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DUPLICATE RETICLES MANAGEMENT SYSTEM

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ABSTRACT

Duplicate reticles provide a fab with an opportunity to mitigate the impact of catastrophic reticle damage or the need for offsite repair/cleaning and provide the necessary capacity for products in a high volume manufacturing environment. Implementation of a management system for duplicate reticles helps to maintain a minimum number of run paths while ensuring availability of multiple reticles to process lots simultaneously. Dedicating the duplicate reticles each to a group of exposure tools prevents duplicate reticles from ending up on the same exposure tool, and managing this dedication by tool/reticle inhibits has proven to be an effective method of distributing the WIP between the exposure tools while minimizing the management of the layer supported by those duplicate reticles.

1 INTRODUCTION

In semiconductor manufacturing, a reticle is a photomask used in lithography (Semiconductor Engineering 2023). A lithography system is essentially a projection system that projects light through a blueprint of the pattern that will be printed (ASML 2023). The pattern is encoded in the light, and system's optics shrink and focus the pattern onto a photosensitive silicon wafer (ASML 2023). A reticle is a single layer of pattern that covers a small portion of the wafer and has to be stepped and repeated in order to expose the entire wafer (WikiChip 2023). The fab is set up to use the specific reticle for each photo layer at the lithography tools. Fab 8 received duplicate reticles for multiple products. The objective was to proceed with dual reticle processing to improve productivity in the Lithography module. Having duplicate reticles also ensures a backup reticle is available in the event that the POR reticle is damaged or needs repair. Since this was the first time Fab 8 was implementing dual reticle processing, new infrastructure was needed to safely manage reticle dispatching and availability.

2 PROBLEM DESCRIPTION AND PROPOSED SYSTEM

In a semiconductor fab, factory automation and dispatching/scheduling systems are often used for managing a variety of complex WIP flow optimization problems like managing queue time restricted zones, managing interactions with Advanced Process Control (APC) system, building long cascade WIP trains, planning optimum batch sizes, etc. (Chakravorty and Nagarur 2020; Peng et al. 2020). As we have expanded to duplicate reticles in our fab, and since the fab has automatic reticle delivery and dispatch system, reticles can be delivered in a random fashion to any tool. Sometimes, both reticles may end up on the same tool specifically due to complexities of interaction with the APC system (Peng et al. 2020). This is not desirable for either increasing throughput or reducing cycle time for WIP (work in process) requiring this reticle. In order to prevent such a scenario we can employ a plan which selectively places inhibits within the Fab Manufacturing Execution System (MES). An MES is used in semiconductor manufacturing to monitor,

track, manage resource allocation, operation scheduling, process control, data collection, analysis and document the process of producing goods in a factory (Siemens 2023). Inhibits are restrictions that prevent a lot from using a reticle on a tool (there are other supported inhibits that don't involve reticles). An inhibit can be placed or removed when needed and the MES and other systems like the Equipment Interfaces that control tool level processing or Dispatching systems that dispatch work to tools can see these restrictions in the MES and block processing. In this plan, we allocate the first reticle from the same reticle group to half of the tools in the fleet and inhibit the first reticle for the other half. In the same manner, we proceed with the second reticle from the reticle group, except this time, inhibit this reticle to the first half of the tools in the fleet and allocate it to the second half.

3 DUPLICATE RETICLE MANAGEMENT SYSTEM

A new in-house Duplicate Reticle Management (DRM) System was developed, tested and deployed in 300mm GlobalFoundries Fab. Implementation of DRM System for duplicate reticles helped to maintain a minimum number of run paths while ensuring availability of multiple reticles to process lots simultaneously. Managing the dedication by tool/reticle inhibits has proven to be an effective method of distributing the WIP between the exposure tools while minimizing the management of the layer supported by those duplicate reticles.

4 CONCLUSION

By using the automatic Inhibits by DRM, we can avoid dispatching duplicate reticles to one tool , promote efficient allocation of reticle capital with superior product run path efficiency , planning and allocating properly based on an established plan setup in proper specification system with buddy check approval system . Appropriate safeguards are now in place when new reticles and new tools are introduced in the factory system. We have successfully implemented the DRM system to enable dual reticle processing in Fab 8.

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