Fab Management Forum

Jumpstart Your Smart Journey

J. Behnke
GM Final Phase Systems
INFICON, East Syracuse NY, United States

Abstract
Recent events have led to a global chip shortage creating demands for existing fabs/factories to produce more than their "Stated Capacity". The Semiconductor industry has the most complicated factories in the world, yet we continue to primarily use the traditional approach to increase capacity which is to add limited capital for bottleneck operations. There are several issues with relying only on this approach: 1) capital equipment is expensive and can take a year or more to be sourced, installed, and qualified for production, 2) the assumption that the increased capacity in the bottleneck area can be handled by the remainder of the factory equipment to provide the forecasted increase in capacity, 3) every factory has unrealized capacity due to productivity losses which can be harnessed more quickly and easily than adding capital equipment. Another critical unintended consequence of running above "Stated Capacity" in this time of high demand for specific part types is its non-linear impact upon cycle time.

An alternative approach to rapidly increasing factory output is to Jumpstart Your Smart Journey. There are several Smart Digital Twin enabled solutions that deliver great ROI but many of them take 9-18 months to fully realize. The quickest way to improve a factories performance is to quickly install a Digital Twin that is capable of immediately providing real time bottleneck performance analysis, directing priorities for maintenance and engineering teams, and most importantly providing a comprehensive line balancing solution. Line imbalance or WIP bubbles are always problematic but under heaving loading conditions they become unbearable as the excess capacity used to absorb them is now committed for daily production goals. This is one of the primary reasons that cycle time increases non-linearly.

This presentation will discuss the requirements and timeline to Jumpstart Your Smart Journey. The most critical item is to establish a comprehensive Digital Twin followed by configuration of a factory specific line balancing solution. For most factories this can be done in just a few months and deliver rapid improvements in output and cycle times from existing capital/resources. A review of other Smart applications which use the same Digital Twin and can be deployed after the initial Jumpstart phase will also be presented to demonstrate further growth and evolution into a Smart Factory.

Biography
Mr. Behnke has 35 years of semiconductor industry experience including: logic and memory manufacturing,

technology/product development and fab operational excellence. As the GM of Final Phase Systems an INFICON Product Line, John leads a team that develop and deploy SMART software solutions that enable fabs to improve their manufacturing efficiency. FPS's suite of software solutions are built upon a common Datawarehouse which enables advanced Fab Scheduling and optimized WIP movement as well as other related capabilities. He is also a Co-Chair of the Semi North America Smart Manufacturing Special Interest Group.

Prior to FPS John served as the CEO and President of Novati Technologies, the SVP and GM of the Semiconductor Group of Intermolecular, the CVP for Front End Manufacturing, Process R&D and Technology Transfers at Spansion and the Director of AMD's Fab 25's Engineering and Operations groups where he was a founding member of AMD's Automated Precision Manufacturing (APM) initiative which led the Semiconductor industry's development and use of APC and other advanced factory systems. He also led the successful conversion of Fab 25 from Logic to Flash memory which was enabled through the virtual automation of the fab.

Mr. Behnke earned a B.S. degree in Mechanical Engineering with an Industrial Engineering Minor from Marquette University. Mr. Behnke holds five U.S. patents.

Can AI Optimize Your Equipment's Throughput ?

D. Suerich
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Abstract

In response to global chip shortages, many semiconductor fabs have started to demand even higher throughput from the equipment on their manufacturing floors. While process timing is often constrained by physics, opportunities do exist to reduce wait time waste by optimizing the manner in which substrates are scheduled within complex tools, for example, in equipment that combines multiple operations within a single cluster.

However, scheduling wafer flows within a complex cluster tool – particularly in a high-volume, high-mix environment – presents several engineering challenges for optimizing wafer movements. Is it possible to avoid deadlocks and maximize throughput while enforcing strict process and recipe rules? When a tool's components are operating in a degraded mode or are disabled for maintenance, can the equipment continue to perform efficiently? A tight labor market that requires OEMs to make tough decisions about where to allocate scarce expert developers compounds the challenge.

Advances in artificial intelligence (AI) and machine learning have introduced the possibility for automated solutions that can discover optimal routing in real time, replacing the effort for creating high-quality substrate schedulers manually. Such an approach would increase fab throughput while simultaneously reducing time to market and engineering effort for OEMs.

In this talk, PEER Group will compare three generations of cluster tool schedulers: Traditional, Offline optimized via machine learning, and Real-time equipment optimization using AI.

Biography

Doug Suerich is Product Evangelist at The PEER Group Inc., the semiconductor industry's leading supplier of factory automation software for smart manufacturing and Industry 4.0. Doug focuses on big data and remote connectivity solutions that help manufacturers collaborate securely on tools and data in production environments. A passionate advocate for smart manufacturing, Doug serves as an active member of the SEMI® SMART Manufacturing Technology Community, Americas Chapter.

Doug has over 20 years of experience leading software teams for a variety of industries including semiconductor, manufacturing, and transportation. Most recently, he was involved in architecting PEER Group's remote connectivity solution, Remicus™, and he was a champion in promoting the use of cloud computing and latest-generation web technologies.

Prior to joining PEER Group, Doug was a software development manager, automation engineer, information systems specialist, and consultant. He has extensive experience designing and integrating robust automation software solutions. Doug holds a Bachelor of Applied Science with Honours in System Design Engineering from the University of Waterloo.

Remote operations / training new employees in time of disruption; integrating new training solutions; managing operations when staff is digital.

A. C. Zimmer
Executive Search & Selection Consultant
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SONAR

Abstract

CoViD has proven one thing: it is possible to run a company successfully without the physical presence of employees! What does this mean for the future? Will home office establish itself? What impact will this have on management and onboarding of new employees? How do I lead a digital team? It will depend on some factors to be used differently. In detail:

Team building: lead teams horizontally. One success factor is that everyone is deployed according to their skills, meaning not only their professional qualifications, but also their skills in terms of interpersonal relationships. The team leader will be well advised to select his team members from this aspect and deploy them accordingly. He is therefore not necessarily the most senior, but rather the one who is most likely to be able to organize, lead and motivate the team and enable them to focus on the task at hand: he's the coach on the sideline, not the best player.

Communication: communicate openly, honestly and at an early stage. It is more about "listening" than "talking", as a remote team will only be successful if all members have the same information and know exactly what is expected. Criticism is expressly encouraged, and suggestions should come from those who deal with the topic every day. "Leading through questions" should prevail.

Clear goals, tasks, responsibilities: a precise distribution of tasks is essential. It will be important that those who are best qualified for the respective task take on responsibility, and this qualification is not necessarily a purely technical one. Likewise, it will be necessary to precisely define the goals and to adapt them, should this prove necessary. It is not a top-down process, but an iterative action that accompanies the process fluently. A framework should be set out within which the team members can move freely.

Equipment, timing, schedule: ensure (as team leader) that the team has the necessary equipment available right from the start; give clear time constraints, keep an approved agenda, and stick to it.

Participants (n ° of max): the team: as small as possible, as large as necessary.

Develop people: give colleagues the chance to work out their ideas and suggestions; discuss these with them; give open, honest feedback; praise freely and honestly; give credit; think about each one in your final report.

You'll end up successfully if you respect some simple lessons: coach your team; generate enthusiasm; develop people; ask; say "Yes, we'll do it".

Biography

Andreas is an international acting personnel and industrial consultant with 25+ years' experience. He's a specialist for high-end technologies (Semi, LED, PV, Electronics, Test & Measurement, etc.), active

throughout Europe, with customers in Europe, USA, Asia. He's a permanent participant of leading exhibitions and conferences worldwide (SEMICON, INTERSOLAR, EU PV SEC, LIGHT&BUILDING, ELECTRONICA, PRODUCTRONICA) and fluent in three languages, written and spoken.

Within the SEMI industry, he operates with his partners from SONAR GmbH, Munich (www.sonar-gmbh.com).

Prior to his consultancy career, Andreas covered positions in Sales and Marketing with OSRAM, Germany and Italy, for almost ten years. Further on, he matured experience in controlling, change management, re-engineering. Andreas lives in Munich. He has one son and is in his spare time an avid tournament ballroom dancer and sailor.

For more information, go to his LinkedIn-profile: https://www.linkedin.com/in/andreas-c-zimmer-16807112/, or contact him directly: aczimmer@zianco.com or +49 89 31988638.

Challenges and opportunities for adopting digital Twins in semiconductor industry

F. Golra
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Abstract

Virtualization of a real-life object, process or system is not new; what brings the concept of digital twins to the forefront is its potential real time connection to the real world and leveraging AI and big data analytics to interact with and evaluate different "what if" scenarios.

Through our experience in the development of digital twin solutions for semiconductor equipment manufacturers, we share the findings of an analysis on their adoption in semiconductor industry. Depending on their perspective, OEMS and integrators have an outgoing focus by finding its value for product improvement, customer service and new business models. On the contrary, fabs have an incoming focus by finding its value for cost reductions, process improvements and safety.

By replicating manufacturing systems and processes, digital twins afford an opportunity for online and offline support for extending the APC technologies like Equipment Health Monitoring for assessing tool health as a function of deviation from normal behavior, Predictive Maintenance for using process and equipment state information to predict maintenance needs, Predictive Scheduling for improving scheduling of system by utilizing current and projected information on tool and factory state, capabilities and schedule, Virtual Metrology for the prediction of post process metrology variables using process and wafer state information, and Yield Prediction for monitoring information to predict process or end of line yield.

For adopting digital twins, the stakeholders will have to prepare themselves for new challenges. The product teams need to become proficient in both hardware and software by developing new skills like design, simulation, analytics, etc. Integration, management, and maintenance of both physical and digital twins need to be considered. Maintenance of digital twins and their links to the physical twins become a core approach for upgrades and thus require new business models.

An additional effort to standardize data interchange, not only between the physical and digital twins but also for the integration of digital twins would be required. With more data from digital twins, unless the stakeholders can find innovative "what if" scenarios, its value would remain unclear. The ownership of data is already becoming an important concern. The stakeholders would need to devise procedures for data sharing and partitioning and ensure the confidentiality of data and intellectual property security.

Biography

Fahad Golra is currently working as a research coordinator at Agileo Automation. After his doctorate in process modeling, he has been active in research activities around model federation, model driven development, Industry 4.0 solutions based on RAMI 4.0, OPC UA and digital twins. He is actively participating in different standardization activities in OPC Foundation, SEMI association and ISA.

# Vocus: The most sensitive detector of air molecular contaminants

C. Frege
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TOFWERK

Abstract

A fast and precise monitoring of room air and material outgassing is critical to ensure good product quality in the semiconductor industry. As cost per chip rises significantly from one technology node to the next, maintaining optimal yield is more than ever paramount. As such, measurement of air molecular contaminants (AMCs) from high to extremely low concentration levels (ppmv-pptv) has become of great importance within the different fab processes. Current technologies used for monitoring AMCs are specific to some categories (acids, bases, volatile organics, condensables) and/or fail detecting low concentration levels of AMCs. The TOFWERK Vocus chemical ionization mass spectrometer offers new insights into monitoring of AMCs in the fab with extremely fast time response (seconds), detection limits in the range of single digit pptv and high versatility being able to measure trace acids, bases, condensables and volatile organic compounds simultaneously .

Vocus is also a mobile instrument that can, when necessary, be deployed to specific areas within the fab. In this work we present the use of a Vocus for continuous monitoring of outgassing after a process that simulated standard cleaning procedures of a FOUP (a specialized plastic enclosure used for wafer transport). For these measurements the outgassing of molecular acids (MAs) and molecular bases (MBs) was monitored over 16 hours in separate experiments simulating cleaning of a FOUP. With 1 min LODs in the range of 3-10 pptv, Vocus measures some molecular contaminants that persist at trace concentrations (10-30 pptv) for many hours.
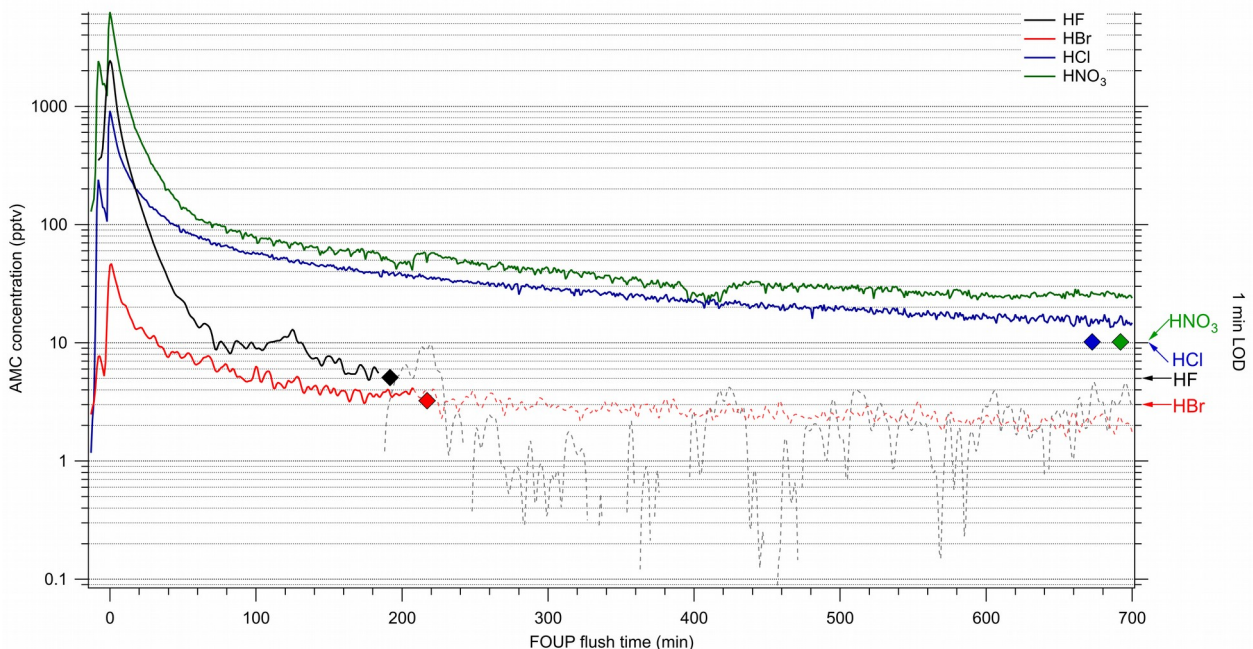
Concentration decay of common inorganic acids in a FAB environment. The markers show the quantification limit of each compound. Arrows on the right axis show the 1 minute LOD of the Vocus

Precise and sensitive measurement of the outgassing compounds could guide process adjustments to decrease defects related to queue time and optimize the cleaning process of individual FOUPs prior to

loading with new batches of wafers. More importantly, such measurements could inform development of next generation of FOUPs using novel polymeric materials and new surface treatment procedures.

Biography
Carla Frege is an application scientist at Tofwerk AG (Thun-Switzerland). She holds a PhD degree in atmospheric and climate science from the Swiss Federal Institute of Technology in Zürich (ETHZ). Her interests lie in the application of atmospheric science to industrial use-cases. Her current projects include the research and development of sensitive technology for monitoring of airborne molecular contamination (AMC) in the semiconductor industry.