

## MEMORANDUM

To: Katalin Voros, Operations Manager  
From: **Kim Chan**, Assistant Development Engineer  
Subject: 2009 Year-End Report  
Date: 15 January 2010  
cc: Sia Parsa, Andy Neureuther

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This is a summary of the activities and projects that I was involved in during 2009.

### I. SEMICONDUCTOR PROCESSING

I have been working on local loading effect of centura-mxp project for the Advanced Lithography Group.

- Used MASK3 FLATTENED reticle with the aberration patterns, modified job file to accomdate more dies per wafer, spun coated 9000A of UV210-0.6 photoresist, ran exposure matrix tests on test wafers and oxide wafers, developed wafers, inspected under microscope, exposed experimental wafers with best F/E, developed, inspected, measured oxide thickness, descummed resist, measured oxide thickness, measured resist thickness, took pictures, uvbaked wafers, measured resist thickness, etched oxide wafers on centura-mxp with "MXP-OXIDE-ETCH" and "MXP-OXSP-ETCH" recipes, measured oxide thickness, repeated etch process three more times, entered oxide thickness data, plotted graphs and discussed it with Professor A. Neureuther.

I have been helping process group with ETRs and special projects, as well as assisting members with their specific need/requirements.

- Cleaned and lubricated GCA wafer stepper 2 and 6 stage rails, cleaned and lubricated GCA pattern generator stage rails, and made masks for the Microlab while Marilyn Kushner was on vacation.
- Ran asiq measurement ETR for Joern Lidde.
- Ran kruss to measure contact angle on Yonghao Xiu's ETR samples and assisted him on uvscope and linewidth measurement microscope.
- Showed and assisted Craig Tindall from LBL to use Technics-c.
- Showed and assisted Barton Lane on asiq and reichert.
- Checked V401 evaporator accessories, measured top plate dimension, took pictures of top plate, sent pictures to ETR customer.
- Ran Al evaporation test and evaporated Al on two substrates in NRC evaporator. Measured Al thickness on asiq on Jian Li's ETR.
- Cleaned Au wires, Cr rods, tweezers and evaporated Au and Cr on Jason Yeo's ETR substrates in V401 evaporator.
- Wrote pocket wafer process instruction for Marilyn. Showed Marilyn how to coat the new I-line resist and how to use photoresist pen to touch up the pocket wafer edges. Made 25 six-inch pocket wafers in February and 25 six-inch pocket wafers in September as follow: piranha cleaned wafers, etched in HF, grew wet oxide, measured oxide thickness, primed in HMDS, coated with I-line photoresist, cleaned pocket wafer mask, exposed wafers with 4" pocket, developed, inspected, hardbaked resist, touched up wafer edges with resist pen, baked them, etched wafers in centura-mxp, stripped resist in PRS-3000, piranha cleaned, made TMAH and 10:1 HF baths, rinsed wafers in D. I. water, dipped in HF, rinsed in D. I.

water, etched in TMAH bath, measured pocket depth, continued to etch until the correct pocket depth, piranha cleaned, dipped in HF, grew oxide on pocket wafers and measured oxide thickness to complete the process. Reworked three pocket wafers as the lithography step didn't turn out good.

- Tested five different bottles of AR3-600 BARC, which was manufactured less than a year, with various coating method, inspected and took pictures of the defects. The film was turning bad. Repeated the test with two bottles at room temperature two weeks later, but the result was the same.
- Found patterns on masks had irregular exposure sizes. Took pictures on mask patterns, e-mailed them to RZE, ran angle and alignment test, called vendor in, ran tests and sent pictures to vendor to confirm the problem on gcapg was fixed.
- Since OiR 897-10i I-line photoresist had changed over to OiR 700-10 I-line photoresist, wafers were coated with OiR 700-10 photoresist at various speed on svgcoat1 and svgcoat2, measured on nanospec to check the photoresist thickness, updated program charts and posted new charts on svgcoat1, svgcoat2 and svgcoat3.
- Tried to add an Ar gas process on vacoven for a lab member. After connected Ar gas to vacoven, set up program on vacoven, adjusted Ar gas flow and tested the Ar anneal process. Ar process failed because the pressure was too low. Found pump speed needed to be regulated so the pressure can be controlled.
- LDD-26W developer for developing patterned UV210-0.6 resist was being discontinued. Therefore, ran experiments with different developers to compare result on UV210-0.6 resist wafers. Afterward, inspected and measured the resist lines in the LEO SEM for the result and data. When found there was T-top effect on the UV210-0.6 resist, ran another experiment with different delay time after installing the MERV7 efficiency rated carbon filters to the intakes of the GL4 fan/filter units, increased the exhaust velocity on the svgdev6 developer drain and added the carbon filter to the AIRCO unit for the ASML stepper, took cross section SEM pictures to compare the T-top effect result and recommended process to minimize the T-top effect.
- OiR 897-10i Positive Photoresist was being discontinued. Therefore, compared OiR 897-10i Positive Photoresist with replacement photoresist OiR 700-10 Positive Photoresist performance. Laszlo designed new test masks and used a better made mask for the experiment. HMDS primed wafers, spun OiR 700 10 Positive Photoresist, spun OiR 897-10i Positive Photoresist, ran FEM tests on gcaws6, inspected, ran actual wafers with an exposure range, inspected, sputtered Au on diced wafers, inspected in LEO SEM and compared both I-line photoresists.
- Modified and tested program 2 on HMDS primeoven. Compared contact angle results on sink4 HMDS and primeoven HMDS program processes, spun uv210 resist, exposed wafers on ASML stepper, developed, checked adhesion on the wafers and program process time. Laszlo modified program 2 to shorten the process time. Measured contact angle results after the HMDS process on the primeoven, spun uv210 resist, exposed wafers on ASML stepper, developed, checked resist adhesion is good on the wafers and checked program process time on primeoven.
- Showed Gaoxin how to use 4-pt. Probe, asiq, asml stepper, ksaligner, kruss, matrix, sinks, sopra, svgcoat1, Tystar2, wafersaw and etched silicon. Assisted Gaoxin to clean wafers and do the photolithography process on the SiC wafers and bonded wafers with cool grease.
- Assisted our summer high school interns to modify a gcaws6 job and do the photolithography process on their Al wafers. Primed wafers with HMDS and coated wafers with I-line photoresist for making show wafers for the high school interns.

- Demonstrate the Crestec EBL tool to visitors from Stanford University, Mr. Sexton from Australia and other visitors from other places.

Processing involved many silicon equipment and analytical instruments in the Microlab. This year I learned how to use edwards, ptherm and Tegal plasma barrel etcher. I learned how to evaporate ITO on the NRC evaporator and sputter ITO on Edwards. I tried the LEO SEM operation after the SEM upgrade. I attended the Hitachi SEM and JEOL SEM demonstrations.

## **II. EQUIPMENT & PROCESS MAINTENANCE**

### **Equipment Maintenance**

- Rebooted asiq computer to clear stage frozen problem.
- Ran image quality control and illumination uniformity tests on the ASML stepper.
- Tried to solve the ASML stepper problems such as stuck wafer, stuck reticle inside the stepper and to turn the laser back on. Converted from batch streaming mode back to normal batch mode.
- Ran wafers to test the ASML stepper after a problem report was clear sometime.
- Checked Canon focus, exposure, vacuum and turntable problems and solved them.
- Checked mark management, stage, registration alignment, wafer z, beam current, Crestec software, focus, monitor black out and flash drive problems. Tested and fixed problems whenever possible.
- Checked and followed up on Crestec EBL system status with the Crestec engineers after it moved to the Marvell Nanolab (MNL).
- Ran tests to correct 16 micron baseline error and tried to solve the triple image problem on gcaws2.
- Checked and cleared gcaws6 problems such as removed frozen computer, stuck reticle, stage time out error, RMS error and exercised RMS, ACS, EQ, light low, aperture, transfer arm and auto-focus failure problems on gcaws6 when possible. Adjusted the AWH air pressure, checked the alignment focus and tested gcaws6 operation.
- Assisted Greg Mullins from RZE on gcaws6 and gcapg while he was working on it.
- Ran lamp uniformity test, formatted a floppy diskette and copied backup files for gcaws6.
- Reseated banana plugs to clear Hummer no current problem and tighten loose nut on gas on/off valve.
- Checked the LEO SEM vacuum status, camera problem, mouse and stage movement problems when it was down.
- Checked LEO SEM operation after LEO SEM service representative repaired it.
- Removed stuck wafers in Matrix chamber for lab members and tested it.
- Checked new msink1, msink3 and msink5 operation and reported the problems. Took pictures of msink6 and msink8.
- Checked the nanospec reported problem and cleared it.
- Assisted lab members on parylene operation and hydro power problem.
- Checked the status of the Quintel aligner contact problem in EE143 lab.
- Checked Quintel aligner substrate separation controller. Reseated wafer chuck, cleaned dummy mask and checked operation to clear the reported problem.

- Refilled HMDS in sink4 HMDS bubbler and checked QDR resistivity problem in sink6.
- Tested sink7 power system and the phosphoric acid bath operation after the temperature reached the set point.
- Checked sinkcmp operation and asked Al/Phil to check the QDR program.
- Tested, cleaned vacuum hole with steel rod and acetone to solve the vacuum problem on spinner1.
- Aligned transfer arm on svgcoat6 to clear reported problem and assisted Joe to center the wafer on svgcoat2.
- Replaced I-line and G-line photoresists on svgcoat1, svgcoat2 and svgcoat3. Replaced UV210 photoresists on svgcoat6 and primed the photoresist lines.
- Tested svgdev wet wafer and receiver transport problems.
- Rinsed LDD-26W developer tank and filled tank with MF26A developer on svgdev6.
- Cleaned svgdev6 developer cover and labeled it.
- Checked uv210 photoresist dispense problem on svgcoat6, found PEB hotplate was not heating to the proper temperature on svgdev6 during processing and reported the problems.
- Checked v401 evaporator heating problem with a v410 evaporator user.
- Checked UV imaging problem and showed Evan the double image problem on uvscope.
- Checked the flaking paint on the metal cassette for vacoven and asked Bob about cleaning it.

### **Process Maintenance**

I have been responsible to maintain general photolithography processes for the Advanced Photolithography Group. This involved the following:

- Sorted and recycled used 6" wafers.
- Ran focus tests on the asml stepper.
- Grew oxide, measured oxide thickness on nanoduv and nanospec on wafers.
- HMDS primed, coated resists, exposed wafers, PEB, developed and inspected them.
- Inspected wafers on the uvscope and took pictures on the uvscope when needed.

I have been responsible to maintain part of the general photolithography processes for the Microlab and the process group. This involved the following:

- Monitored UV210 photoresist uniformity and thickness from svgcoat6.
- Monitored Eo and illumination uniformity of ASML stepper using UV210 photoresist.
- Recycled test, flat and ultra-flat silicon wafers to be used on the ASML, GCAWS2 and GCAWS6 steppers.
- Sorted and marked 6" dummy wafers for ASML stepper, svgcoat1, svgcoat3, svgcoat6 and svgdev6.
- Prepared photoresist coated wafers for ASML, GCAWS2 & GCAWS6 stepper field servicemen and the process group.

- Checked Canon aligner reported exposure problem and cleared problem after cleaned 2" wafers, spun G-line resist, ran exposure test, developed and inspected wafers.
- Checked Crestec supplies, restocked Al/C SEM tapes, gloves, texwipes, MIBK/IPA developer, PG remover, acetone and IPA in the Crestec room when I saw they were low.
- Searched vendors that carry Al/C SEM tape for Crestec EBL system. Found only NEM Co. from Japan carries it.
- Spun coated PMMA on oxide wafers, measured resist thickness, diced PMMA resist coated wafers and ZEP520A resist coated wafers into chips for Crestec use.
- Coordinated with Crestec representatives about the equipment reservation each month.
- Checked H & W calibration mask and measured gcapg L-bar linewidth.
- Spun coated standard G-line and I-line resists, ran FEM, baseline and theta corrections on gcaws2.
- Ran F/E matrix, system focus, microscope rotation, global, insitu, MicroDFAS baseline tests and made corrections on gcaws6.
- Formatted diskette and copied gcaws6 back up files.
- Formatted diskettes, set up job files and edited job files on gcaws6 for lab members.
- Followed up on the LEO SEM upgrade status and informed staff about it. Took pictures on the LEO SEM new controller keyboard, and checked Au reference sample on LEO SEM after the upgrade.
- Restocked gloves and texwipes for LEO room when I saw it was needed.
- Checked out outdated chemicals in the refrigerator, disposed resist/acetone waste, AR3-600 BARC and other chemicals.
- Tested PRS-3000 stripper in sink5 with thick and thin resist coated dummy wafers to clear the reported problem.
- Cleaned 4" dummy wafers for svgcoat2 and 6" dummy wafers for svgcoat1, svgcoat6 and ASML stepper in the matrix and sink5.
- Tested EBR line on svgcoat3.
- Refilled developers on svgdev6, EBR and HMDS on svgcoat6 when I saw they were low.
- Cleaned and dehydration baked wafers for processing.
- HMDS primed, coated resists, exposed wafers, PEB, developed and inspected them as needed for testing equipment and process.
- Restocked MIBK/IPA 1:3 Developer for lab members when it was low.
- Monitored the photoresist inventory on svgcoat6, labeled DUV photoresists and stored DUV resists and AR3-600 anti-reflective coating in refrigerators.
- Checked photoresist inventory, informed Susan or Adrienne to order UV210-0.6 resist when it is low.
- Refilled chemicals in aptchrome.
- Rinsed empty chemical bottles that were occasionally left behind by the lab members.
- Checked a ASML job file under utilities mode for a lab member.

- Worked with a lab member to edit his job file and fixed his MicroDFAS alignment problem on gcaws6.
- Showed staff and lab members how to run FEM on gcaws2 and gcaws6.
- Consulted lab members on such as gcaws6 alignment mark design, alignment, gcaws6 job file, photoresist process, photoresist lifting, lithography, LEO SEM issues and NRC evaporation.
- Assisted staff and lab members in programming on the svgcoats and coating AR3-600 anti-reflective coating.
- Searched OCG-825 G-line photoresist process data on the web sites and printed it for a lab member.
- Transferred uv210 resist, MF 26A developer, AR3-600 BARC, checked out TMAH and chemicals for lab members.
- Sent OiR 700-10 I-line resist experimental data, spin curve chart, checked gcaws6 equipment specification, expose glass wafer, conductive resist, PAD etch and MF 26A developer information for lab members.
- Marked wafers, stripped resist, piranha cleaned, diced after Jimmy etched them in Lam5, inspected, measured line width on resist & poly wafers and took SEM pictures for staff.
- Checked matrix ash rate and checked SPR-220 resist information for staff.
- Cleaned wafers and grew oxide in Tystar1 for staff.
- Showed Marilyn Knusher how to exercise the rms, assisted her to make baseline theta correction on gcaws6 and exposed wafers on ksaligner.

### **III. INSTRUCTION & DOCUMENTATION**

#### **Instruction**

- Instructed and qualified researchers on equipment operation and fabrication procedures when necessary.
- Assisted and showed staff how to use 4 point probe, canon, gcaws6, hummer, kruss, ksaligner, LEO S.E.M., linewidth, matrix, svgcoat1, svgcoat2, uvscope and wafersaw.
- Gave lab tours for the EECS 143 lab students and new potential lab members who attended the lab orientation.
- Showed visitors and potential lab members the edwards, edwardseb3, ultek, randex sputter systems, nrc and v401 evaporators.
- Assisted and showed a few lab members how to use the
  - ASIQ surface profiler
  - ASML stepper
  - Canon aligner
  - Crestec EBL system
  - GCA pattern generator
  - GCA wafer stepper 2
  - GCA wafer stepper 6
  - Linewidth measurement system
  - Matrix
  - Nanoduv
  - Nanospec
  - NRC sputtering system

- parylene
  - Quintel aligner
  - Reichert Microscope
  - Sinks
  - Sopra
  - Svgcoat2, Svgcoat6 and svgdev6
  - Technics-c
  - Tystar furnaces
  - UVScope microscope
  - -V401 evaporator
  - Vacoven
- Qualified lab members on the operation of the
    - Asiq surface profiler
    - Canon projection aligner
    - Crestec EBL system
    - GCA wafer stepper 6
    - Kruss Contact Angle Measurement System
    - LEO sem
    - NRC evaporator
    - Ptherm plasma etcher
    - Quintel aligner
    - Sinks
    - Spinner1
    - Sopra ellipsometer
    - SVG coat and develop systems
    - UVScope
    - Vacoven

## **Documentation**

- Wrote daily reports to Professor Andy Neureuther on the first half of the year.
- Reviewed kruss and gcaws6 chapter manuals to see if revisions were necessary.
- Revised canon, hummer, leo, parylene, quintel, sink4, sinkcmp, uvscope and vacoven chapter manuals.
- Revised svgcoat6 and svgdev6 qualification test and test key.
- Graded cpa, gcaws2, gcaws6, jeol107 SEM, lam1-3, LEO SEM, Quintel aligner, sink5, 7 & 9, sink6, sink8, svgcoat6 & svgdev6, svgdev, wafersaw and westbond lab quizzes.
- Input the UV210-0.6 resist thickness and Eo data into the process monitor on the Microlab web page.
- Recorded gcaws2, gcaws6 F/E matrix test and baseline correction results on log books.
- Wrote LDD-26W, MF 26A and MF CD 26 Developers study progress report.
- Wrote LDD-26W, MF 26A and MF CD 26 Developers study report.
- Wrote FujiFilm OiR-700-10 (new I-line) verses OCG OiR-897 10I I-line resist profiles and exposure report.

#### **IV. SUMMARY**

I had assisted Professor A. Neureuther on the local effect experiment. I used MASK3 FLATTENED reticle with the aberration patterns, modified job file to accomdate more dies per wafer, spun coated 9000A of UV210-0.6 photoresist, ran exposure matrix tests on test and oxide wafers, developed wafers, inspected under microscope, exposed experimental wafers with best F/E, developed, inspected, measured oxide thickness, descummed resist, measured oxide thickness, measured resist thickness, took pictures, uvbaked wafers, measured resist thickness, etched oxide wafers on centura-mxp with "MXP-OXIDE-ETCH" and "MXP-OXSP-ETCH" recipes, measured oxide thickness, repeated etch process three more times, entered oxide thickness data, plotted graphs and discussed it with Professor A. Neureuther.

I had completed ETR runs and projects, had assisted staff and lab members to make processes run smoothly in the Microlab. I had assisted the Microlab to maintain equipment when necessary to keep equipment in good running conditions and minimize equipment down time. I had graded written quizzes and qualified lab members on equipment so lab members could use the Microlab facility. I had revised chapter manuals, test and test key to keep them updated. I had made masks for lab members and took care of the gcapg problem when Marilyn was away on vacation. I had assisted the process group to maintain the general processes in the lab to run smoothly this year.