

The AMD Fab30 Advanced Throughput Control Framework

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Semiconductor Manufacturing with its fast changing products and highly variable processes is prone to overlook severely low performing tools as long as the tool group these tools belong to is operating inside the usual performance envelope. Regularly performed throughput studies do not fully cure the problem, since resources in Operations and Industrial Engineering are usually limited and an immediate response to throughput changes is necessary to reduce losses as well as to identify high-performing tools for BKM (best known method) procedures.

To have the advantage of immediate response to changes in tool performance, AMD Fab30 is using a system of software tools – the Advanced Throughput Control Framework (ATC). It is embedded into AMD's APM (Automated Precision Manufacturing) strategy, to automatically generate tool performance data from the tools' standard SECS (SEMI Equipment Communications Standard) messaging and to gather relevant performance ratings from that data. These characteristics are used to both monitor and control tool performance on entity level. Presented in this paper are both the main methodology of ATC and significant examples.

Examples what we will show in the paper:

Throughput losses at one single tool of a tool group and losses at one chamber of a cluster:

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Fig.1 Throughput loss at a CVD tool group

Figure 1 shows the daily average throughput of a CVD tool group consisting of ten tools. Although the performance of one of the tools degrades to less than half over a period of two weeks, the effect is unobserved due to the other tools' variability.

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Fig. 7 Throughput losses at a PVD chamber

A deeper examination of the data unveils a symptomatic weakness of using averaged throughput metrics. The time series of PVD2's tantalum chamber's process time per lot – therewith averaged data as well, but with a much smaller sampling rate – shows a serious throughput issue, recovering partially over a period of two weeks (fig. 7). Later done investigations into similar cases uncovered a malfunction of the chamber's pump system. Using a throughput control chart would have signaled the throughput loss within a couple of hours, avoiding the loss of about 15% of the wafer outs of this tool....

For that reason the AMD Fab30 EPM, consisting of a framework of software tools embedded into AMD's APM (Automated Precision Manufacturing) strategy, includes ATC (Advanced Throughput Control). It provides its customers with up-to-date, accurate and detailed throughput metrics. It automatically generates this data from both the MES repository and the tools' standard SECS (SEMI Equipment Communications Standard) messages.