

SEMI Standards Meeting – EUV Masks
July 13, 2004
San Francisco, California

Chairs: Thomas White (ISMT/AMD) and Scott Hector (ISMT/Freescale)

White opened the meeting with a review of the agenda, meeting purpose, disclosure requirements and SEMI policies on standards meetings. Also noted was that EUV mask protection was ranked the #3 issue by the IEUVI Steering Committee in October 2003.

There was a brief review of highlights from the February 2004 EUV Mask Technology Workshop and the IEUVI Mask TWG Top Issues.

Scott Hector reviewed the status of EUV mask-related standards. SEMI P37 will be submitted with a collection of past proposed revisions. Individual Legendre modes must be converted to numerical limits on a per-case basis. It was noted that mask thickness between the major surfaces is related, which will be addressed with a thickness variation (or uniformity) parameter. Some parameters may be able to be relaxed based upon the SEMI P40 chucking standard. Legendre modes characterized by polynomial equations should not be so complex and maintain awareness of signs of the coefficients. Spatial frequency ranges use different metrology methods. Substrate dimensional tolerances depend upon the future carrier and frame standards. Eventual fiducial marks could obsolete the datum points defined in P37.

Roxann Englestad (University of Wisconsin) presented “Effects of Electrostatic Chucking and Substrate Thickness Uniformity on EUVL Mask Flatness”. Legendre modes are being evaluated (which is very computer-time consuming). Outer limits of acceptable nonflatness for resultant chucked flatness may extend as far as fourth order modes but possibly not for both axes simultaneously. Almost all non-flatness can be captured within the first four orders. Models show that the mask-chuck gap can be reduced to near zero, so all remaining nonflatness is on the pattern side of the mask, unless chuck bowing is induced. Another consideration is the sign on the individual modes, whether the mask curves “up” or “down”. A mask with the backside center closer to the chuck is easier to clamp than one with the edges closer to the mask, as mask-chuck friction is less of an issue. The proposed Walton definition – a substrate can be sufficiently described using mask thickness uniformity and pattern side high spatial frequency – will likely be confirmed when this work is complete. Need to decide which modes are “high” or “low” frequency. Modes do not superimpose linearly, so such effects are complex. Wisconsin needs to integrate gravity into some chucking models.

The meeting reviewed the blue ballot draft of the EUV mask Data Matrix automated identification standard proposal. This document has been filed under the Traceability committee. Much of the document was drawn from the existing SEMI T11 standard, with the mark size reduced. No particular comments were collected. It was asked if the marks would be readable while the mask is inside a carrier; possibly, given clever designs, but this is not something required by the standard document.

White presented the draft version of the IEUVI mask improvement roadmap, in the context that the 2009 generation specifications would coincide with SEMI standards. It was noted that carriers should be evaluated for opening, handling, and closing cycles counted individually. Storage specs may be too long as analytical tools may not be stable for such lengthy periods, so this spec should be aligned with testing protocol. How can molecular contamination be evaluated – contrast, reflectivity, using witness samples? Schott reported (and had reported previously) that one sample under no particular protection showed stable reflectivity over an 18 month period. A new parameter was suggested, the lifetimes of the multilayer and absorber films.

Finally, the mask layout was reviewed, along with two possible configurations of permissible handling/contact areas for inclusion in a standard draft. The full perimeter zone, 5 mm wide, was selected for the ballot. End effector domains around the mask are also needed, including both grippers and resting end effectors. A survey will be distributed to capture and evaluate this information. It is not known if any large features that may extend into this permissible handling zone would cause concern (would end effectors partially contacting gross features be an issue?).