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Micrion

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April 13, 1992

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Dear Marty

This is the 14th bimonthly report detailing work done on contract N000-14-89-C-2238 during February 1992 and March 1992.

3.31 Advanced Column Development

Essentially column development is complete except for three automated algorithms and continued lifetime testing.

Three algorithms to perform automated focusing, stigmation and alignment were written and then tested on a column on the column test stand. Auto-focus and stigmation routines involve analysis of the variance of an image and iterative changes to appropriate lens voltages to maximize the peak in variance. This technique is essentially the same as that used for SEM focus and stigmation.

Automated alignment (as opposed to manual 'tweaking') involves adjustment of either the source or the aperture position until there is no image motion when either the first or second lens focus voltage is changed. A correlation method is used to detect image motion for the auto-alignment technique.

These auto-routines have all been tested extensively on the column test stand - the algorithms need to be transferred to the 0.25 um X-ray machine as the final step.

3.32 Repairs

We began investigation of using the SEM in transmission mode (TSEM) to improve measurement techniques of repair placement. The technique has been extensively developed at NIST by M. Postek et al. Measurements done using TSEM have the potential for being more accurate because of the increased contrast between the absorber and membrane, and a better signal-to-noise ratio. It also provides for the ability to inspect for voids or defects on the back side of the mask.

The JEOL SEM at Micrion is equipped with rudiments of TSEM detection and associated electronics. We plan to modify both to optimize use of the technique.

Using TSEM we verified that two defects found by KLA on the print and not seen on the mask were excess material on the backside of the mask. This type of information is particularly useful during development of the inspection-repair process.

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3.33 System Stability
Nothing new to report.



3.34 Software

Another inspection repair loop was initiated. The goal is to use a programmed defect pattern. The mask will be sent to Micrion in May and a print to KLA. Micrion is completing the coordinate lock feature to the ENH I (enhanced mode defect data transfer program) to increase resolution: this improvement will allow Micrion to drive to an 80 um field or less to find the defects, compared to the previous 200 um field of view that we could drive to using the original format.

Software development for the 0.25 um machine continued - the device drivers and the low and high level library interfaces are complete as well as both beam and vacuum control functions.

In the near term an existing applications program for milling and deposition will be modified to provide these functions for X-ray mask repair, while the long term goal is to develop an all purpose high resolution mask repair program.

3.35 Electronics

Considerable effort has gone into design of a new raster generator and analog drive to support deflection amplifiers. The new raster generator will support a maximum pixel step rate of 100 ns/pixel, will allow for optional repair scan strategies and compensate for both ion flight time and beam current variations.

The analog drive is complete. The design of the deflection amps will be reviewed in April, and the amplifier board is presently being fabricated.

OTHER

● The ninth quarterly review was held on March 26 and was very well-attended. We now have active participants from IBM, KLA, Hampshire Instruments, Motorola, MIT, and Dupont.

● The program is still on schedule. No changes to the original statement of work (SOW) have been made. A September completion of the 0.25 um system is still anticipated. Though the 0.5 um system is still functional, support of this system has not hampered the progress of the program and has actually been extremely beneficial. Much process development and subsystems testing are being done on this system which will then be retrofitted to the 0.25 um system.



Sincerely

Dr. Diane K. Stewart

cc: Lt. Herb Byrnes, Naval Air Systems Command
Robert Reams, Harry Diamond Laboratories

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