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April 11, 1991

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

Dear Bob

This is the eighth bimonthly report detailing work done on Contract N00014-89-C-2238 during February and March 1991. Note the charge numbers which reflect the tasks associated with development of a 0.25 um X-ray mask repair machine for the final phase of this contract.

3.31 Advanced Column Development

We installed a second set of insulators and a cup electrode on the proof of concept(POC) column. The rebuilt column arced considerably. The insulators were redesigned, fabricated and installed in the POC column and the arcing was eliminated.

The current performance is 40 pA of current focused to 36 nm, which is a slightly larger spot size for that current than calculated. We ordered single isotope gallium liquid metal ion sources to test for magnetic contributions to the beam.

3.32 Repair Processes

We repaired opaque and clear defects on a 0.5 um X-ray mask manufactured by Hampshire Instruments, and exposed it to their Series 5000 Stepper.

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Exposures into both positive and negative resists verified that the Micrion X-ray mask machine is capable of successfully repairing defects associated with 0.5 um features.

We began to investigate deposition of gold from the precursor chemical dimethyl gold hexafluoroacetylacetonate. Previous work has shown that the yields (ratio of metal atom deposited per incident gallium ion) are much higher than yields measured for FIB deposition of tungsten from tungsten hexacarbonyl. We deposited gold films with yields of 6, calculated by assuming the films were 100% gold. If we realistically estimate that the material is 50% Au and 50% Ga(from Auger experiments done by Micrion) the effective yield of 3 is still 4x greater than that of tungsten, which has an effective yield of 0.7. This means that the proximity distortions could be reduced by 4x as well. We are planning a series of experiments to test this.

3.33 System Stability

We are currently investigating the phenomenological effects of various movements of the mask holder into and around the vacuum chamber on beam drift, which reflects the longterm instability of the system. The most serious effect that we have seen is when a mask holder is removed from the system for more than 0.5 hours. Once reinserted the system takes up to 3 hours to equilibrate to the machine specification of <0.1 um drift in 10 minutes. This is likely due to the temperature difference between the inside and the outside of the machine. A possible solution to this drift is to prewarm the mask and holder prior to insertion into the system.

We installed a new set of vibration isolators on the system and are evaluating vibration characteristics before and after installation.

3.34 Software

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Micrion, KLA and IBM organized an effort to test the defect data transfer between KLA and Micrion. IBM sent KLA a chrome on quartz structure printed from an X-ray mask. KLA will inspect this and send the inspection data on tape to Micrion. Micrion will test the data transfer and proceed to repair the corresponding X-ray mask, which will have to be printed again to test the repairs.

3.35 Electronics

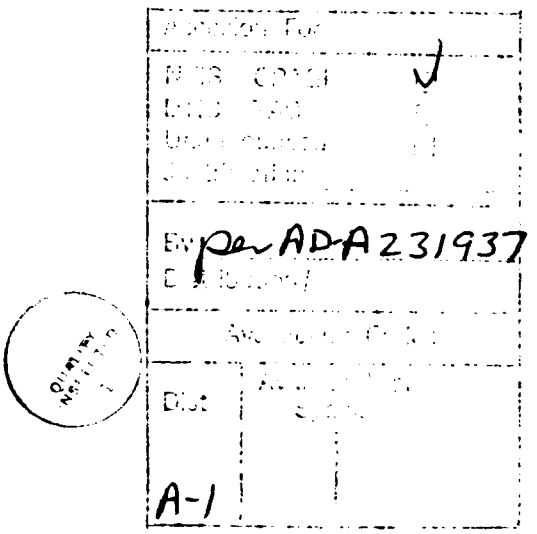
We are designing the platform for the 0.25 um machine, which will include much faster deflection electronics. Both the electronic and software components of the platform will be discussed in detail at our next review meeting, which will be held on Wednesday, June 12, 1991.

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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