Investigating Subsurface Defects: 3D EBAC Mapping with Varying Beam Energies

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Problem

- Complex interconnect stacks hide open and high-resistance defects.
- Conventional fault localization struggles to detect buried failures

Investigation

- Used multi-energy EBAC (2–10 kV) on the reference and the failing ring-shaped structures. (Only failing images were showing on the poster.)
- Captured EBAC images from current amp connecting to top and bottom pads.
- Extract contours or edges based on intensity gradients of each EBAC images.
- Built 3D reconstructions from stacked images to analyzing the defect layers.

Findings

- Low kV: highlights surface features.
- High kV: probes deeper conductive layers.
- 3D reconstruction showed high noise level at upper layers of pad stacks.
- The open and high-resistance anomalies were most likely near the lower layers of the bottom pad stack.

Conclusions

- First 3D EBAC defect mapping using variable beam energies.
- Non-destructive, high-resolution method for localizing buried defects.
- Promising tool for advanced semiconductor failure analysis.

Setup

SEM: ThermoFisher NanoSEM 450
Nanoprobing: Kleindiek system with APT software
Analysis: Keithley 4200A-SCS Parameter Analyzer
Sample: Delayered to lower metal layers
Structure: Two-terminal ring-shaped device

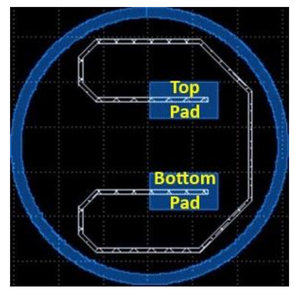

Illustration of the 2-terminal ring-shape structure

Seeing deeper with EBAC: 3D imaging across energies reveals hidden defect in advanced chips