太引資訊系統股份有限公司

Total Yield and Knowledge Engineering Systems

Fast Forward your Full Potential

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• 1. 說明晶圓廠簡易流程與相關測試資料
• 2. 說明晶圓廠測試資料之 Lot、Wafer、Shot、Chip (Die)、Latch、Bit之間的關係
• 3. FRL之Signature分類
• 4. Signature之Yield Loss之預測
• 5. 診斷Signature之資料分析
• 6. 實驗驗證
• 7. 介紹太引資訊系統

晶圓良率測試之FRL資料分析

TYNE EDA / KM solution links every process steps to exceed your expectations

 Inline History Data—Lot Base

<table>
<thead>
<tr>
<th>Lot</th>
<th>EQP</th>
<th>Job_In_Time</th>
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<tr>
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<td>20080101 180136</td>
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<td>xxx3</td>
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 Inline History Data—Wafer Base

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<th>Wafer</th>
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<th>Boat</th>
<th>Job_In_Time</th>
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 Inline Measure Data

<table>
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<tbody>
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</tr>
<tr>
<td>Wafer</td>
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<td>Value</td>
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<tr>
<td>Spec_High</td>
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<td>Target</td>
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</tr>
<tr>
<td>Spec_Low</td>
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</table>
問題

• FDC資料量相當大:每秒一筆
• Transformed Indicators : Max, Min, Pxx, Mean, STD, Slope, …
• 如何根據上述Indicators作監控

Defect

• 包含微粒(Particle)和缺陷
• 由Defect來Monitor Wafer現階段的製程情況
• 機台借由光線辨識Defect的大小、Pattern並拍實體圖像
• 機台可辨識Defect不同分類

Defect Map

Defect + CP Bin Map
問題

- Defect與良率的關係：
- Killer：圖上的Particle是Chip Fail的原因？
- 各Layer的Defect如何預測良率
- 個數多寡、大小、位置、類別如何給權重
- 找出重要Layer有效管制

Wafer Acceptance Test

- WAT: 電性測試
- 在Chip與Chip中間的切割道上預先設計一些Device, 借由量測這些Device來了解Chip內的電性特性
WAT Shot

- WAT Shot (Reticle Size): 僅針對部份 Shot 設試
- Kerf Location: 記錄 Test Device 相對於 Reticle 的位置（EX: 1 個 Shot 均有 8 個 Chips）

1 2
3 4
5 6
7 8

Chip Probe / Wafer Sort

- Probe Card: 針測板
- Bin: IC 分類之稱呼
- Chip or Die (裸晶): 晶片上面的基本單位

CP Bin Map

Bit Viewer--Bit Fail
Fail Region Latch

- FRL: 將Bit Fail的結果，根據Scramble轉換成Latch Fail的資訊
- 1 G Bits = 4,096 Latches
- 1 Latch = 256 Bits

FRL Map

Fail Region Count

- FRC: 測試時將Bit Fail情況轉換成Latch數量的測試結果（計算右圖Chip FRL Fail的數量）

CP Recognition

你看出哪些Pattern

Signature Assign
問題

- 每天的Signature Assign可觀察出是否有新異常現象產生
- Signature所造成的良率損失如何預測？
- Key Signature又如何以這些異常Wafers來找出製程的問題？Process Step？EQP？Chamber？...
- 自動分類
- Defect對上FRL可以更精確判定為Killer

Signature vs Yield loss

<table>
<thead>
<tr>
<th>Wafer</th>
<th>Signature</th>
<th>Yield</th>
<th>FDC</th>
<th>FAC</th>
<th>FMGN</th>
<th>Weight</th>
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</table>
A system is needed to track the status, actions and drive closure. Analysis & Actions to drive those yield losses.

Yield Enhancement

Current

Opportunity

Stretch Yield

Goal Yield

Variation

Improvement

Accelerating Yield Ramps

Parallel Execution

Opportunity

Characterization Teams own ramping the 'Potential' %.

- Understand the design / process / product limits & recommend new "optimized windows"
- Work with Design / Test / Improvement Engineers to translate losses into changes & process fixes. My 'boll' is too high > reduce GC CD!
- Regularly update the Loss pareto and the Yield Improvement Roadmap.
Improvement Engineering Teams own ramping the ‘Hypothetical maximum’ %.
- Understand the process/product interactions which give yield losses.
- Translating “optimized window” recommendations and opportunities into unit process changes.
- Successfully Integrating several Unit process changes together for each Improvement.
- Driving improvement projects of the Yield Improvement Roadmap.

Manufacturing Engineering to own reducing the ‘Variation’ %.
- Temporarily containing the unit processes with excursions.
- Drive tightening the distribution which contribute to the baseline yield losses.
- Improving Process Capability and eliminating mismatched Equipment.
- Pushing Root cause closure and ensuring no excursion re-occurrences.

Our Products & Services
- Statistical Process Control (SPC) Software solutions, O.O.C. alert & documentation. REDUCE VARIATION
- Engineering Data & Lot Review Systems, Collections™ Time & Lot based engineering data review and classification systems. DRIVE IMPROVEMENTS
- Engineering Data Analysis, Ayedas™ Total solution including Database design & implementation, Data Loaders, and full range of engineering data analysis FIND, ANALYSE & IMPLEMENT NEW OPPORTUNITIES
- Chart Package, Statistical analysis and charts library
- Yield Management, Systems and Statistics consulting.
Tool matching. “Mining for improvement opportunities”

Tools are never exactly matched
Better tools can find tight Process Windows
Or marginal Products

Regular “Best Tool” highlights systematic process window opportunity.
Likewise for a Best Product!