pack mounted on adapter plate
  - Waffle Pack adapter plates
  - JEDEC Tray adapter plate
ALBATROSS: DOUBLE AS FLEXIBLE, BIG DIE READY

DOUBLE AS FLEXIBLE

▪ Wafer / Hoop ring
▪ JEDEC Tray, T&R / DeTaping
▪ 12“ Wafer / 0,3 – 35 / 45mm Die

Benefits: Bin Sorting

▪ MULTI OUTPUT STATION:
▪ 6* Tape & Reel
▪ 2* JEDEC Tray
▪ 12* Waffle pack
▪ Reconstructed Panel /5µm placement acc.
▪ Automatic Tool Changer
Merlin: high-speed DIE SORTER 2020

Smart Quality Sorter
- HIGH VOLUME MANUFACTURING ➔ 450k / 650k a day
- Smart Intelligence = super fast product change over
- 12” Wafer / 0.2 – 7 or 9mm Die

Quality, Speed & Automation
- 100% Quality with 6 Side Inspection
  - 15pic per die = 180pic per second
- Tape and Reel
- Reconstructed Wafer and Tray
- ONLINE IR INSPECTION, Sidewall and Backsite
- ARC AUTOMATION
Let’s talk about Inspection

Who can see the crack?

Die surface with standard coaxial light (pixelated to hide confidential details)

Backside (visible light)
Let's talk about Inspection

Who can see the crack?

Die surface with standard coaxial light

Backside with IR light (pixelated to hide confidential details)
Let’s talk about Inspection

Adding side wall inspection

Inspection with visible light

Inspection with IR light

=> Only with IR light cracks can be seen well enough for reliable detection
Artificial Intelligence / IR BSI with reduction of over-rejects

Without particles filter: 30% reject due to particles

With filter: <3% reject, as particles on back side are ignored
New: angle IR Sidewall

Contrast and size of crack depend on its direction.

Sometimes straight view gives better detectability, sometimes the angled view.

Using both gives the best reliability
### Higher resolution ➔ inspection quality

<table>
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<tr>
<th>Resolution</th>
<th>3µm/pix – 4 Megapixel</th>
<th>1µm/pix – 25 Megapixel</th>
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Impossible to detect small defects or check control pattern

Higher resolution at -> full speed <- for -> all die sizes
Factory Smartification

TRACEABILITY of Products, Quality and Machine Status
- Real time data => OPC/UA
- Machine performance & Product quality
- Statistic, Monitor, Reporting
- Break down Analysis
- Factory/Output Improvement

Smart Material Management
- Automatic Material Management (Wafer / Reels) by AIV / OHV
- Operator assisted product change over

Smart Product change over
- Smart Product Change over, RMS
- Predictive Maintenance
Consideration of Production Materials:
- Wafer in a Cassette (input)
- Can Automatically be Loaded with
  - AIV (Automatic Intelligent Vehicle)
  - or TOP LOADER via
  - Load Port solution
Factory Smartification

MATERIAL MANAGEMENT: OUTPUT REEL CONCEPT

- Software connection between die sorter and fleet manager via PalaMax
- AIV pick drawer box from warehouse
- Bring to die sorter by AIV
- Arrive and communicate with die sorter
- Change the empty cassette to a new cassette with new wafers automatically

Reel size input/output
Batch type?
Factory Smartification

“CENTRAL CONTROL ROOM”
- Remote machine operation
- Save 50% TECHs on floor

MACHINE TRACEABILITY IN REAL TIME
- Detailed reporting tools
- Drill-down data analysis
- Identify error reasons and their root causes
- Improve production behavior
- Smart Factory / AIV communication

PRODUCT TRACEABILITY
- Drill-down analysis
- Get the VALUE of Vision inspection
- Identify reject reasons and their root causes
Challenges and New Developments in Die Sorting

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