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February 7, 1991

Mr. Robert Reams
Harry Diamond Laboratories
2800 Powder Mill Rd.
Adelphi, MD 20783-1197

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Dear Bob:

This is the seventh bimonthly report done on Contract N00014-89-C-2238 detailing work done during December and January.

2.31 Advanced Column Development

We are currently evaluating the spot size of the beam when the column is run in the optimum mode. We are using existing algorithms and techniques so we can compare the data to existing measurements made on commercial columns, and we are developing new algorithms and measurement techniques more consistent with the small size we are trying to measure.

We have consistently measured spots 45 nm+/- 15. We have not determined if the difference between the theoretical performance of 25 nm and the measured 45 nm is due to the measurement technique, problems with the column design, or instabilities such as magnetic and mechanical in the test stand itself. All of these are possibilities.

On the mechanical side, insulators and a new cup electrode were redesigned and sent out for fabrication. The source and variable aperture design cycles continued.

2.32 Repairs

We completed a series of repairs on a gold/silicon X-ray mask supplied by Hampshire Instruments. The clear repairs were to deposit tungsten to complete the connections on 0.5 um lines. The opaque defects were excess material between 0.5 um lines which had to be milled away. The mask was returned to Hampshire Instruments for exposure to their stepper and subsequent transfer into resist. SEM analysis is being done at Hampshire Instruments.

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We received an X-ray mask from IBM with mapped defects. We plan to begin repairing the mask after a concerted system stability study is completed.

2.33 System Stability

We are currently doing a detailed study of electronic, column and mechanical stability of the government machine to determine system limits. The machine will not meet stability requirements for repairing defects on 0.25 um feature X-ray masks, though it is adequate for repairing 0.5 um feature X-ray masks. The data from this study will help determine where, and maybe how we have to tighten up specifications such as temperature control of the machine - for example, will we have to make the 0.25 um machine out of INVAR, and/or specify extreme environmental controls for the system.

2.34 Charge Neutralization

The new flood gun is operational. If the X-ray community decides to use a silicon nitride membrane the floodgun will be vital - silicon nitride is insulating and will easily charge.

2.35 Imaging/Edge Analysis

We received a silicon wafer patterned with structures designed for resolution statistics from IBM. We plan to begin a resolution/accuracy study on this substrate in March. Our first goal is to verify that the machine meets our goals for repairing 0.5 um features, and then we will begin to evaluate what the limits of the present machine are.

The ability to image and to routinely find an edge is a major part of this study.

Other

KLA - We are continuing discussions with KLA and plan to test the defect data transfer link later this spring. IBM is providing KLA with a chrome/glass structure and Micrion, with the mask from which that substrate was patterned. KLA will send us a file with defect locations after they inspect their 'mask'.

MIT Subcontract - J. Melngailis is pursuing angle dependent deposition effects which should help with understanding the problems of redeposition on nearby features during repairs.

Micrion

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Review - Micrion's next quarterly review will be held Wednesday, February 27 at Micrion.

Sincerely

Diane K. Stewart

Diane K. Stewart
X-ray Program Manager

cc: M. Peckerar, NRL
N.Economou, Micrion
D.Hunter, Micrion
C.Libby, Micrion



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