ANFF

ACT Node News

THE AUSTRALIAN NATIONAL UNIVERSITY

THE UNIVERSITY OF WESTERN AUSTRALIA
Achieving International Excellence

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ACT Node

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Extreme Lithography: where bottom-up meets top-down

The polymer group of Prof. Andrew Whittaker at The University of Queensland (UQ) is working in collaboration with *Intel Corporation* on providing solutions for next-generation lithography technologies, such as extreme ultra violet lithography (EUVL). In particular they are investigating solutions for improving line edge roughness (LER) of nano-scale features as small as 20nm in size using self-assembled block co-polymers.

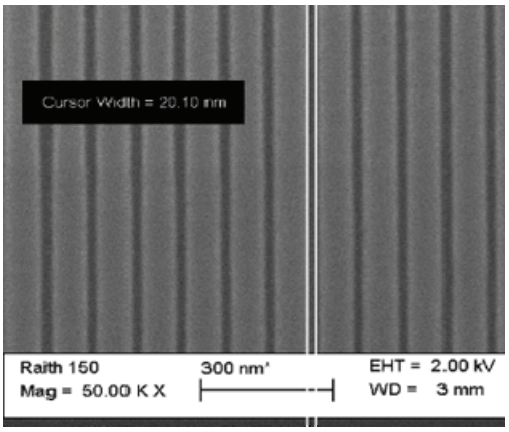
The development of this project can be best described as the synergy between top-down lithography and self assembly, an example of a bottom-up approach, in tackling nano-fabrication issues.

For this project, the UQ researchers have been using the Raith-150 Electron Beam Lithography (EBL) system at the ACT Node of the Australian National Fabrication Facility at The Australian National University for fabricating resist templates with line-widths down to 20nm with assistance from ANFF process engineers.

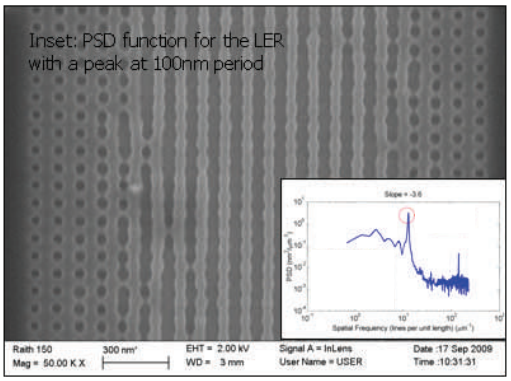
The successful development of these templates is allowing the researchers in the Whittaker group to study the use of the self assembly of their novel block co-polymer to reduce LER in lithography, which currently limits performance of fabricated microchip devices.

The group has been investigating high-resolution patterning and the control of frequency and amplitude of LER components of PMMA features with the Node's Raith-150 EBL system.

One researcher from the Whittaker group, Dr Elliot Cheng, has already patterned resist template features in the 20nm regime and developed methods to prepare model resist with defined LER frequencies.



SEM image showing high resolution patterning of PMMA with 20nm line-width features (above) and high amplitude LER lines with controlled frequency (below)



These results will then be used to test the efficiency of the self-assembled systems, whilst the high-resolution imaging capability of the system can also be used to examine and quantify the healing processes.

Story and images by Dr Elliot Cheng – The University of Queensland

Welcome to the second issue of the ANFF ACT Node's newsletter. As this will be the last issue to be distributed before the end of the year, all the staff at the ACT Node would like to take the opportunity to wish everybody a very happy and safe festive season & New Year and look forward to a productive 2010.

Other news in this issue:

Next Issue: due March 2010

ACT Node information:

- The ANU facility specialises in III-V compound semi-conductors.
- The UWA facility specialises in II-VI compound semi-conductors and MEMS.
- We can provide full support with the use of the equipment available.
- Full pricing policy and rates are available on the ANFF website at www.anff.org.au or contact us direct for more information - see contact details overleaf.

The Director's Cut

As the 2009 year draws to a close it seems an appropriate time to reflect on the achievements of the ANFF ACT Node thus far and look to the coming year.

It has been a very busy year for the ANFF ACT Node located at ANU and UWA - all staff at both locations are now on board and busy serving and meeting the needs of the user community, while ordering and establishing the new facilities. All flagship equipment is now either operational or undergoing installation and commissioning and everything is now on-track to be fully operational for the beginning of the New Year. I would like to take this opportunity to thank all staff of ANFF at both facilities for their excellent efforts during 2009. Special thanks are also due to ANU and UWA staff for providing access to the various in-kind facilities for the user community.

Keen interest has been shown in our services by researchers from several universities, and a number of external agencies (including international institutions) and companies. This bodes well for the New Year as all the equipment comes on-line and our capacity grows.

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Facility Equipment and Infrastructure Update

The construction works of the new ANU laboratory are approaching their end.

The BJD 2000 e-beam evaporator from Temescal has just been commissioned. The training is scheduled for the second week of December. It features a 6-pocket electron-beam gun, as well as a thermal evaporation capability. This is important for all e-beam lithography work carried out on the flagship RAITH 150 Electron Beam Lithography system. The system also features a Veeco-Ion Tech ion source that allows surface cleaning prior to metallisation. This feature may be important to reduce contact resistance by removing oxides from the sample surface.

The Nano-Imprint Lithography (NIL) - a combination of the EVG 620 mask aligner and the EVG 520HE hot embosser - was commissioned in the first week of December and training of ANU staff is now taking place. This will be followed by training for ANFF staff from the University of South Australia and the new Melbourne Centre for Nanofabrication (MCN) in Victoria. The system will offer a full facility for optical lithography that, in combination with the hot embosser, allows for NIL works by hot embossing or a combined UV exposure/hot embossing.

The new Nano-Imprint Lithography/Hot Embossing system undergoing inspection prior to shipment to ANU

Three other systems will be commissioned in January 2010:

- The Oxford Instruments Plasmalab System100 PECVD featuring dual frequency RF generator for strain control, a heating electrode up to 700°C for dense dielectric films.
- The Plasma-Therm RIE-ICP featuring chlorine etching, He-backside cooling, heating electrode and end-point detection.
- The FEI Helios focused ion-beam system featuring nano-fabrication capabilities (e-beam and ion-beam deposition, ion-beam etching) as well as characterisation tools (EDAX).

(***The Director's Cut -*** *continued from page 1)*

We are very keen to develop strategic relationships with industries to meet their fabrication and processing needs.

We have also developed the newsletter you are now reading, as well as launching our Node's website, both of which are important for generating awareness and interest in our fabrication & processing capability, and the ANFF in general.

Further opportunities to enhance and extend our processing capability are in the pipe-line with our recent success in securing further government funding in the recent EIF round. This funding will allow us to establish new facilities to complement our current suite of facilities and allow for complete micro/nano photonic device development and fabrication.

It is vital for us to build on these opportunities and gain momentum in the coming years - developing partnerships in exciting research & development - a task we are keen to accomplish in collaboration with you all.

At the recent Annual General Meeting of ANFF in Melbourne, The University of Western Australia was formally admitted to ANFF and this will allow the creation of a separate ANFF Node at UWA in the New Year. We wish our UWA colleagues good luck in creating the new Node and further strengthening their facilities and very much look forward to working with our UWA colleagues and other ANFF nodes in providing seamless service to the user community.

We would also like to wish you all Merry Christmas and Happy New Year and look forward to seeing you at the ANFF ACT Node in the New Year.

Jagadish - Node Director

Website Launched

Our Node's website was launched in November. The website has information on the work carried out at both the ANU and UWA facilities, along with details of the services and processing capability available at our Node.

As well, there is information on current projects, news (with links to our newsletters, brochures, up-coming conferences, etc) and booking & contact information. There are also brief profiles of the Node staff.

The web address is:

http://anff-act.anu.edu.au

We have also created an on-line feedback form, accessible via our website, to rate our services with space to provide more specific comments. Please send us your feedback, including any enhancements and we will try to incorporate them down the track.

UWA Facility meets Industry Fabrication Requests

ANFF activities at UWA are proceeding full-speed ahead. In brief, some of the recent fabrication services performed for industry included the delivery of linear infrared detector arrays for *Integrated Spectronics Ltd* for use in airborne spectrometers.

Ongoing, strong collaborative efforts with divisions of *Raytheon Vision Systems Ltd* (based in the US and Australia) that aim at the development of advanced semi-conductor characterisation capability are being expanded into the development of next-generation infrared vision systems. This is to be enabled by the marriage of *Raytheon's* infrared detectors with the MEMS-based infrared filter technology developed at UWA and was recognised by the award of the inaugural Defence Science and Technology Organisation Eureka Prize for Outstanding Science in Support of Defence or National Security.

The nano-indentation capability at UWA has been utilised by *iCeutica Ltd* for characterisation of pharmaceutical compounds, and by *bluechiip Ltd* for characterisation of materials for RFID technology. Strong collaboration with *Panorama Synergy Ltd*, a local WA company, is on-track towards the development of novel digital cinema projection technology based on magneto-photonic crystals.

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