Micron’s global manufacturing network spans 12 sites across Asia and North America. Our distributed footprint not only enables us to efficiently serve a broad range of customers, but it also promotes a culture of collaboration and innovation—one that brings together diverse experiences, perspectives and backgrounds. By combining teams from information technology and manufacturing, we’ve created smart manufacturing initiatives involving big data and machine learning to improve efficiency, better meet customer requirements and optimize operation capabilities.

In this case study, we examine an Industrial Internet of Things (IIoT) initiative Micron has created using edge servers and dynamic signal acquisition cards. Implemented in our worldwide manufacturing operations, this initiative improves efficiency and productivity, resulting in better quality control, defect detection delay shortening, and expected cost savings of more than $10 million per year.

Semiconductor manufacturing, with its hundreds of precise steps and sensitive processes, is one of the world’s most complex industries, making it an ideal candidate to benefit from smart manufacturing initiatives.
Using IIoT to Listen to the Chemical Mechanical Polishing Process

One of our key IIoT smart manufacturing initiatives monitors wafer tool health by applying acoustic sensors to wafer processing machines to collect signals as wafers are polished. By comparing baseline sound fingerprints from proper wafer acoustic signals to sound fingerprints detected during mass production polishing steps, we can recognize abnormalities and identify potentially problematic tool conditions.

During the chemical mechanical polishing (CMP) process, wafers are placed in equipment where they are chemically and mechanically polished. If improper tool conditions exist, defects can be caused by particles such as dried slurry, particles from hardware wear and tear, or diamond (hard particles) from conditioning. Considering there are other processing steps before wafers are inspected by real-time defects analysis (RDA), and not all wafers are sampled during RDA, these defects can greatly impact wafer manufacturing before they are detected, triggering a stop in production.

Sensors used in traditional manufacturing, like torque and pressure, are not sensitive to these defects. Micron’s acoustic monitoring system enables us to gather acoustic signals from the wafer and identify abnormal sound. Advanced signal processing techniques in edge servers and dynamic signal acquisition cards extract features of polish sound at the edge. Machine learning and deep learning techniques are then used on the big data cluster to differentiate the problematic polish sound fingerprint from the baseline sound fingerprint.

Summary

Micron’s machine learning efforts are prominent in our worldwide manufacturing operations, and our acoustic wafer monitoring system is an example of one such effort. With this system, Micron expects:

- Savings of greater than $10M/year company-wide
- Detection delays shortened by over 90%
- Better quality control with 100% inline monitoring

Micron is leveraging our industrial customer’s solutions in our own factories. As an end customer for IIoT solutions, and through servicing our broad industrial customer base for over 25 years, we know that selecting the right electronic components and storage solutions up front in the design process matters to long-term success. Our full industrial portfolio can help you meet functional product requirements while ensuring long-term product quality and reliability.

Learn more at www.micron.com/embedded

Micron’s Industrial Quotient: The New IQ for Success in IIoT

Micron’s Industrial Quotient (IQ) is about making intelligent choices for your IoT designs. Choices that not only help meet functional requirements, but also ensure long-term reliability and quality while keeping product lifecycle management simple. With a mindset and portfolio that delivers sustainable value, Micron’s IQ is lowering total cost of ownership in IIoT.

Figure 2: Micron’s Acoustic Wafer Monitoring in the CMP Process

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