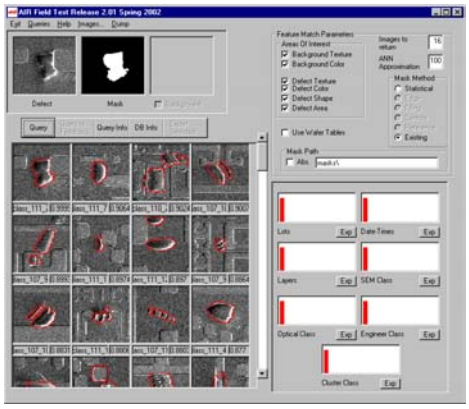
Industrial Inspection

Automatic Image Retrieval and Data Management for Semiconductor Defect Databases

Rapid Yield Improvement Through Automation

Semiconductor wafer manufacturers invest much of their time in isolating the causes of yield-impacting defects during the lithographic printing and processing of integrated circuits on wafers. Due to increased automation of wafer inspection and metrology, manufacturers today collect over 20,000 images per week at a single facility, and maintain them for 6 to 18 months in the data management system. The ORNL Automated Image Retrieval (AIR) software system provides the only effective means available to the industry today to perform data queries based on image content.



The ORNL AIR software engine is easily accessed by many interfaces. Shown is a Windows-based retrieval interface that displays similar imagery.

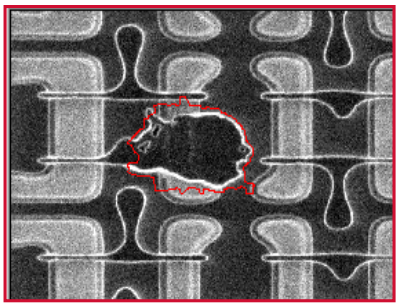
AIR describes images in a unique way so that many users can perform varied queries from a single system. In semiconductor manufacturing, AIR reduces the time required to source defects by taking advantage of the historical repository of image data.

Base Technology

Content-based image retrieval (CBIR) refers to techniques used to index and retrieve images from databases based on their pictorial content. AIR uses extensive feature descriptions (e.g., color, texture, and structure) and an efficient approximate nearest neighbor indexing method to index a database. AIR also uses novel fractal-based techniques to segment defect and substrate regions and provides an intelligent data management method to mitigate redundancy in the database, resulting in substantial reductions in the required size of the data repository.

Specifications and Features

- Windows OS / MS Visual C++
- Accusoft ImageGear (JPG, TIF, etc.)
- ORACLE, SQL Server, MS Access
- Access through MS ADO interface
- Add image, <1.0 sec
- Retrievals, <10 sec (>70,000 images)



AIR uses novel methods for defect detection and description when images are available that do not have non-defective references for comparison.

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