

EUV Mask Handling, Chucking, and Standards Workshop, October 3, 2003  
Discussion session – captured comments

1. Fiducial marks

- Implement?
  - o Need to carefully determine the marks so that various tools locate them accurately (different detection modes in different tools)
  - o Look for supplier to fabricate marks as early as possible.
  - o Exitech is interested, has worked on laser ablation of glass.
  - o Learn from pattern recognition for wafer tools
  - o Are patterning tool suppliers interested in using the marks? (good for PSM fabrication)
  - o What marks do PG suppliers use for second layer write?
- How many? More than 3?
  - o Etec recommends more than 3
- Locations?
  - o Survey mask shops.
- Positional tolerance?
  - o Survey mask shops.

2. Mask backside

- Passivation? If so, specifications?
  - o Collect data on e-chuck reliability at ISMT-N in ML coater.
- Metal based upon film stress?
  - o Seek data from wafer tools on residual metal on chucks
  - o Look into grounding for front and back sides; exclusion regions might affect stray fields.
  - o With direct contact to the back can use monopolar chuck and can monitor mask charge to help dechuck.
  - o Difficult to ground reticle in tool.

3. P37 Flatness Specification

- o Someone needs to propose a spec in order to begin a debate; without a baseline no discussion can begin.
- o Propose U.Wisconsin works with LLNL to have a proposal by the next meeting just before SPIE.

4. Mask substrate Thickness – Concern about flatness metrology of thinner substrates.

- Technical challenges
  - o Modeling assumptions need to be validated with experiments
  - o Backside particles have a larger effect on thinner substrates.
- Economical impact
  - o Need input from polishing experts.
- Decision deadline
  - o Vote taken to continue or not to continue to consider investigation of thinner substrate; only small number voted, but more voted to not continue. Only 1 desired to investigate this option. Most attendees abstained from voting.
  - o Working on thinner substrates could cost up to a year of valuable research effort.

- Proposal: evaluate cutoff frequency for low order modes as a function of thickness. (UoW work with LLNL) 2 or 3 thickness values are sufficient.
- 6025 format compatible with existing infrastructure.
- Compare IPD tolerance for wafer to mask; wafer tolerance is smaller and wafer is thinner. Therefore, if thin mask has problems so does wafer.

#### Additional material

The following material is the minutes from the October 14 mask working group teleconference chaired by ISMT, and which has been distributed previously. It is included here since it directly continues the discussions from the Workshop and is likely of interest. Represented were ASET, Asahi, ASML, Canon, Intel, Motorola, NuFlare, Osmic, Zygo, and International SEMATECH.

The meeting opened with a brief review of the October 3 workshop. Four primary topics were raised during the discussion session: mask fiducial marks, adding a passivation to the mask backside film, revising the P37 flatness specification, and evaluating a possible change to the mask substrate thickness.

One equipment supplier has offered that two fiducial marks may be enough; Zygo noted that having four, one near each corner, would allow 90° and 180° rotation of the mask (useful for removing tool-induced effects). However, some sort of orientation indicator (perhaps an asymmetric mark) may be needed. It was noted that the marks must remain visible after smoothing.

For the mask backside, using the same material as the chuck surface for the possible passivation layer may be useful (matched hardness). It is unknown what process may be used to add a passivation, likely a deposition process. NuFlare noted that there are advantages to wrapping the mask with a conductive coating, as this would provide areas of contact where there is no resist to penetrate (and particulate). A quiet ground circuit is necessary in this case, to not deflect a patterning e-beam.

Discussion of the P37 flatness spec and the substrate thickness overlapped. While both the mask and the chuck need to be very flat, the chuck is a “capital component” and can merit more detailed attention in its manufacture. A thinner mask can allow relaxing the flatness specification, at least in lower-order Legendre modes (high spatial frequencies are a function of the polish and cannot be removed by chucking). A tolerance of 50nm pv on both sides results in a 100nm worst thickness variation. Wedge should not be a concern if the mask stage has tilt adjustment (though a method of characterizing the presented surface flatness would be needed).