

Honeywell Gets to the Heart of the Issue to Protect Quality

Case Study

Honeywell's data analytics and Uniformance® Suite helped save business worth \$20 million a year by rapidly identifying the cause of a chemical quality issue for a supplier in the semiconductor industry.

Background

Honeywell Electronic Materials (HEM) has provided critical materials to the semiconductor industry for more than half a century. HEM leverages expertise and bench strength in both chemistry and metallurgy to develop advanced material offerings. Its product portfolio includes electronic polymers, targets, chemicals and heat spreaders, thermocouples, and thermal interface materials. HEM maintains an exceptional commitment to quality. HEM is dedicated to working closely with their customers resulting in a wide range of innovative products serving the needs of electronics manufacturers in multiple industries. Customers turn to HEM for solutions to their technology roadmap challenges because they provide security of supply, reliable quality and delivery, fast cycle development and rapid prototyping.

Challenge

HEM found that one of its chemical products supplied to silicon wafer manufacturers experienced an unexplained step change in a quality variable. The deviation affected all of its customer's factories starting with material manufactured on a particular date.

As a result of this change in the chemical's properties, it had begun to fail quality tests, putting at risk about \$20 million a year in future business.



Efforts to identify the root cause were helped by the fact that HEM records a wide range of process data as standard practice, including temperature, ambient conditions, raw material suppliers and composition, and quality data from multiple customers. It was therefore able to explore the historical data to try to discover and quantify contributing factors.

Initial investigation by the HEM team narrowed the likely root cause down to a few key environmental and process variables, however a definitive correlation to the quality issue remained elusive. Moreover, some data was recorded only on paper, limiting the data fidelity and reducing opportunities to include this data in computer analysis.

HEM engaged with its sister company, Honeywell Process Solutions (HPS), and its Connected Plant group using Sentience Data Analytics to help with data analysis and to identify the cause of the property change.

"The collaboration of our experts with the Honeywell Process Solutions team resulted in the right tools, methodology and know-how to identify a safer manufacturing process window to meet customer needs. Using modern data analytics tools helped us quickly validate process conditions that resulted in a more stable and reliable product."

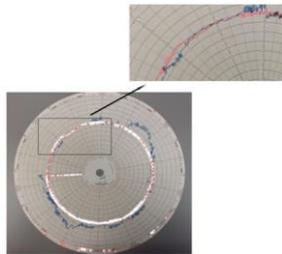
Evelyn Kennedy
Director of Technical Programs
Electronic Chemicals & Electronic Polymers

In parallel, a Honeywell corporate R&D team provided expertise and analytical support that proved no change had occurred to the chemical composition of the product and thus no contaminate existed.

Solution

The Honeywell Connected Plant's data analytics team worked jointly with HEM's subject matter experts to obtain the necessary data, perform exploratory analyses, and quantitatively model the impact of contributing factors before suggesting corrective actions. Effectively, a root cause analysis would determine which process variables to monitor, fix, or automate with closed-loop control.

The joint data analytics and subject matter expert (SME) team was off to a strong start with the identification of factory temperature and humidity during production as potentially playing a role in the quality change observed. These variables were, however, recorded on paper (printed disk charts).



To facilitate the necessary analysis, the team digitized these hardcopies by scanning them and then used image analysis to convert the temperature and humidity readings into electronic data.

The team then employed, among other tools, the Honeywell [Uniformance®](#) Suite, which offers a range of powerful data analytics software. Several machine learning techniques were employed for the analysis, including regression, SVM, random forest and decision trees.

For More Information

Learn more about how Honeywell's analytics solutions can improve your consistency and quality – visit uniformance.com or contact your Honeywell Account Manager, Distributor or System Integrator.

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Results

The analysis revealed two key factors were largely responsible for the change in the chemicals supplied:

- Environmental factors and, in particular, the factory temperature and relative humidity were the most significant factors correlated with the deviating variable and with one another.
- Reaction temperature and times during the process were also a factor, and the analysis narrowed the lead contributors down to the warm up process. Other temperatures and reaction time steps were only weakly correlated or uncorrelated and difficult to adjust.

These issues could be addressed through new process controls: temperature control in the factory and tighter process control on the reaction. This helped reduce manufacturing variability thus improved quality. The work by Honeywell Connected Plant data analytics to identify key contributing factors to process variability was instrumental to the whole team effort of HEM and Corporate R&D to show no other change had occurred to the chemistry and ultimately lead to closure of the quality issue.

Benefits

By combining Honeywell Connected Plant data analytics expertise and the powerful analysis of Uniformance, with HEM's in-depth process knowledge, HEM was able to identify and resolve an issue presenting a real risk to customer satisfaction, production costs and ongoing revenues.

The cause of the issues was rapidly identified through the data analytics project, enabling a cost-effective resolution to a problem that would have jeopardized \$20 million worth of business a year. Overall, the project delivered a rapid and substantial return on investment.

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